

NEVADA DEPARTMENT OF WILDLIFE
STATEWIDE FISHERIES MANAGEMENT



FEDERAL AID JOB PROGRESS REPORTS

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TOPAZ LAKE
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: *Topaz Lake*
Period Covered: *January 1, 2016 through December 31, 2016*

SUMMARY

Average monthly storage for Topaz Lake during 2016 was 88% of average (20,883 acre-ft, the 18-year average was 23,670 acre-ft). This was the first year since 2012 that near normal storage levels were observed in the Walker Basin.

Mail-in, angler questionnaire data for 2015 estimated 1,084 anglers fished 4,224 days to catch 6,880 fish. Since Topaz Lake straddles the Nevada and California state line, anglers may possess either state's fishing license so the data reported here represents only those anglers buying a Nevada fishing license. The average catch rate was 1.63 fish per angler day. Coldwater and Warmwater General Fisheries Management Concept objectives were successfully met in 2015 and 2016 based on the mail-in survey as well as angler contacts and drop-box data.

Monitoring for aquatic nuisance species (quagga mussels) continued in 2016 and no veligers or adult mussels were found.

Fish surveys conducted during 2014 verified an increasing population of adult smallmouth bass; however, during 2015 and 2016, adult numbers were lower. Juvenile smallmouth numbers found during snorkel surveys increased in 2016 (none were found during 2014, 28 were found during 2015, and 30 were found during 2016). A study aimed at assessing the effectiveness of artificial habitat structures on recruitment and survival of black bass was continued during 2016 with the installation of ten additional structures placed along the western shore throughout the summer (22 were placed during 2015).

A study aimed at assessing the rainbow trout fishery was initiated during 2010. Growth and catch rates of four trout strains (bowcutt trout and Eagle Lake, Bel Air, and Tahoe strains of rainbow trout) indicated that bowcutt trout performed better than other strains. Creel survey results continue to indicate that bowcutt trout are by far the most likely to carry over from one year to the next.

BACKGROUND

The Nevada/California border almost equally divides Topaz Lake, but it is owned and operated by the Walker River Irrigation District (WRID). Nevada Department of Wildlife (NDOW) and California Department of Fish and Wildlife (CDFW), nonetheless, share fishery management responsibilities. Both agencies collectively have established

a significant coldwater fishery in the reservoir. The earliest record of stocking by Nevada occurred in 1930 with black bass (*Micropterus* sp.) and since then, the lake has been stocked abundantly with rainbow trout (*Oncorhynchus mykiss*). Other stocked fishes include brown trout (*Salmo trutta*), kokanee salmon (*O. nerka*), Lahontan cutthroat trout (*O. clarkii henshawi*), bowcutt trout (a hybrid between cutthroat and rainbow trout), tiger trout (a hybrid between brown trout and eastern brook trout, *Salvelinus fontinalis*), and black bullheads (*Ictalurus melas*). Common carp (*Cyprinus carpio*) also exist. Today, however, rainbow and bowcutt trout make up the principal sport fishery, other fishes such as tiger trout, largemouth bass, and occasionally brown trout encompass a minor fishery. Even though smallmouth bass were known to occur in the West Walker River and anecdotal reports from anglers suggested they were in the lake earlier, they were first confirmed by NDOW during 2008. Smallmouth bass are now established and they comprise a significant component of the sport fishery, particularly during the summer when trout fishing becomes slow. The native fish community is comprised of mountain whitefish (*Prosopium williamsoni*), Tahoe sucker (*Catostomus tahoensis*), Lahontan tui chub (*Siphateles bicolor obesus*), Lahontan reidsides (*Richardsonius egregious*), and speckled dace (*Rhinichthys osculus*).

Topaz Lake fishing season is open from January 1 to September 30. The fishing regulation states "Fishing is legal from 1 hr before sunrise to 2 hrs after sunset, except for the area within the jetties of Topaz Marina, which is closed to fishing. Limit is 5 trout, 10 mountain whitefish, and 15 warmwater game fish of which not more than 5 may be black bass."

There are two major boat-launching facilities, Topaz Landing and Douglas County Park. Topaz Landing is privately owned with a fee for launching, while Douglas County Parks is public and charges a fee to launch boats. The Douglas County boat ramp is large enough for multiple launchings and can be used at all but extremely low water levels. In addition to a fish cleaning station, there are camping sites and restrooms. An angler drop-box near the Douglas County boat launch was installed in 2010 to collect basic information including hours spent fishing, number of fish caught, general size of fish and species. Douglas County Parks is open from January 1 to September 30.

Water storage typically declines during late summer, as water demands remain high. As the irrigation season ends in October, the water level increases throughout winter. Crop irrigation begins in mid-April and river runoff typically peaks shortly after, and the reservoir then reaches maximum capacity for the year. Maximum pool is 125,000 acre-ft, but usable storage, governed by the depth of the outlet, is about 59,500 acre-ft. At minimum stage, the reservoir reaches a depth of 59 ft. At full storage, maximum depth approaches 92 ft and the mean depth is 52 ft. It has 2,410 SA and sits at 5,005 ft above mean sea level when full.

OBJECTIVES

General Management Objectives:

- Conduct a general fisheries assessment through opportunistic angler contacts, angler drop-box surveys, and mail-in angler questionnaire data.
- Monitor lake level and clarity when on site.
- Monitor for the presence of adult quagga mussels by conducting tactile surveys around boat docks and reservoir substrates at least three times per year.
- Conduct quagga mussel veliger sampling through plankton tows at established transects at least three times per year.

Black Bass Study Specific Objectives:

- Increase habitat complexity and provide additional juvenile habitat cover with additional artificial habitat structures.
- Monitor habitat structures and spawning activity through snorkeling surveys during summer.

PROCEDURES

General Management Objectives:

Conduct a general fisheries assessment through opportunistic angler contacts, angler drop-box surveys, and mail-in, angler questionnaire data. Information obtained from angler contacts included total time fished and number, size, and species of fish caught. Location of angler, place of residence, and type of bait or lure used were also recorded. Angler drop-box survey forms were collected from a single drop-box located next to the Douglas County boat ramp. Angler questionnaires were sent to 30,000 anglers purchasing a Nevada fishing license. Information returned to the Department of Wildlife was entered into a database and summarized for use in assessment of individual fisheries. Since Topaz Lake straddles the Nevada and California state line, anglers can possess either state's fishing license so the data reported here represents only those anglers buying a Nevada fishing license. Opportunistic angler contacts were made on eight occasions during January (two days), May (two days), June (two days), July (one day), and August (one day).

Monitor lake level and clarity when on site. Lake volume was measured by a USGS gage in acre-ft near the dam and water clarity was measured using a Secchi disk. Secchi disk measurements were taken on four occasions (April 1, May 10, July 6, and August 10, 2016) near mid lake.

Monitor for the presence of adult quagga mussels by conducting tactile surveys around boat docks and reservoir substrates at least three times per year. Monitoring of buoys, submerged rocks, exposed rocks, moored boats, and boat docks was conducted on eight occasions in 2016 (January 1 and 4, April 1 and 21, May 10 and 11, July 6, and August 10). Tactile surveys included snorkeling around boat docks

and buoys as well as visual inspection of surfaces that became exposed as the reservoir level dropped throughout the summer.

Conduct quagga mussel veliger sampling through plankton tows at established transects at least three times per year. Three stations have been established to sample for quagga mussel veligers. The first station was near Douglas County boat ramp, the second near mid-lake, and the third near Topaz Landing boat launch. Vertical tows were made from the hypolimnion to the surface and a minimum of 1,000 L of lake water was filtered through a 63- μ m mesh plankton net. Samples were only taken on two occasions during 2016 (May 10 and July 6). Samples were preserved in 75% ethanol and analyzed by Pisces Molecular in Colorado and Eco Analysts in Idaho.

Black Bass Study Specific Objectives:

Increase habitat complexity and provide additional juvenile habitat cover with additional artificial habitat structures. Habitat structures, purchased from Mossback Fish Habitat, are made of nontoxic “scuffed” PVC trunks with composite limbs to simulate sunken trees or root structures that would be found in a natural environment. Three different types of structures were utilized consisting of Safe Havens (Figure 1), Root Wad 3 Posts, and Trophy Tree Kits. Product dimensions and specifications are presented in Table 1.

Figure 1. Safe Haven Fish Habitat Structure



Table 1. Mossback Habitat Specifications

	Dimensions	Limbs	Number of Anchors
Safe Haven	50" x 50"	24	1
Root Wad 3 Post	25" x 50"	12	1
Trophy Tree Kit	50" x 50"-100"	36	2

All structures were constructed in Fallon and transported to the lake on a small flatbed trailer. The structures were then transported to the install locations with the use of an 18 ft aluminum Delta Angler boat. Suitable locations were determined based on

bathometric maps and then proofed using depth measuring devices. All structures were placed in at least 6 ft of water and not more than 15 ft in order to target areas where all species were suspected to be most vulnerable to predation. These locations and depths also function as suitable spawning habitat for warm water species, which produce offspring that can utilize the structures as well. Structures were submerged and anchored using six-feet of nylon coated aircraft cables and either one or two cinder blocks per structure. GPS locations were recorded for each structure for future monitoring purposes.

Monitor habitat structures and spawning activity through snorkeling surveys during summer. Snorkel surveys were conducted on four occasions (May, June, July, and August). A single snorkeler dove from a boat near habitat structures and swam near each structure. Fish species, approximate size, and their location to the structure were recorded.

FINDINGS

General Management Objectives:

Conduct a general fisheries assessment through opportunistic angler contacts, angler drop-drop box surveys, and mail-in, angler questionnaire data. A total of 45 shore anglers and 29 boat anglers were contacted at Topaz Lake during 2016. A combined total of 74 anglers were contacted during 2016 compared to 105 during 2015 and 71 during 2014. Shore anglers showed a catch rate of 0.49 fish per hour (0.27 fish per hour during 2015, and 0.30 fish per hour during 2014) and 1.20 fish per angler day (during 2015, 0.51 trout per angler and in 2014, 0.32 trout per angler). A total of 39 rainbow trout were measured from shore anglers that averaged 17.5 in and 43 trout were measured from the boat anglers that averaged 15.4 in. Five bowcutt trout averaged 20.4 in during 2016. No anglers targeting bass were contacted during 2016 and only 15 anglers targeting bass were contacted in 2015. During 2015, bass angler use was limited and only three bass were measured; however, they averaged 19 in at a catch rate of 0.21 fish per hour. These numbers also represented a decline in the catch rate compared to 2.08 fish per hour during 2014, and 3.33 during 2013, however, size of smallmouth bass increased (14.9 in during 2014 and 15.3 in during 2013). No largemouth bass were reported by anglers during 2014, 2015, or 2016.

Historical mail-in, angler questionnaire data is shown in Table 2. In 2015, below average numbers were reported for all categories except fish per angler day, which was the highest reported in the past four years. This data does not distinguish between anglers targeting trout or bass so it is not possible to assess angler catch rates for warmwater species separately based only on this information. Historically, trout have dominated the sport fish community as well as angler catches, on the other hand, creel contacts and angler drop-box surveys suggest bass numbers may be stabilizing or even decreasing due to drought conditions experienced over the past several years.

Table 2. Mail-in Angler Questionnaire History

Year	No. of Anglers	Days Fished	Fish Caught	Fish/Angler Day
2004	3,408	19,056	28,817	1.51
2005	3,185	18,931	27,054	1.43
2006	2,945	14,704	23,098	1.57
2007	2,935	24,586	44,152	1.80
2008	2,482	10,474	12,443	1.19
2009	3,148	20,157	28,755	1.43
2010	2,793	14,895	22,395	1.50
2011	2,767	13,265	22,652	1.71
2012	2,574	8,414	12,497	1.49
2013	1,502	6,453	6,457	1.00
2014	1,094	7,670	7,147	0.93
2015	1,084	4,224	6,880	1.63
Average	2,493	13,569	20,196	1.43

Available data suggests that low water levels observed from 2013 to 2015 may have either resulted in a decline of smallmouth or reduced the recruitment efficiency into the adult population. Trout are augmented through hatchery stocking and no natural reproduction has or is expected to occur in the lake.

Twenty-three drop box surveys were collected during 2016. Eighteen drop-box surveys were collected during 2015 and none were collected during 2014. The Douglas County boat ramp was open for most of 2016; however, it was closed throughout most of the year during 2015 and 2014 and data was limited. The angler drop-box survey does not distinguish between black bass species, however, angler creel contacts reported 100% of the bass caught during the past two years were smallmouth bass, therefore, it is assumed that most, if not all, bass reported from the drop-box survey were smallmouth. Largemouth bass are present in the lake, but numbers are low. Angler drop-box data for 2011 through 2016 is shown in Table 3. In 2016, anglers reported catch rates of 0.83 fish per hour and most fish caught were rainbow trout. In 2015, anglers averaged 0.41 fish per hour. A decrease in percentage of bass caught has been observed since 2013 (47% of fish caught), 2015 (21% of fish caught), and 2016 (5% of fish caught).

Table 3. Angler Drop-Box Survey from 2010 – 2016

	2010	2011	2012	2013	2014	2015	2016
No. Anglers	4	32	29	25	0	18	23
Hrs Fished	24	167	122	144.5		95	141.5
Bass	0	22	4	45		8	6
Tiger	1	1	7	1		0	0
Rainbow	6	108	132	50		31	112
Fish/Hour	0.29	0.78	1.17	0.66		0.41	0.83
Fish/Day	1.75	4.09	4.93	3.84		2.17	5.13

Topaz Lake is managed as a “two tiered fishery” under the guidelines of the Coldwater and Warmwater, General Fishery Management Concepts. The coldwater concept states “angler success rates should range between 0.25 and 0.75 fish per angler hour and 1.0 and 2.0 fish per angler day.” The warmwater concept states “angler catch rates should range between 0.25 and 0.75 fish per hour and 1.0 and 2.0 fish per angler day. Largemouth bass should average 10 inches.” The size of fish reported from the angler drop-box survey showed all bass caught were larger than 14 inches and 96% of trout caught were larger than 11 inches (Table 4). Available data for angler catch rates and size of fish suggests that Topaz Lake is meeting the management objectives.

Table 4. 2016 Drop Box Size of Fish

	<3.9"	4-7.9"	8"-10.9"	11"-13.9"	14"-15.9"	16"-17.9"	>18"
Bass					4		2
Rainbow		1	4	71	17	10	10

Most trout stocking occurred during October and December when Topaz Lake was closed to fishing, which is typical of this put, grow, and take fishery. Tiger trout were stocked during the spring when they met the size required (Table 5).

Table 5. 2016 Stocking Summary

Date	Species	Strain	Number	Size
3/29/2016	Tiger Trout	TIGER	2783	10
10/10/2016	Cuttbow	MARLETTE	5950	9
10/18/2016	Rainbow	INCLINE	2075	8.4
10/18/2016	Rainbow	TRIPLOID	2567	9.4
10/21/2016	Rainbow	TAHOE	4720	10.2
11/7/2016	Rainbow	TAHOE	5760	9.5
11/8/2016	Rainbow	ERWIN/ARLEE	1024	9.7
11/10/2016	Rainbow	ERWIN/ARLEE	6060	9.4
11/10/2016	Rainbow	TAHOE	1494	10
11/10/2016	Rainbow	ERWIN/ARLEE	4242	9.4
11/14/2016	Rainbow	INCLINE	6588	8.8
11/15/2016	Rainbow	TAHOE	4536	10
11/16/2016	Rainbow	TAHOE	4554	10
12/5/2016	Rainbow	TAHOE	4932	9.7
		Total Rainbow	48,552	9.5
		Total Tiger	2,783	10
		Total Cuttbow	5,950	9.0

Table 6 shows the five-year stocking history for both the Nevada Department of Wildlife (NDOW) and the California Department of Fish and Wildlife (CDFW). NDOW stocks approximately 50,000 catchable rainbow that range from 8.8 to 10.7 in whereas

CDFW typically stocks 10,000 to 25,000 smaller rainbow trout that range from 6.0 to 8.9 in.

Table 6. Stocking History – NDOW and CDFW

Nevada Department of Wildlife

		Number	Size (in)
2015	Rainbow	61,210	9.3
	Tiger	4,995	9.3
	Bowcutt	6,277	10.1

2014	Rainbow	50,815	9.5
	Tiger	4,502	8.9
	Bowcutt	-	

2013	Rainbow	52,830	10.4
	Tiger	12,644	3.8
	Bowcutt	4,752	9.5

2012	Tiger Trout	5,010	10.0
	Rainbow	53,339	10.7

2011	Rainbow	6,780	5.0
	Rainbow	50,110	9.6
	Bowcutt	5,794	10.1

California Department of Fish and Wildlife

		Number	Size (in)
2016	Rainbow, triploid	15,200	6.8
2014	Rainbow, triploid	15,410	6.0
2013	Rainbow, triploid	25,200	6.5
2012	Rainbow, triploid	23,780	8.9
2011	Rainbow, triploid	15,600	6.2
	Rainbow, triploid	10,000	7.1
2010	Rainbow	12,812	6.3

Monitor lake level and clarity when on site. Complete water quality profiles were not taken during 2016. However, large rainbow trout (greater than 18 in) were observed during January of 2017, suggesting that water quality remained within trout tolerances during the summer of 2016. Annual surface temperature ranged from a high of 77°F on August 10, to a low of 38°F on January 1 (Table 7). A strong thermocline with stratification is common throughout the summer and suitable trout habitat is typically reduced to a few vertical meters. Lake level and surface temperatures during 2016 were similar to those observed during 2015 and 2014. During summer of 2014, suitable trout water quality was limited to approximately six feet of the water column from 26 to 33 ft where temperatures were below 68°F (20°C) and dissolved oxygen levels were above 6.0 ppm. It is likely that water temperature and dissolved oxygen levels throughout the lake during 2016 were similar to those observed during 2014 and 2015.

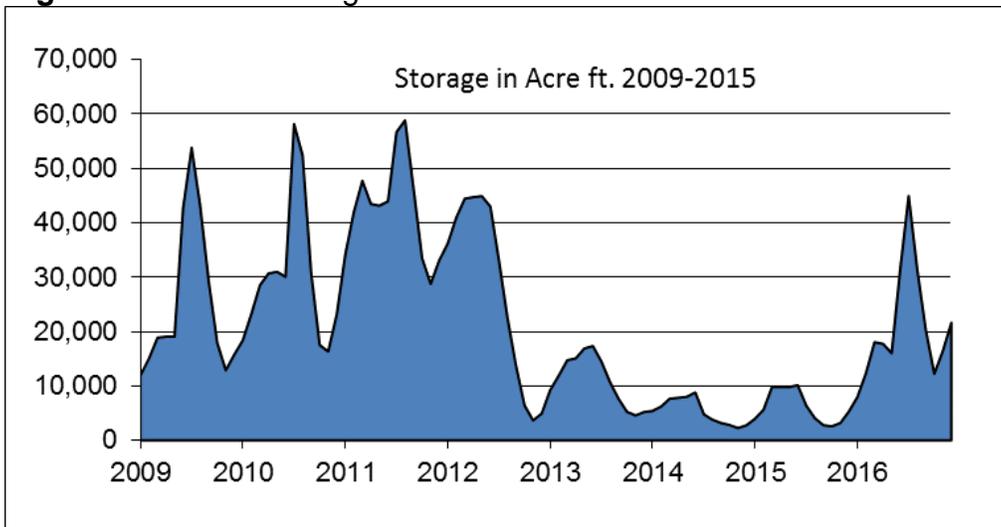
Secchi depth measurements were taken on four occasions when water quality data was recorded. Water quality (clarity) diminished throughout the summer months and the average depth of clarity was 10 ft (3.3 m), which is consistent with past data (Table 7).

Table 7. Surface Water Quality Sampling 2016

Date	Air Temp F (C)	Water Temp F(C)	Secchi Depth Ft (M)
1/1/2016	17 (-8)	38 (3)	-
4/1/2016	63 (17)	58 (14)	17 (5.2)
5/10/2016	81 (27)	58 (14)	13 (4.0)
7/6/2016	88 (31)	73 (23)	9.8 (3.0)
8/10/2016	91 (33)	77 (25)	3.3 (1.0)

Water storage reported in Figure 2 was taken from USGS gage number 10297000. Only usable storage was measured at this gauge, which did not include the 65,000 acre-ft at minimum pool. While historical lows were observed during 2014 and 2015, reservoir levels rebounded to average levels (88% of the historical average) during 2016. Annual storage was observed at the lowest level of 8,000 acre-ft of usable water on January 1, 2016 (during 2014 the lowest observed level was October 26 at 2,220 acre-ft and during 2015 the lowest observed level was 2,560 acre-feet on September 19). The reservoir continued to gain storage until the start of the irrigation season. The reservoir peaked on June 23, 2016 at 46,160 acre-feet.

Figure 2. Usable Storage 2009 – 2016



Water clarity fluctuates throughout the year at Topaz Lake. During winter, algae and macrophytes are reduced, creating higher water clarity. During late summer and fall, water clarity diminishes and during moderate to heavy winds, visibility reduces to just a few feet. Adverse effects on sport fish survival and recruitment could be attributed to water level (e.g., lack of inundated vegetation for protection of juvenile black bass). Additionally, rising water temperatures combined with falling oxygen levels in summer due to a low water volume and increased surface area could affect trout survival.

Monitor for the presence of adult quagga mussels by conducting tactile surveys around boat docks and reservoir substrates at least three times per year. Several substrate-sampling methods were used for monitoring for the presence of

quagga mussels including tactile and visual surveys of boat docks, buoys, and submerged and exposed rocks. Results have all been negative for detection of adult quagga mussels.

Conduct quagga mussel veliger sampling through plankton tows at established transects at least three times per year. All samples have been negative for the detecting the presence of quagga mussel veligers.

Study Specific Objectives, Black Bass:

Increase habitat complexity and provide additional juvenile habitat cover with additional artificial habitat structures. Installation of habitat structures was completed throughout the course of several months and GPS coordinates were recorded with each new structure (Table 8, Figure 3). Several structures placed during the spring had to be moved to deeper water during late summer due to rapidly declining reservoir levels. Two structures were vandalized and had to be repaired and replaced. Boat anglers were observed fishing near the structures and anecdotal information suggests that the structures are providing a higher concentration of fish that anglers are targeting. It is likely that structures are attracting larger bass by providing a concentrated forage base of younger non-game and game species.

Table 8. Mossback GPS locations 2016

Label	Water Body	Easting	Northing	Zone
S-25	Topaz lake	279841.0	4282887	11
S-26	Topaz lake	279847.4	4282847	11
S-27	Topaz lake	279828.6	4283824	11
S-28	Topaz lake	279968.6	4283989	11
S-29	Topaz lake	280173.1	4284158	11
S-30	Topaz lake	280387.3	4284268	11
S-31	Topaz lake	280428.7	4284380	11
S-32	Topaz lake	280422.5	4284361	11
S-33	Topaz lake	280406.6	4284293	11
S-34	Topaz lake	280339.2	4284220	11

Monitor habitat structures and spawning activity through snorkeling surveys during summer. Snorkeling surveys during May, June, July, and August resulted in observing 30 juvenile smallmouth bass of an estimated size range between three and five inches (28 juveniles were found during 2015 and no juveniles were found during 2014). No adults were observed during 2016 or 2015 (four were observed in 2014). Clinging aquatic vegetation has grown on the artificial habitat units and visibility was reduced during late June due to macrophyte and suspended algae growth in the epilimnion, reducing fish observation efficiency during July and August surveys. When Secchi disk measurements were up to 10 ft during spring snorkeling efforts, it was likely fish escaped prior to being observed. Approximately 80 fish were observed near structures, but not positively identified (Table 9).

Figure 3. Artificial Habitat Structures Placement, 2016



Table 9. Snorkel Survey Results 2016

	2015	2016
No. Bass	28	30
No. Trout	0	0
No. nongame	50	95
No. Unidentified	75	80
Hours Snorkeled	2.9	7.5
Bass/Hour	9.66	4

MANAGEMENT REVIEW

The 2015 Mail-in Angler Questionnaire Survey suggests that although angler use remains low, catch rates have recovered from the all-time lows observed since 2013. Results from the 2016 drop-box and contact creel surveys suggest that management objectives for angler use and success were met in spite of drought conditions that persisted through 2015. The high summertime temperatures and low dissolved oxygen levels experienced during 2013 and 2014 likely lead to limited trout carryover, however,

results from drop-box surveys and angler contacts during 2016 suggest that trout were able to survive the summer. Most trout carryover observed during the past three years and all carryover fish observed during 2016 have been bowcutt trout.

Monitoring of adult quagga mussels through tactile and visual inspection of boat docks, buoys, and substrates should continue annually. Monitoring of veligers should also continue. Results from 2016 were negative.

A rainbow trout study was conducted from 2010 through 2014 to examine the effectiveness (growth and catch rates) of stocking Bel Air, Tahoe, and Eagle Lake strains of rainbow trout and bowcutt trout. Results suggested that bowcutt trout outperformed the other strains. Various species of trout including rainbow trout, tiger trout, brown trout, and cuttbow trout should be stocked based on habitat, fish availability, and the results of the trout study. Results from angler contacts during 2016 suggest that carryover bowcutt trout were averaging two to three inches larger than other strains of trout.

A black bass study was initiated in 2014. The addition of protective cover for juvenile bass was continued and further study of population structure and habitat use will determine if artificial habitat results in increasing the angler catch rate and maximum size or relative abundance of bass. Even though bass angling was less successful during 2014 and 2015, it is likely a result of persistent drought and subsequent low reservoir levels and not due to the addition of the artificial habitat structures. Artificial habitat was placed in Topaz Lake where cover was limited and was monitored during the summer. Only four adults were observed utilizing these structures during the fall of 2014 (none were observed during 2015 or 2016), however, juveniles were utilizing structures during the summer of 2015 and 2016. In addition to providing cover for juvenile bass, artificial habitat should also provide protection for forage species. Additional artificial structures should be placed into the lake and should be monitored for use by juvenile black basses. Additional monitoring techniques should be evaluated to maximize detection efficiency.

RECOMMENDATIONS

General Management Objectives:

- Conduct a general fisheries assessment through opportunistic angler contacts, return of angler drop-box surveys, and mail-in, angler questionnaire data.
- Monitor lake level and clarity when onsite.
- Monitor for the presence of quagga mussels by conducting tactile surveys around boat docks and reservoir substrates at least three times per year.
- Conduct quagga mussel veliger sampling through plankton tows at established transects at least three times per year.

Black Bass Study Specific Objectives:

- Increase habitat complexity and provide additional juvenile habitat cover with artificial habitat structures.

- Monitor habitat structures and spawning activity of black basses through snorkeling surveys and acoustic techniques during summer.

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Date: February 2017