Upper Truckee River Lahontan Cutthroat Trout Restoration Project

2015 Annual Report

USDA Forest Service, Lake Tahoe Basin Management Unit

Lahontan cutthroat trout, *Oncorhynchus clarkii henshawi*

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Executive Summary

In 2015, the Lake Tahoe Basin Management Unit (LTBMU) continued implementation of the Upper Truckee River Lahontan Cutthroat Trout Restoration Project that began in 2008. Non-native trout were removed from approximately 1.7 km (1.1 mi) of the main stem of the Upper Truckee River (UTR) below Meiss Meadows, 2.0 km (1.2 mi) of the Showers Lake outlet tributary (SLT) and 0.63 km (.4 mi) of an unnamed tributary that empties into the Showers Lake outlet tributary. Removal efforts in Dardanelles Lake continued with the treatment of 18 lake acres. In 2015, a total of 633 fish were captured; 199 brook trout (BKT; *Salvelinus fontinalis*), 276 Lahontan cutthroat trout (LCT; *Onchorhynchus clarkii henshawi*), and 158 speckled dace (SPD; *Rhinichthys osculus*). All Lahontan cutthroat and speckled dace were returned to the stream and all brook trout were sacrificed.

Introduction

Historically, the fish assemblage in Lake Tahoe was dominated by a single predator, the Lahontan cutthroat trout (LCT). LCT were extirpated from Lake Tahoe by 1939 (Cordone and Frantz 1968, Moyle 2002). Over-fishing, logging, mining, dams and water diversion construction, intense grazing, road building, urban development, and the introduction of non-native fish and other aquatic organisms caused major changes in Lake Tahoe's fish composition and degradation of fish habitat (Erman 1997, Murphy and Knopp 2000) and cumulatively led to the extirpation of LCT from the basin. LCT were listed as an endangered species in 1970 (Federal Register Vol. 35, p.13520). In 1975, under the Endangered Species Act of 1973 as amended, LCT were reclassified as threatened to facilitate management and to allow for regulated angling (Federal Register Vol. 40, p.29864).

Since the end of the 19th century, numerous non-native species have been introduced to water bodies in the Lake Tahoe basin, altering its biological assemblage. The non-native salmonid species currently found in Lake Tahoe and/or inlet streams include: rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), kokanee salmon (*Oncorhynchus nerka*), and lake trout (*Salvelinus namaycush*). Lake trout are currently found in Lake Tahoe, Fallen Leaf Lake, Stony Ridge Lake, and Gilmore Lake. The non-native warm water fish that have been documented to occur in Lake Tahoe inlet streams and near shore environment are: brown bullhead (*Ameiurus nebulosus*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), black crappie (*Pomoxis nigromaculatus*), and goldfish (*Carassius auratus*) (Kamerath et al. 2008). The presence of non-native fish disrupts natural food webs, and is negatively correlated with the distribution and abundance of native fish (Moyle and Nickols 1973, Betolli et al. 1992, Findlay et al. 2000, MacRae and Jackson 2001, Vander Zanden et al. 2003, Carey et al. 2011). Brook trout and brown trout compete with cutthroat trout for space and resources (Gerstung 1988, Gresswell 1988, Griffith 1988, Fausch 1989, Hilderbrand 1998, Schroeter 1998, Dunham et al. 1999). LCT and rainbow trout are closely related and have similar spawning behavior which often leads to hybridization when they are present in the same water body(Vander Zanden et al. 2003).

LCT from Macklin Creek were successfully reintroduced into the headwaters of the Upper Truckee River in the early 1990s by the California Department of Fish and Wildlife (CDFW), in collaboration with LTBMU. This re-introduction took place following the removal of brook trout from a total of 8 km (5 miles) of stream and 6 hectares (15 acres) of lake through three years of rotenone application. Additional brook trout removal using electro-fishing and gillnetting took place from the mid-1990s to 2006. Sampling continued for three years after the last brook trout was caught. Monitoring efforts from 2013 determined the restored habitat was still free of brook trout. The LCT population in Meiss Meadows is currently one of the only high-elevation self-sustaining populations of LCT found in meadow habitat in the Sierra Nevada mountain range.

In 2008 the LTBMU began implementation of the Upper Truckee River (UTR) Lahontan Cutthroat Trout Restoration Project downstream of the Meiss Meadow area. The project area encompasses 16 km (10 miles) of perennial stream and ~34 hectares (85 acres) of lake habitat

within the UTR watershed (Fig. 1), and is referred to as the "Expansion Area". The objective of the effort is to facilitate natural range expansion of the Meiss Meadows LCT population downstream by removing non-native trout. The project is in California (El Dorado County) on National Forest System land within the LTBMU and is entirely in the Meiss Management Area (USDA 1988).

Reclaiming aquatic habitat in the UTR watershed is consistent with CDFW goals and objectives for recovering and developing waters for native salmonid fisheries. The CDFW currently works under the interagency Fishery Management Plan for Lahontan Cutthroat Trout in California and Western Nevada Waters (Gerstung 1986), which identifies the UTR as a priority area in Lake Tahoe to reclaim aquatic habitat for LCT. The UTR and tributaries upstream of the confluence with Showers Lake drainage are also designated by the California Fish and Game Commission as a Heritage and Wild Trout Water for a self-sustaining population of LCT within their historic (native) drainages.

Restoration efforts in the expansion area were approved by the U.S. Fish and Wildlife Service (USFWS) in the 2008 Biological Opinion (BO; File #: 2008-F-0434-BO). During the 2010 field season, re-initiation of consultation was conducted and an amended BO (file #: 2008-F-0434-R001) was received in October 2010. The amended BO allowed for the removal of LCT where potential hybridization with rainbow trout was anticipated. The LTBMU and USFWS agreed that in the interest of LCT recovery in the Lake Tahoe basin, genetically pure populations of LCT within the expansion area is the desired goal. This annual report is prepared in part to meet the requirements in the BO (#2008-F-0434-R001) for reasonable and prudent measures on the progress of the LCT restoration project.

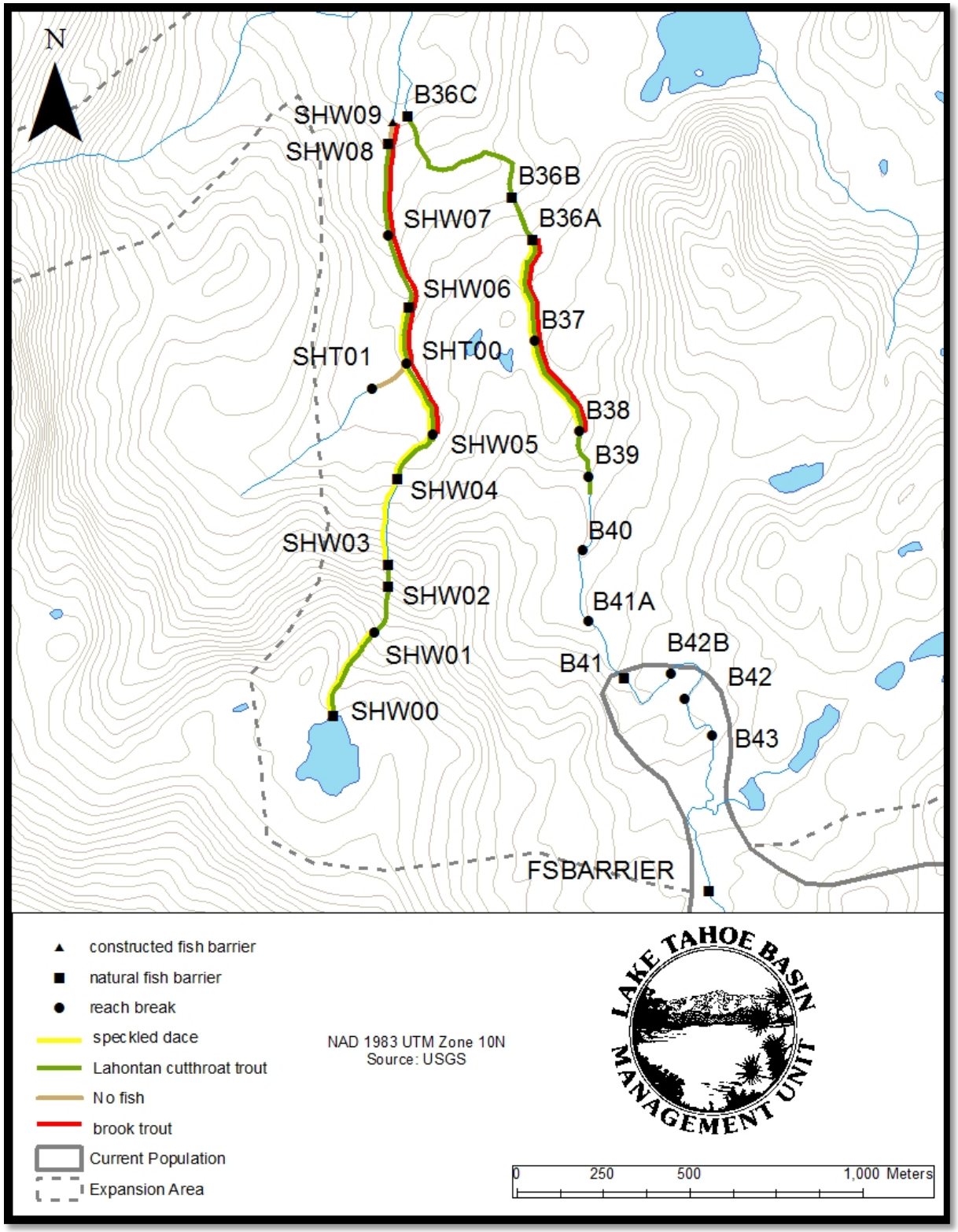


Figure 1. The Lake Tahoe Basin Management Unit (LTBMU) Upper Truckee River Lahontan Cutthroat Trout Restoration Project 2015 treatment area.

Methods

The LTBMU Aquatics Crew manually removed non-native trout using an electro-fishing protocol based on - "Guidelines for Electro-fishing Waters Containing Salmonids Listed under the Endangered Species Act" (NMFS 2000). A three-pass depletion method was used to enable tracking of non-native trout removal progress on a site-specific basis. Three-pass depletion relies on barriers to prevent the recapture of the same fish during multiple passes. Natural low water fish barriers (i.e. waterfalls, chutes, cascades) were identified in 2008 before implementation of the project, and were used to delineate the river into treatment reaches. If a reach contained no non-native trout on the first pass, only one pass was conducted. If non-native trout were detected, three passes were completed. The barriers used in 2015 were the same as those used in previous years (Fig. 1), so that progress could be compared annually. Throughout implementation, fish sampled were identified and measured into size classes. Above barrier 36C on the main stem of the UTR and above barrier SHW09 on Showers Lake Tributary (SLT) (Fig. 1), all LCT and speckled dace were placed back into the reach they were captured and brook trout were removed from the river.

Two backpack electro-fishers were used for survey efforts; a Smithroot LR-24 and a Smithroot LR-20B. The electro-fishers were set between 300-500 volts and 30-60 hertz for all reaches. These settings are not standard but worked effectively with the typical electric conductivity and turbidity of the expansion area drainages. Fish recovered quickly in most instances. Electro-fisher settings were adjusted as needed and recorded when changed. Electro-fishing crews (3 people per crew) implemented removal treatments from the third week in July through the third week in October completing five trips.

On the UTR, reaches above barrier B39 were not treated because no non-native salmonids had been detected in the past 3 years. The 5 reaches (1.9 km, 1.1 mi) from barrier B36C to B39 were treated with one treatment of 3-pass depletion and then 2 more single passes were conducted for a total of five passes. Annual comparisons of LCT in the UTR are made between the total numbers of fish caught in the first 3 passes. Three-pass depletion was performed multiple times during project implementation, and therefore the same individuals may have been counted more than once. Because the goal of the project is to eradicate non-native trout to recover LCT, this lack of confidence in exact LCT numbers is acceptable, however in subsequent years it could be addressed by caudal fin clipping LCT before they are released.

SLT reaches between SHW04 and Showers Lake (0.8 km/0.5 miles) were treated with a single pass due to absence of non-native salmonids for the third year in a row. SHW04-SHW05 was treated with two passes. Three-pass depletion was conducted on the remaining reaches (SHW09 to SHW05; 1.0 km/0.6 miles) and the tributary to SLT. The 3-pass depletion method was conducted once on all reaches between SHW09 and SHW05 and twice on SHW05-SHOW06. One additional pass was completed on SHW06-SHW07. Two three-pass depletion treatments were conducted on the tributary to SLT (SHT00 to SHT01; 0.63 km/.4 mi) and a final one pass treatment was carried out for a total of seven passes. The tributary to the SLT (Fig.1) was not treated above SHT01 because there was no surface water upstream of this point.

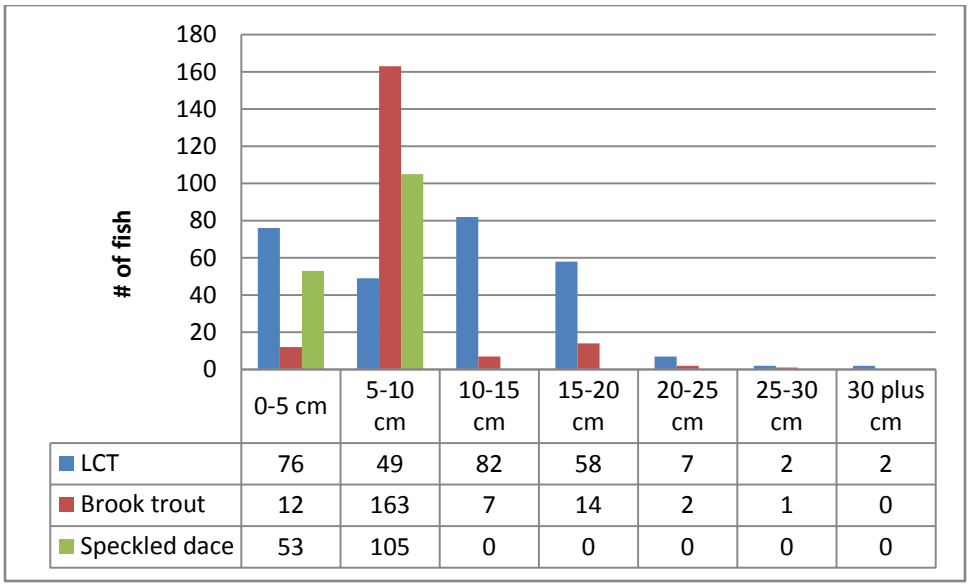
In 2015, the LTBMU Aquatics Crew continued removal of non-native salmonids in Dardanelles Lake. Monofilament gillnets made with six different size meshes (10, 12.5, 18.5, 25, 33, 38 mm) were used. Each panel was 6 m long and 1.8 m deep for a total net area of 64 square meters. Nets were deployed around the perimeter of the lake and pulled out perpendicular from the shore towards the deepest areas. A crew member on shore tied the top of the net to a land anchor and recorded data while another crew member in a float tube pulled the net away from shore, allowing it to flake out into a straight line. Once the net was fully stretched, the person on the float tube tied off the bottom of the net to a rock to anchor it on the bottom. Parachute cord was tied to the float line and a foam float was attached as a buoy. The nets were set so that the smallest mesh size was closest to the shore with progressively larger mesh sizes towards the center of the lake in order to effectively target the size class that tends to inhabit each area of a lake.

Eight gillnets, which had been set in the autumn of 2014, were pulled on 5/26/2015. Gillnets were set again in the autumn with eight nets being placed on 10/8/2015 and then checked, cleaned and removed on 10/16/2015. No nets were left in the lake for an over-winter set.

Results

2015 Field Work

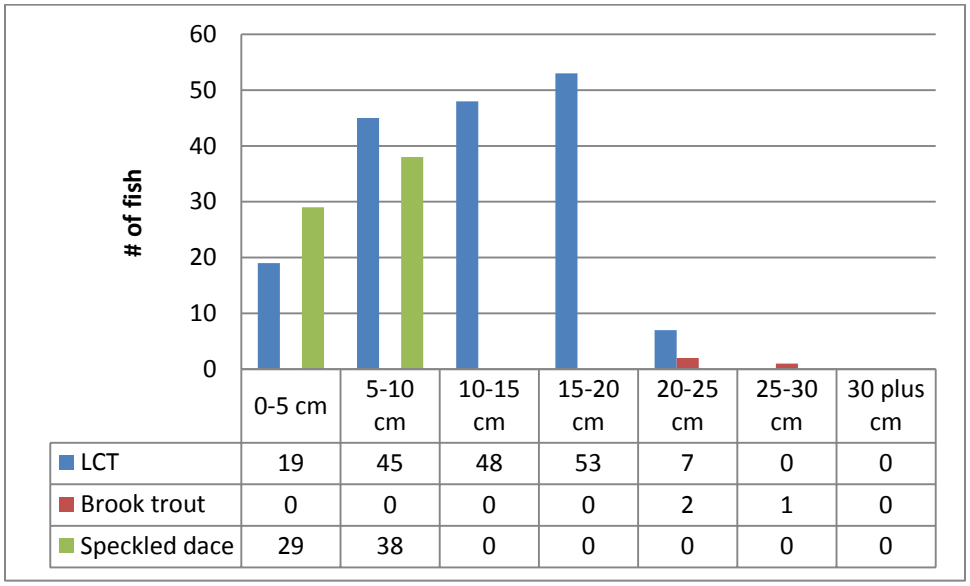
In 2015, non-native trout removal occurred on approximately 4.3 km (2.7 mi) of stream and 7 hectares (18 acres) of lake habitat in the project area, including 1.9 km (1.1 mi) on the mainstem UTR, 2.4 km (1.6 mi) in the SLT, and 18 acres of Dardanelles Lake and associated stream. Electro-fishing efforts captured a total of 633 fish: 276 LCT, 199 brook trout, and 158 speckled dace (Fig. 2). All brook trout were sacrificed. Incidental mortality was 19 LCT and seven speckled dace. Due to multiple treatments on the UTR and SLT, it is probable that individual LCT and speckled dace were captured more than once. Total catch of LCT and speckled dace therefore reflects total fish caught, not the number of unique individuals caught in the UTR and SLT.



	0-5 cm	5-10 cm	10-15 cm	15-20 cm	20-25 cm	25-30 cm	30 plus cm
LCT	76	49	82	58	7	2	2
Brook trout	12	163	7	14	2	1	0
Speckled dace	53	105	0	0	0	0	0

Figure 2. Total number of fish captured through electro-fishing efforts in the expansion area in 2015.

Electrofishing efforts captured 242 fish on the mainstem UTR between B36C and B39 in 2015: three brook trout, 172 LCT and 67 speckled dace (Fig. 3). All brook trout were sacrificed and all LCT and speckled dace were returned to the stream. All brook trout captured were between 20-30cm TL while LCT were caught in all size classes except 25-30 cm and 30 plus.



	0-5 cm	5-10 cm	10-15 cm	15-20 cm	20-25 cm	25-30 cm	30 plus cm
LCT	19	45	48	53	7	0	0
Brook trout	0	0	0	0	2	1	0
Speckled dace	29	38	0	0	0	0	0

Figure 3. Size class distribution of fish sampled in the UTR in 2015.

Electrofishing efforts captured 391 fish on the SLT during 2015: 196 brook trout, 104 LCT, and 91 speckled dace (Fig. 4). All brook trout were sacrificed and all LCT and speckled dace were returned to the stream.

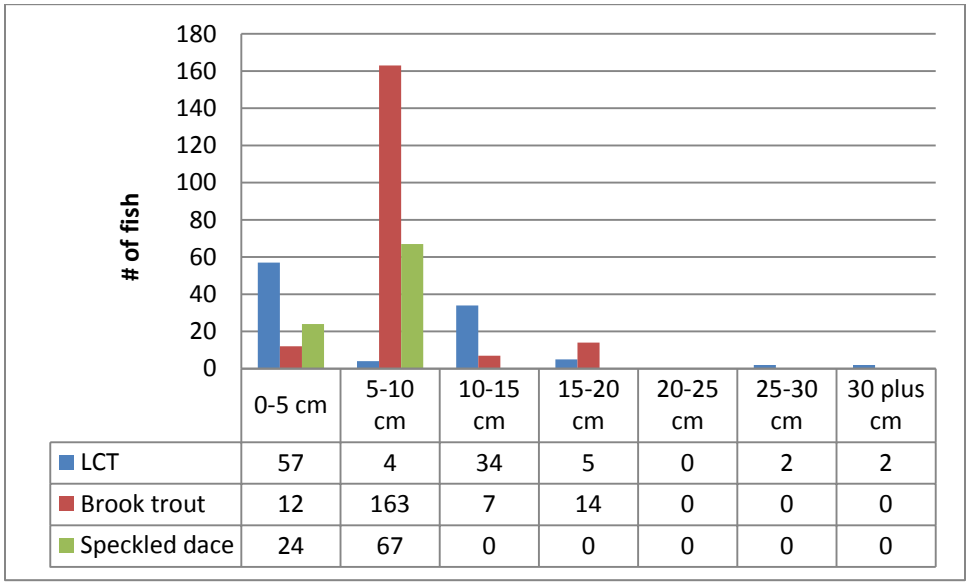


Figure 4. Size class distribution of total fish sampled in SLT in 2015.

Only LCT and speckled dace were caught in the most upstream reaches between SHW05 and Showers Lake. No fish were caught in Showers Tributary. Both LCT and brook trout were caught in all reaches between SHW09 and SHW05 in multiple size classes.

No fish were found in gillnets which had been set over the winter of 2014-2015. No fish were caught during the autumn gill nets sets.

2008 - 2015 Progress

A total of 18.3 km (11.4 miles) of river have been treated since 2008 (Table 1).

Table 1. Kilometers treated per year for each river segment.

Year	UTR (13.0 km total)		RLT (8.6 km total)		SLT (2.0 km total)	
	Distance (km)	Reaches	Distance (km)	Reaches	Distance (km)	Reaches
2008	1.0	B38-B42	--	--	--	--
2009	2.7	B36C-FS	--	--	--	--
2010	5.3	B28-B41	2.3	T1BA9-T1BA6, T1BA4-T1BA1	--	--
2011	2.6	B33-B41	3.1	T1BA10-T1BA1	--	--
2012	2.1	B35-B41	3.1	TIBA10-T1BA1	--	--
2013	2.7	B36B-FS	--	--	2.0	SHW00-SHW09
2014	1.9	B36C-B39	--	--	2.0	SHW00-SHW09
2015	1.9	B36C-B39	--	--	2.0	SHW00-SHW09

In 2012, the amount of time spent on treatment was recorded. Since 2012, a total of 180.25 hours of electrofishing have been conducted on the UTR and SLT (Table 2).

Table 2. Effort (hours) electrofishing the UTR and SLT since 2012 and 2013.

Year	UTR		SLT	
	Effort (hours)	Reaches	Effort (hours)	Reaches
2012	13.99	B35-B41	--	--
2013	26.04	B36B-FS	35.84	SHW00-SHW09
2014	31.46	B36C-B39	40.24	SHW00-SHW09
2015	21.13	B36C-B39	11.56	SHW00-SHW09

Showers Lake Tributary

In 2015 SLT showed a decrease in total brook trout captured from 324 to 196 and an increase in LCT captured from 28 to 88 on the first treatment compared with 2014 (Fig. 5).

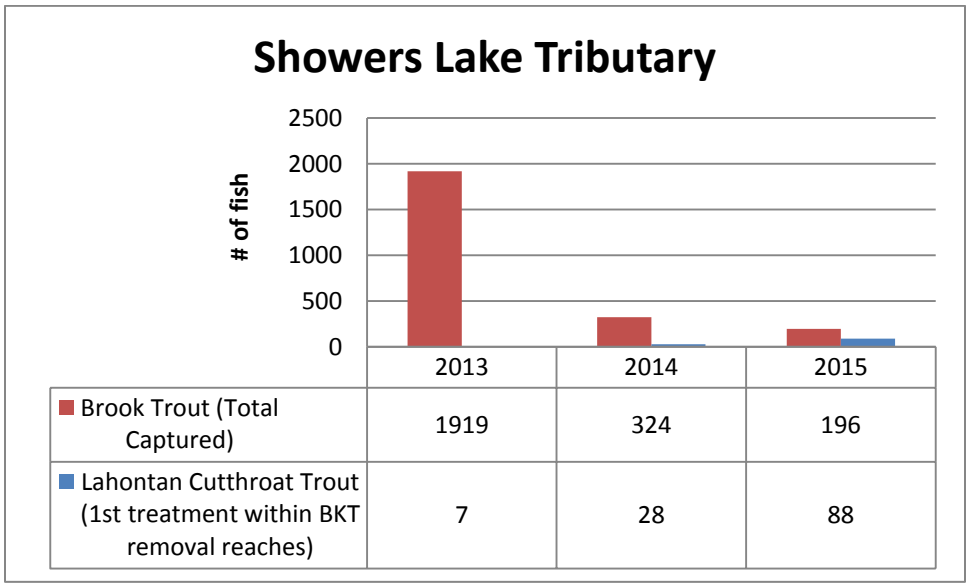
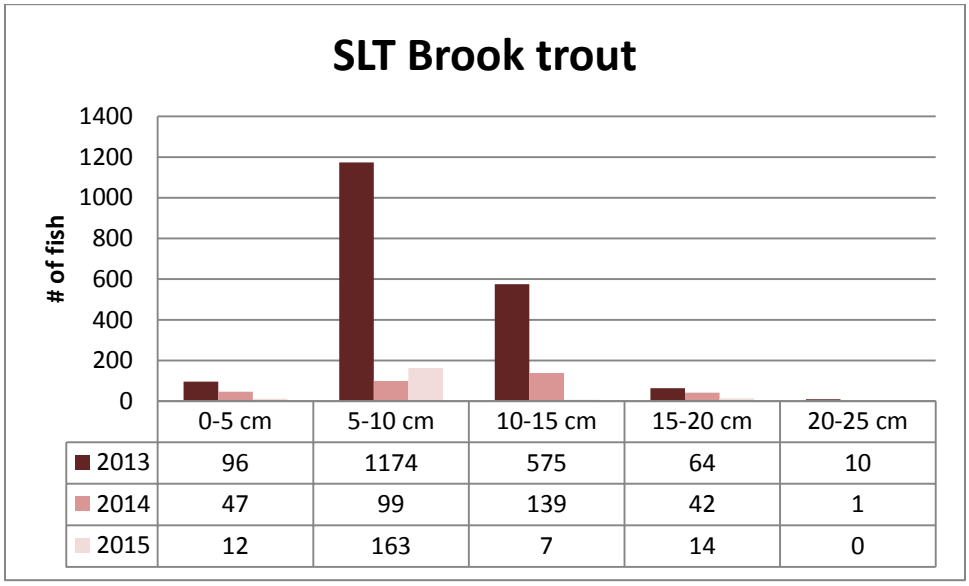


Figure 5. Brook trout and LCT captured in SLT in 2013, 2014 and 2015.

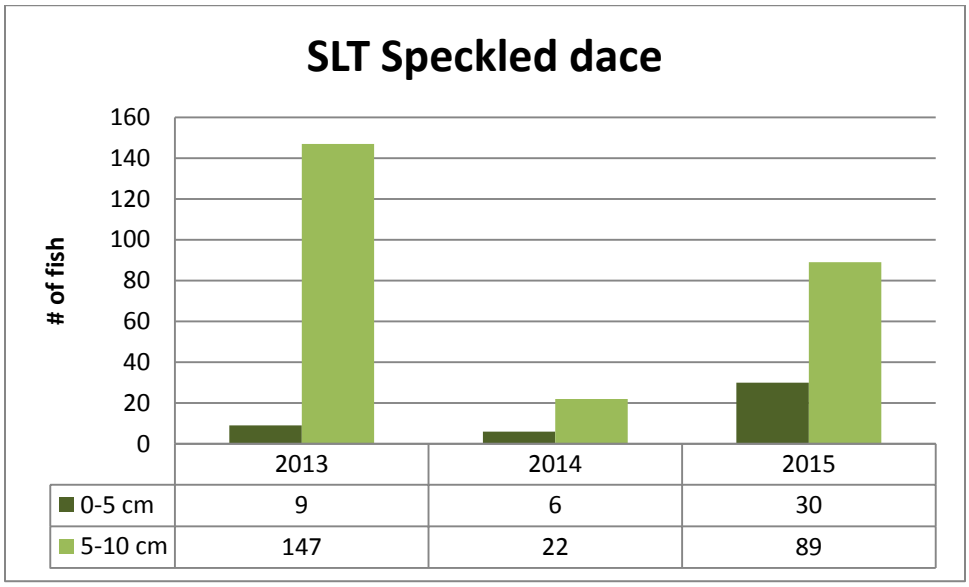
The size distribution of brook trout captured in SLT shifted towards smaller fish in 2015 with the majority of fish captured between 10-15cm in 2014 and the majority between 5-10cm in 2015 (Fig 6.)



	0-5 cm	5-10 cm	10-15 cm	15-20 cm	20-25 cm
2013	96	1174	575	64	10
2014	47	99	139	42	1
2015	12	163	7	14	0

Figure 6. Size distribution of BKT captured in SLT.

Speckled dace have been captured in the greatest numbers on SLT between SHW01 and SHW00. Numbers have fluctuated over the three years of electrofishing the SLT (Figure 7).



	2013	2014	2015
0-5 cm	9	6	30
5-10 cm	147	22	89

Figure 7. Size distribution of SPD captured in the SLT.

Upper Truckee River

LCT have been caught in all treatment reaches of the UTR since 2008. Since 2011, no brook trout have been documented between B39 and B41.

Numbers of LCT in the smaller size classes (0-5 cm, 5-10 cm, and 10-15 cm) increased from 2010 to 2012 and decreased from 2012 to 2015 in the UTR (Fig. 8). Brook trout in the 20-25 cm size class decreased from 2008 to 2014, but three brook trout were caught greater than 20 cm in 2015 (Fig. 9).

The total number of brook trout captured on the UTR has decreased dramatically every year since 2012. (Fig. 9) Speckled dace captured has decreased from 2014 to 2015 (Figure 10).

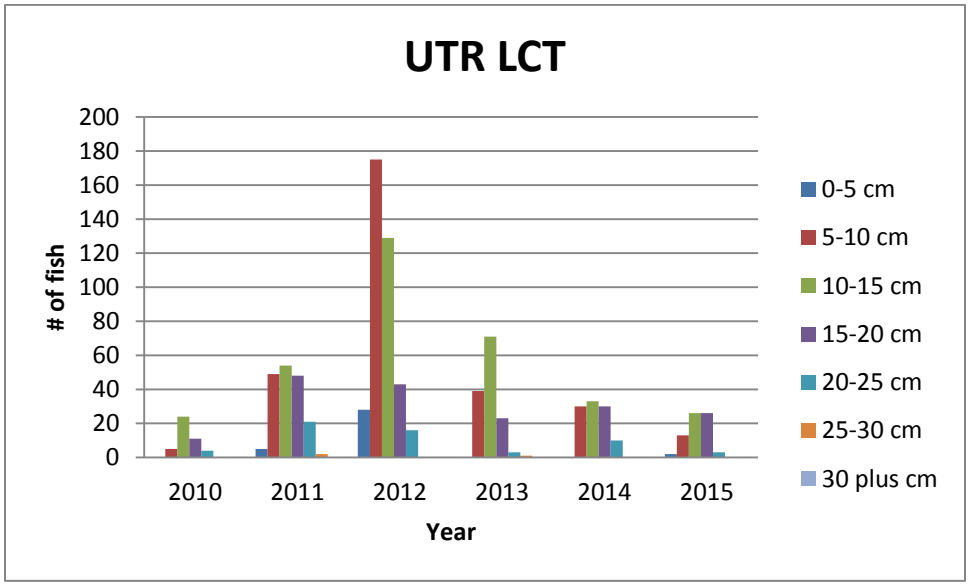


Figure 8. Number of LCT caught in the first 3-pass treatment in each size class per year in the UTR reaches B36B through B39.

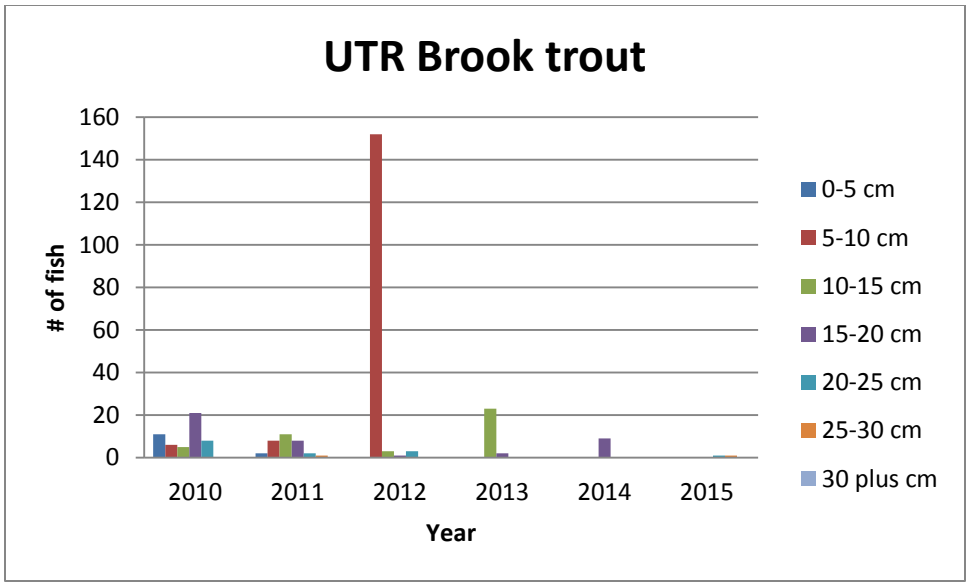
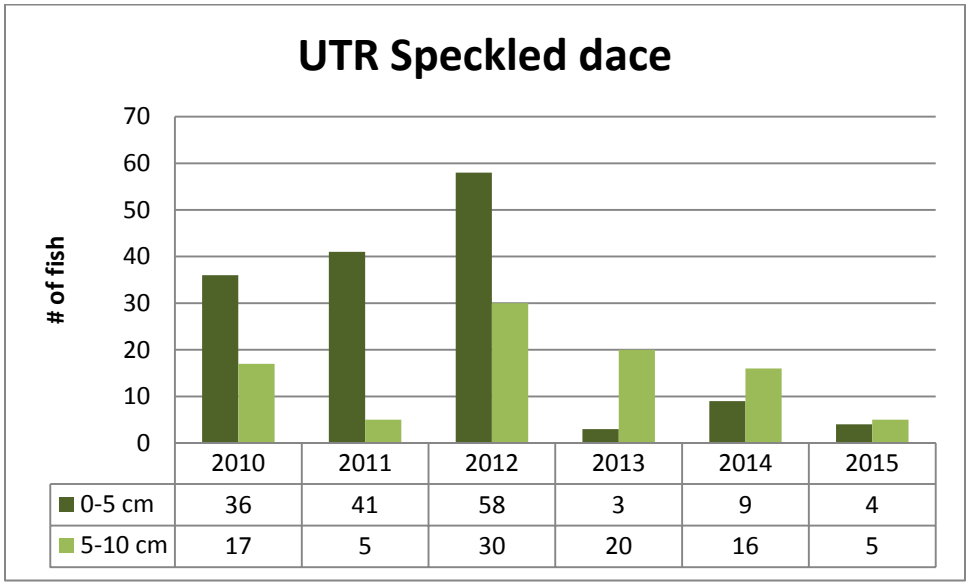


Figure 9. Number of brook trout caught in the first 3-pass treatment in each size class per year in the UTR reaches B36B through B39.

In 2015, the number of speckled dace caught in the UTR was the lowest in six years (Figure 10).



	2010	2011	2012	2013	2014	2015
0-5 cm	36	41	58	3	9	4
5-10 cm	17	5	30	20	16	5

Figure 10. Number of speckled dace caught in the first 3-pass treatment in each size class per year in the UTR reaches B36B through B39.

Dardanelles Lake

No fish were captured in the nets set over winter 2014/2015 and no fish were captured in the 2015 autumn set. No fish have been caught since the 2013/2014 overwinter set. Since then six separate sets have yielded no fish. A total of 453 brook trout have been removed from Dardanelles Lake (Table 3).The absence of fish indicates that the brook trout population in Dardanelles Lake is most likely entirely eradicated. This removal effort is eliminating the potential downstream movement of brook trout into the expansion area as well as opening up potential new habitat for LCT.

Table 3. Total fish caught by size class in Dardanelles Lake per gillnetting set.

Set	Date Set	Date Pulled	5-10 cm	10-20 cm	20-30 cm	30+ cm	UNK	TOTAL
1	9/24/2012	9/26/2012	12	30	152	18	0	212
2	9/26/2012	9/28/2012	5	23	84	28	0	140
3	9/28/2012	10/1/2012	0	7	12	4	0	23
4	10/1/2012	10/10/2012	8	10	13	6	0	37
5	10/10/2012	10/29/2012	0	21	15	2	0	38
6	9/28/2013	6/3/2014	0	0	0	0	3	3
7	9/8/2014	9/11/2014	0	0	0	0	0	0
8	9/11/2014	9/15/2014	0	0	0	0	0	0
9	9/15/2014	9/24/2015	0	0	0	0	0	0
10	9/24/2015	9/29/2014	0	0	0	0	0	0
11	9/29/2014	5/26/2015	0	0	0	0	0	0
12	10/8/2015	10/16/2015	0	0	0	0	0	0

Discussion

No brook trout have been documented in the UTR reaches between B39 and FSBARRIER since 2013 (Fig. 1). These reaches (B39 and above) should be monitored every three to five years to ensure project success. The eradication of non-native trout within this segment of stream indicates success in the project objectives, as 1.77 km (1.10 mi) of stream that is now free of non-native fish and the native LCT in these reaches are excluded from electrofishing pressures. In 2014 0.5km of additional stream between 36B and 36C was treated on the UTR. No brook trout and seven LCT were captured in this new section. This section was treated again in 2015 with three LCT captured.

The absence of any brook trout smaller than 10cm in the UTR for the last four years indicates that there has been no spawning for several years. Two brook trout were captured on the first treatment and one brook trout was captured on the second pass treatment of the UTR, providing further reason to believe that brook trout are almost fully eradicated from the UTR above B36C, the entire targeted area on the mainstem UTR.

During the 2015 field season, LCT were consistently detected in all treatment reaches of the UTR. More LCT were present in the upper reaches when compared to the lower reaches of the UTR, likely because the area is downstream of the Meiss Meadow reclamation area where a self-sustaining population of LCT exists and removal of brook trout from the upper reaches of the UTR has created 0.6km of additional brook trout free habitat. Several 0-5cm LCT were captured below the B39 barrier, indicating that LCT successfully spawned in the treatment reaches of the UTR.

The LCT population in the UTR went from 103 in 2014 to 70 in 2015, and was substantially reduced from the 391 LCT caught in 2012. Environmental conditions, in particular low rainfall and low snowpack, may be negating any positive benefits from the removal of brook trout. Water levels in the UTR mainstem were high in 2011 and low in 2012, 2013, 2014, and 2015. In 2011 mean annual discharge at the USGS gage on the UTR was 148cfs whereas in 2012 and 2013 it was below 55cfs. In 2014 the mean annual discharge was below 34cfs. For 2015 the mean annual discharge is 25.05cfs as of 12/09/2015. Average mean annual discharge for the past 24 years was 75.0 cfs (USGS Station 103366092). In low water years, fish may move downstream to find refuges where more water is present, habitat suitable for reproduction is reduced upstream, and there may be more natural passage barriers to upstream migration as water levels drop. Low water levels also reduced the quantity of fishable habitat in the reaches and led to the creation of small disconnected pools where water temperatures increased throughout the season. Water temperatures above 13.3°C can result in major mortality for LCT eggs, and adults experience high mortality above 26.0°C (Gerstung 1988, Dickerson and Vinyard 1999). A permanent temperature logger was installed upstream of the project area in 2014; however, the logger was lost prior to any data collection. Temperature is an important habitat variable and another logger will be installed in 2016.

The number of brook trout captured in SLT was substantially lower in 2015 compared to 2014; however, treatment effort included over 40 hours of electroshocking in 2014 compared to approximately 12 hours in 2015. Although the presence of 0-5cm brook trout in 2015 indicates that efforts in 2013 and 2014 did not break spawning, the reduction in brook trout numbers shows that eradication efforts are effective. Data from 2015 indicate the upper 0.8 km (0.5 mi) reaches of the SLT between SHW05 and Showers Lake is also clear of brook trout. Treatment will continue on all reaches of the SLT for one more year before any reach can be designated free of non-native fish.

LCT presence was not consistent in the entire Showers Lake tributary with low numbers present in most all reaches and none present in SHW04-SHW03. Roughly 50 0-5cm LCT were collected just downstream of the lake outlet. These fish most likely spilled over from the lake during spring runoff. This patchy distribution is likely due to the fish passage barriers, lack of sufficient habitat in certain reaches, and the relative newness of non-native fish removal efforts.

LCT were the only salmonids present above SHW05, probably because LCT were stocked intermittently in Showers Lake between 1997 and 2012. It should be noted that there is not an inlet stream into Showers Lake that could provide spawning habitat.

Caudal fin clips were collected from 88 specimens of LCT in all size classes from the Showers Lake tributary. Samples were sent to University of Nevada – Reno (Dr. Mary Peacock) to test genetics for LCT x Rainbow Trout hybrids.

Throughout the expansion area, LCT were found in several size classes. This suggests suitable spawning habitat is available in the system, reproduction is occurring, and LCT may thrive in the expansion area when competition with and predation from brook trout is eliminated. This theory is supported by the increase in LCT in the upper reaches of the UTR in the expansion area from 2008 through 2012.

Speckled dace captured increased on the SLT from 2014 to 2015 but decreased on the UTR. During the first pass on the UTR in 2015, nearly 90% of the channel was dry (C Lemmers, Field observation). Low water years since 2012 could have a negative effect on speckled dace spawning and therefore population.

Gillnet monitoring of Dardanelles Lake will need to continue in future years prior to any stocking of LCT.

Conclusion

The LTBMU will continue to pursue the recovery objectives for Lahontan Cutthroat Trout in coordination with partners. Recovery efforts will continue in the Upper Truckee River Expansion Area as follows:

- Continue removal efforts in the Upper Truckee River from B36C to B39
- Rest (no treatment) in the Upper Truckee River above B39
- Continue treatment of Showers Lake Tributary from SHW00 to SHW09
- Rest SHW00 to SHW05 if LCT only detected after one more treatment.
- Install additional temperature loggers in project area
- Continue caudal fin clips pending results from 2015.
- Continue coordination with US Fish and Wildlife Service and California Department of Fish and Wildlife to develop a Removal Plan for Round Lake Tributary. Removal plan should include:
    - Location of existing barriers and where barriers are needed to effectively and effiently removal non-desirable fish.
    - Expected timeline to complete removal from T1BA10 to T1BA1
    - Expected timeline to complete removal in Round Lake
    - Budget

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