

NEVADA DEPARTMENT OF WILDLIFE  
STATEWIDE FISHERIES MANAGEMENT



FEDERAL AID JOB PROGRESS REPORTS

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2017

Lake Tahoe Rainbow Trout Study  
WESTERN REGION



**NEVADA DEPARTMENT OF WILDLIFE, FISHERIES DIVISION  
ANNUAL PROGRESS REPORT**

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**NEVADA DEPARTMENT OF WILDLIFE, FISHERIES DIVISION  
ANNUAL PROGRESS REPORT**

**State:** *Nevada*  
**Project Title:** *Statewide Fisheries Program*  
**Job Title:** *Lake Tahoe Rainbow Trout Study*  
**Period Covered:** *January 1, 2017 through December 31, 2017*

**SUMMARY**

Extremely high flows and a record snowpack complicated the study efforts for the Lake Tahoe Rainbow Trout Study in 2017. A total of 27 rainbow trout were captured at the management barrier along Third Creek from March 28 to the beginning of May when the decision was made to remove the barrier due to the high flows. No Lahontan cutthroat trout were caught while the fish barrier was in place. Of the rainbow trout caught, 19 were artificially spawned for egg production. This effort produced 9,332 Incline strain rainbow trout eggs that were taken and raised in Mason Valley Fish Hatchery (MVH).

Wild Incline strain rainbow trout progeny from 2016 were stocked into Marlette Lake, Boulder Lake, and Lake Tahoe and were captured in 2017 to investigate growth and return rates. Growth and return rates were then compared to Tahoe strain rainbow trout (also reared at MVH) stocked into the same waters bodies.

In 2017, 5,092 tagged Incline and Tahoe strain rainbow trout were again stocked into Boulder Reservoir ( $n=1,200$ ), Marlette Lake ( $n=2,000$ ), and Lake Tahoe ( $n=1,000$ ). These fish will be monitored for their longevity, performance, and fecundity.

**BACKGROUND**

Lake Tahoe is located in the eastern portion of the Sierra Nevada's at an elevation of approximately 6,224 ft. Situated along the California border, approximately 30% of the lake lies within Nevada. It is 22 mi long, 12 mi wide, and has 123,300 surface acres. The lake holds 122,160,280 acre-ft of water and has a maximum depth of 1,645 ft. Average depth is 989 ft. A natural rim occurs at 6,223.0 ft above mean sea level (MSL), but a permanent concrete dam built in 1913 extends the lake elevation to 6,229.1 ft above MSL. The lake is fed predominantly by snowmelt from 63 streams and the Truckee River is the only natural outlet.

Lake Tahoe was discovered in the 1840's by white explorers and supported robust populations of Lahontan cutthroat trout, mountain whitefish, and a number of other native non-game species. A number of factors including habitat disturbance, competition, and/or predation from introduced fish species, loss of spawning habitat, and commercial harvest led to the extirpation of LCT by the 1940's.

Lake Tahoe supports self-sustaining, wild populations of lake trout, rainbow trout, brown trout, and kokanee salmon, which represent the bulk of the current sport fish

community. Densities of introduced, non-native fish species such as largemouth bass, bluegill, and crappie have shown marked increases in recent years. These populations are generally associated with shallow, warm portions of the lake such as the Tahoe Keys Marina. Lake Tahoe also contains populations of native non-game fish including speckled dace, Lahontan reddsides, tui chub, Tahoe suckers, and Lahontan mountain suckers. Tributary streams provide permanent, spawning, and rearing habitat for species such as brook trout, brown trout, rainbow trout, and kokanee salmon. Hatchery reared rainbow trout are stocked each year to augment wild populations and enhance sport fishing opportunities.

Several of Nevada's tributaries are crucial to lacustrine rainbow trout, which are collected, artificially spawned, and released back into the tributaries. Eggs collected are hatched and reared at Mason Valley Fish Hatchery. The progeny from these artificial spawning efforts are used to enhance the genetic diversity of a broodstock population in Marlette Lake.

## OBJECTIVES

- Hand spawn all available adfluvial rainbow trout captured at the Third Creek barrier for propagation in the Mason Valley Fish Hatchery.
- Concurrent with the spawning operation at Third and Incline creeks and other creeks in the basin, measure length, weigh, check for Floy tags, and Floy tag all spawning rainbow trout.
- Tag approximately 3,600 Incline strain rainbow trout and 1,600 Tahoe strain rainbow trout to be released in Marlette Lake, Boulder Lake, and Lake Tahoe.
- Assess angler catch and harvest rates, growth rate, and catch location of tagged rainbow trout in all water bodies where stocked through opportunistic angler contacts and return of angler drop-box survey data.
- Conduct population surveys for adfluvial spawning rainbow trout on Wood Creek, Slaughterhouse Creek, Glenbrook Creek, Marlette Creek, Secret Harbor Creek, and Logan House Creek as time permits.
- Set gillnets for two net-nights in Boulder Reservoir to assess growth rate of stocked Incline and Tahoe strain rainbow trout.
- Monitor the performance of tagged rainbow trout in Marlette Lake by utilizing data collected during the NDOW spawning operation.

## PROCEDURES

**Hand spawn all available adfluvial rainbow trout captured at the Third Creek barrier for propagation in the Mason Valley fish hatchery.** A temporary barrier was installed approximately 600 ft (182.88 m) upstream of the Third Creek confluence with Lake Tahoe on March 28, 2017. This barrier stopped the upstream migration of adfluvial rainbow trout and congregated fish immediately downstream. These fish were captured, measured to fork length, weighed, sexed, checked for ripeness, and given individual Floy and PIT tags. Fish that were ripe were then anesthetized and hand spawned. Disinfected eggs were transported to Mason Valley Fish Hatchery to be reared. All fish caught including those spawned were released

back into Third Creek below the barrier. Due to a record snowpack in the Tahoe Basin (winter of 2016/2017) and subsequent high runoff, the barrier was erected until May 4.

**Concurrent with the spawning operation at Third and Incline creeks and other streams in the basin, measure length, weigh, check for Floy tags, and Floy tag all spawning rainbow trout.** Beginning March 28, 2017, Third and Incline creeks were monitored for adfluvial rainbow trout ascending the tributaries using a backpack electroshocker. Once captured, fish were measured to fork length, weighed, sexed, checked for ripeness, and given individual Floy and PIT tags. All fish were released back to the creek.

**Tag approximately 3,600 Incline strain rainbow trout and 1,600 Tahoe strain rainbow trout to be released in Marlette Lake, Boulder Lake, and Lake Tahoe.** On three occasions in 2017, 5,200 Incline and Tahoe strain rainbow trout reared at Mason Valley Fish Hatchery were Floy tagged prior to being stocked into Marlette Lake, Boulder Lake, and Lake Tahoe. Fish were anesthetized in holding tanks and once sedated, a subset of fish were measured to fork length and weighed. All fish in specific lots were tagged in front of the dorsal fin with colored and individually numbered FD-94 anchor tags. They were then allowed to recover in holding pens within the hatchery raceways. Fish were held after tagging for observation and then later stocked into the appropriate water body.

**Assess angler catch rates and harvest or catch location of tagged rainbow trout through opportunistic angler contacts and return of angler drop-box surveys.** All fish captured during the spawning operation and fish surveys were given individually coded Floy and PIT tags. Anglers reported catching 17-tagged fish in Lake Tahoe during 2017.

**Conduct surveys for adfluvial spawning rainbow trout on Wood Creek, Slaughterhouse Creek, Glenbrook Creek, Marlette Creek, Secret Harbor Creek, and Logan House Creek as time permits.** Due to extreme runoff associated with a record snowpack, access to and visibility within these tributaries were limited. Therefore, no spawning surveys were conducted in 2017.

**Set gill nets for two net-nights in Boulder Reservoir to assess growth rate or previously stocked Incline and Tahoe strain rainbow trout.** On September 12, two 150 ft x 6 ft experimental mesh gill nets were set at 0445 hrs and 0500 hrs in Boulder Reservoir. The nets consisted of 1/2, 3/4, 1, 1 1/2, and 2 in mesh panels. One net was set in the pelagic zone starting at the dam and extending toward the middle of the reservoir while the second net was set in the littoral zone of the southern arm. Fish captured were identified, measured to fork length, and weighed with a certified, battery-powered scale. Live fish were returned to the reservoir after processing. Attachment 1 portrays the sites in Lake Tahoe where rainbow trout were stocked in 2016.

**Monitor the performance of tagged rainbow trout in Marlette Lake by utilizing data collected during the NDOW spawning operation.** Data (length,

weight, and body condition) gathered from tagged rainbow trout were used to compare growth rate, longevity, and performance of Tahoe and Incline strain rainbow trout in Marlette Lake.

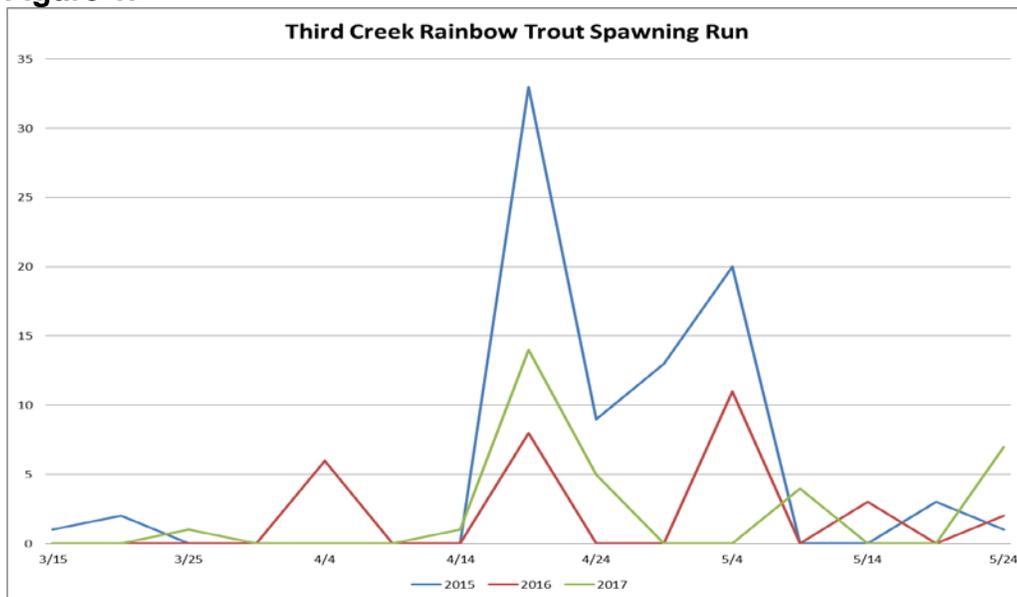
## FINDINGS

**Hand spawn all available adfluvial rainbow trout captured at the Third Creek barrier for propagation in the Mason Valley fish hatchery.** Beginning on March 28, 2017, Third and Incline creeks were monitored for adfluvial rainbow trout.

The installation of a temporary barrier on Third Creek allowed for an adequate assessment of rainbow trout attempting to ascend the tributary while at the same time allowed for the to capture of fish to spawn. Of 27 rainbow trout caught, 19 were hand spawned to produce 9,332 Incline strain rainbow trout eggs. Flow conditions after May 1 became extremely high and therefore difficult to maintain the barrier and capture adfluvial fish. The barrier was removed to prevent it from washing out and fish were allowed to move freely throughout the system. Numerous fish were observed during electroshocking surveys, but were unable to be captured.

The 2017 spawning run began on March 28, which was slightly earlier than in 2016. The peak of the 2017 run was around April 20. Since 2015, there have generally been two spawning peaks (Figure 1) and the first peak of each year occurred around April 20 while a second was observed around May 4. A small peak in fish numbers in 2017 was seen around mid-May, but flow rates exceeded 40 cfs (Figure 2) and it was likely that a number of fish avoided capture.

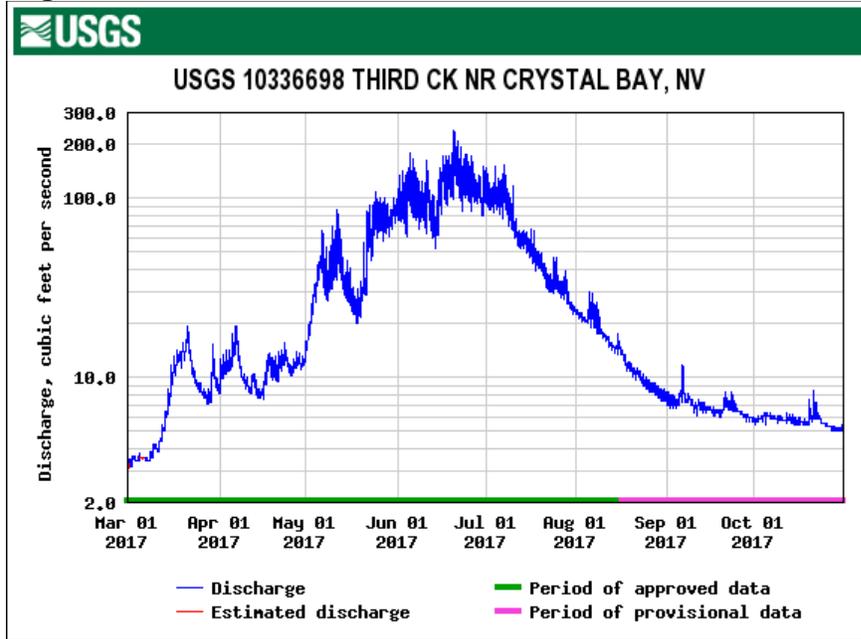
**Figure 1.**



Incline Creek was monitored daily from Lake Tahoe upstream to the Lakeshore Blvd Bridge. Because there was no barrier, fish were free to move upstream as far as

necessary. Visual monitoring with limited electroshocking occurred and only one fish was captured during the 2017 spawning run. However, a number of fish were visually observed, but capturing them was unsuccessful under high flows.

**Figure 2.** Third Creek Flow Rate.



**Concurrent with the spawning operation at Third and Incline creeks and other streams in the basin, measure length, weigh, check for Floy tags, and Floy tag all spawning rainbow trout.** All adfluvial rainbow trout captured in Third Creek during the 2017 spawning season were monitored for Floy and PIT tags. If a fish had not been tagged, then it was measured to fork length, weighed, and fitted with both Floy and PIT tags. A total of 28 rainbow trout were captured in Incline, Third Creek, and Rosewood creeks (a tributary to Third Creek) (Table 1).

**Table 1.** Incline Strain Rainbow Trout Spawning Data for 2017.

Third Creek*	n	FL (mm)	Weight (g)
Male	16	379	766
Female	11	450	1102
Incline Creek			
Female	1	510	1270

\*Includes Rosewood Creek Tributary

During 2017, 48 percent of the fish were from those from either the 2015 or 2016 spawning run or from 2,000-tagged fish spawned from Third and Incline Creeks in 2015 and stocked at Cave Rock (Lake Tahoe) in 2016. For the purposes of analysis, these captured rainbow trout have been separated into two groups, those that were adfluvial wild fish ( $n=6$ ) and those that were wild and hand spawned, hatchery-raised, and released as catchable sized fish ( $n=7$ ).

Of the adfluvial fish caught in 2017, four (two males and two females) were initially tagged during the 2016 spawning run. The initial size at capture averaged 433 mm while during recapture it was 470 mm, leading to an average growth of 37 mm and a range from 15 to 55 mm. The other two were initially tagged during the 2015 spawning run and have been recaptured during spawning runs each year. These were both females that showed growth of 45 mm and 100 mm over the course of two years. Their average size when recaptured was 520 mm (Table 2). Most fish were recaptured in the same stream they were initially caught. One, however, was initially tagged in Incline Creek in 2016 and then recaptured in Third Creek in 2017. Although this occurred, there is a greater suggestion that rainbow trout show site fidelity.

**Table 2.** Adfluvial Rainbow Trout Recapture in 2017.

2 <sup>nd</sup> year recaptured	Capture Date	Initial Capture (mm)	Recapture (mm)	Growth (mm)	K Factor
Third Creek	4/20	470	510	40	1.13
Third Creek	4/20	410	465	55	1.19
Third Creek	3/28	515	530	15	1.18
Third Creek	4/20	338	375	37	1.35
<b>Average</b>		<b>433</b>	<b>470</b>	<b>37</b>	<b>1.21</b>
3 <sup>rd</sup> year recaptured					
Third Creek	4/20	365	465	100	1.50
Third Creek	4/26	530	575	45	0.63
<b>Average</b>		<b>448</b>	<b>520</b>	<b>73</b>	<b>1.06</b>

Seven offspring of wild adfluvial fish (Incline strain rainbow trout) spawned in 2015 were recaptured in 2017. These were raised to catchable size at MVH, tagged with individually numbered yellow Floy tags, and stocked on September 28, 2016 at Cave Rock boat ramp, Lake Tahoe. Prior to stocking, fish lengths were recorded for examining growth rates. These fish showed an average growth of 38.7 mm at recapture with a range from 16 to 90 mm (Table 3). The average k-factor for this group of rainbow trout was 1.10; suggesting they were between fair and poor body condition, being long and thin. Six fish were captured in Third and Rosewood creeks, while one was caught in Incline Creek (October 2017) during monthly electroshocking surveys.

**Table 3.** Incline Strain Rainbow Trout Recaptured in 2017 (all lengths in mm).

Capture Location	Sex	Capture Date	Initial Size Stocked	Size when Caught	Growth	growth/month
Third	M	4/18	272	290	18	2.6
Third	M	4/20	310	352	42	6.0
Third	M	4/20	269	295	26	3.7
Rosewood	M	5/24	234	290	56	8.0
Rosewood	M	5/24	250	266	16	2.3
Rosewood	F	5/24	302	325	23	3.3
Incline	M	10/17	208	298	90	8.2
<b>Average</b>			<b>263.6</b>	<b>302.3</b>	<b>38.7</b>	<b>4.9</b>

**Tag approximately 3,600 Incline strain rainbow trout and 1,600 Tahoe strain rainbow trout to be released in Marlette Lake, Boulder Lake, and Lake Tahoe.** There were 5,092 rainbow trout (3,492 Incline strain and 1,600 Tahoe strain) tagged in 2017 and stocked into Boulder Reservoir, Lake Tahoe, and Marlette Lake where growth and performance will be monitored. A comparison study between Tahoe and Incline strains of rainbow trout will assess the best-suited strain for providing a recreational fishery in each water body.

**Table 3. Tagged Rainbow Trout Stocking by Water Body in 2017.**

Water	Strain	Number	FL (mm)	Weight (g)	K-Factor	Color
Boulder	Tahoe	600	173.70	237.78	1.29	Green
	Incline	492	91.92	190.01	1.34	Blue
Marlette	Incline	1000	151.88	225.35	1.33	Blue
	Tahoe	1000	120.60	210.26	1.30	Green
Tahoe	Incline	2000	155.60	229.07	1.29	Red

**Assess angler catch rates and harvest or catch location of tagged rainbow trout through opportunistic angler contacts and return of angler drop-box surveys.** Throughout 2017, anglers reported catching nine yellow-tagged trout to the phone number listed on the Floy tags affixed to all Incline strain rainbow trout encountered during this project. No catch of Lahontan cutthroat trout were reported. Fish were caught from as far south as Edgewood to as far north as Carnelian Bay, with the largest concentration being caught near Crystal Bay. These fish were the offspring of wild rainbow trout caught in Third and Incline creeks and artificially spawned in 2015. Anglers also caught eight red-tagged fish from Zephyr Cove to Crystal Bay. They mostly concentrated in the Crystal Bay area. Red-tagged fish came from two tagging events; the first were the adult fish caught in Third or Incline Creek during the spawn and the second were 100 of the 2,000 trout that were offspring of the wild rainbow trout caught in Third and Incline creeks and artificially spawned in 2015. Unfortunately, there was a shortage of the yellow Floy tags during the tagging process and, therefore, 100 fish were given red tags. This angler catch data became useful in examining the movement and distribution of both the stocked and wild fish in Lake Tahoe.

**Conduct surveys for adfluvial spawning rainbow trout on Wood Creek, Slaughterhouse Creek, Glenbrook Creek, Marlette Creek, Secret Harbor Creek, and Logan House Creek as time permits.** Due to the high runoff associated with a record snowpack, access to and visibility within these tributaries were limited. For these reasons, no spawning surveys were conducted in 2017.

The high runoff may have benefited these tributaries, since prior to the 2017 spawning season, large shallow, sandy deltas formed at the mouths of each stream due to several years of drought causing limited runoff. The high flows experienced in 2017

may also have flushed these systems and cleaned the gravels necessary for lacustrine fish to spawn successfully. Surveys will be completed in 2018 to examine use by lacustrine fish during the spawning season.

**Set gill nets for two net nights in Boulder Reservoir to assess growth rate or previously stocked Incline and Tahoe strain rainbow trout.** On September 12, two experimental mesh gill nets were set to examine survival and condition of Floy tagged rainbow trout. Nets were placed in both pelagic and littoral zones of the reservoir and left to sit over night for 15 hours each. Ten Floy tagged fish were captured and data is presented in Table 4. This first year to compare differences and it appears there are no major differences between Incline and Tahoe strains of rainbow trout. Both strains showed similar increases in fork length from the time they were stocked (September 27, 2016) to the time they were caught (September 13, 2017). The average weight of the Tahoe strain rainbow trout did, however, increase more than that of the Incline strain rainbow trout (11.3 percent increase vs. 6.3 percent). Body condition (k-factor) for each strain was nearly identical. Future monitoring will be beneficial in making management decisions regarding which strain provides a better public fishery.

**Table 4.** Boulder Reservoir Hatchery Rainbow Strain Evaluation.

Strain (No.)	Fork Length (mm)			Weight (g)			K Factor	
	2016	2017	% increase	2016	2017	% Increase	2016	2017
<b>Incline (5)</b>	239	268	<b>12.13</b>	205	218	<b>6.34</b>	1.35	1.12
<b>Tahoe (5)</b>	240	273	<b>13.75</b>	203	226	<b>11.33</b>	1.28	1.11

**Monitor the performance of tagged rainbow trout in Marlette Lake by utilizing data collected during the NDOW spawning operation.** During the 2017 spawning operation at Marlette Lake, 28 rainbow trout were captured that either had a red (Incline strain) or yellow (Tahoe strain) Floy tag. These fish were reared in MVH and stocked into Marlette Lake in 2016 to augment the broodstock program and for comparing growth and body condition.

A comparison found the Tahoe strain averaged 269.2 mm (10.6 in) and the Incline strain averaged 294.6 mm (11.6 in). Growth rate for the Tahoe strain was 45.7 mm (1.8 in) per year and 78.7 mm (3.1 in) per year for the Incline strain. It appears the Incline strain rainbow is exhibiting a higher growth rate while the Tahoe strain is showing better survival (Table 5).

## STUDY REVIEW

The 2017 field season posed numerous challenges during the rainbow trout spawning period on Third and Incline creeks. Record snow pack and resulting runoff lead to extremely high flows throughout the spring and well into summer. High flows not only made nearly impossible for us to maintain the temporary weir, but it also appeared to have negatively affected the ability of wild to navigate tributaries and spawn. While a similar number of adfluvial rainbow trout were captured in 2017 as in 2016, more were

visually observed during electroshocking surveys. For the second consecutive year, wild fish were caught in 2017 that were previously caught in earlier years of this study. Two of six were recaptured for a third consecutive year. This is possible evidence that there is site fidelity in wild rainbow trout that exists in Lake Tahoe.

**Table 5.** Comparison Data for Incline and Tahoe Stain Rainbow Trout in Marlette Lake.

Year Stocked	2016	2016	2016	2016
Strain	Tahoe	Incline	Tahoe	Incline
Tag Color	Yellow	Red	Yellow	Red
	Average Size		Number Captured	
Stock Year	8.8	8.5	1000	1000
2017	10.6	11.6	20	8
Inch/Year	1.8	3.1		
	Return		20	8
	% Return		2	0.8

A new aspect of this study was to examine the long-term performance of hatchery-reared rainbow trout, which were progeny of wild fish utilizing Third and Incline creeks for spawning. Growth and performance will be determined among the 3,600 Incline strain rainbow trout stocked in 2016 into Boulder Reservoir ( $n=600$ ), Lake Tahoe ( $n=2,000$ ), and Marlette Lake ( $n=1,000$ ). During the first year of analysis, it appears that the Tahoe strain rainbow trout in Boulder Reservoir (a lower elevation, eutrophic reservoir) is performing slightly better than the Incline strain. However, at Marlette Lake (a higher elevation, oligotrophic lake), the Incline strain appears to be outperforming the Tahoe strain. This is not surprising since Incline strain rainbow trout respond favorably in Lake Tahoe and may be suitable in less productive, high elevation water bodies.

When comparing returns of rainbow trout to the spawning trap in Trelease Creek, a tributary of Marlette Lake, Tahoe strain more than doubled that of Incline strain. However, fish were still young and as they mature, a better representation of each strain should be attracted to the trap during next year's spawning. Long-term collection of data will help examine strain longevity, fecundity, and growth to help provide management direction that benefits sport fisheries in Nevada.

## RECOMMENDATIONS

- Hand spawn all available adfluvial rainbow trout captured at the Third Creek barrier for propagation in the Mason Valley Fish Hatchery.
- Concurrent with the spawning operation at Third and Incline creeks and other creeks in the basin, measure length, weigh, check for Floy tags and Floy tag all spawning rainbow trout.
- Tag approximately 3,000 Incline strain rainbow trout and 1,000 Tahoe strain rainbow trout to be released in Marlette Lake and Lake Tahoe.

- Assess angler catch rate and harvest or catch location of tagged rainbow trout in Lake Tahoe along with growth rate through opportunistic angler contacts and return of angler drop-box data.
- Set gill nets in Boulder Reservoir to assess growth rates of tagged Incline and Tahoe strain rainbow trout.
- Monitor the performance of tagged rainbow trout in Marlette Lake by utilizing data collected during the NDOW spawning operation.
- Conduct surveys for adfluvial spawning rainbow trout on Wood Creek, Slaughterhouse Creek, Glenbrook Creek, Marlette Creek, Secret Harbor Creek, and Logan House Creek as time permits.

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Attachment 1

