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SUMMARY

Bassett Lake received very little angling pressure in 2017. Angling will pick up as the fishery stabilizes and the fish size increases. The only stocking that occurred in 2017 was the introduction of 550 bluegill. A gill net survey in April 2017 revealed excellent trout growth. Minimal time was spent at the lake due to other job responsibilities.

During 2017, Cave Lake was stocked with 26,160 rainbow trout that averaged 11.1 inches from April through October. Cave Lake was surveyed utilizing boat electroshocking for the third time. The survey reflected very few carryover rainbow trout. There was a strong younger age class of brown trout and several older age classes of brown trout. Crayfish trapping surveys showed that crayfish populations were stable and healthy.

As part of the Cold Creek Reservoir Study, frame net surveys as well as electroshocking surveys were conducted during 2017. In the spring of 2017, frame net surveys found a reduction in overall tui chub numbers. The composition of the fall survey showed results that are more positive in the efforts of largemouth bass as a biological control on the nuisance tui chub population. A total of 2,000 hatchery-reared rainbow trout and 1,596 bowcutt trout were stocked in Cold Creek Reservoir in 2017. Creel surveys resulted in very few contacts, but angler drop-box returns were the highest ever recorded from the reservoir.

Since the installation of the drop-box in Illipah Reservoir, 2017 received the least amount of angling pressure according to drop-box returns. The 2017 spring gill net survey showed that there was decent carryover of rainbow trout. One management concern was a lack of brown trout age structure. There was one two-year old brown trout caught and several much older brown trout captured. This could be attributed to the extended period of drought that most of the western United States experienced. In addition, the drawdown of water for irrigation and livestock watering created another negative impact to the fishery.

BACKGROUND

Bassett Lake

Bassett Lake is a privately owned body of water that sits 22 miles north of Ely, Nevada. In the last two decades, Bassett Lake has not been actively managed due to a
nuisance population of northern pike. In 2015, a chemical treatment to remove northern pike from White Pine County was undertaken. Subsequent posttreatment surveys did not reveal any persisting northern pike in the lake. In October and November 2015, Bassett Lake received 2,500 rainbow trout, 3,500 fingerling hatchery largemouth bass, and 38 largemouth bass that ranged from 2.4 inches to 18.7 inches from South Fork Reservoir in Elko County.

Cave Lake

Cave Lake is located in Cave Lake State Park located 15 miles southeast of Ely, Nevada. The park and its facilities are maintained by the park ranger and the fishery is managed by NDOW as a put-and-take rainbow trout fishery. The fishery sees approximately 20,000 angler use days per year. Stocking of trout occurs from April through October, with the 32 surface-acre reservoir receiving more than 20,000 hatchery-reared rainbow trout averaging approximately nine inches in length. Although uncommon in the angler’s creel, a self-sustaining population of brown trout also occupies the lake. The state record for brown trout set in 1984 is still held by Cave Lake at 27 pounds 5 ounces.

The combination of a put-and-take rainbow trout fishery and quality visitor facilities attracts users year round. Cave Lake State Park has long been a popular destination for many outdoor recreationists for fishing, hiking, camping, and a base camp for hunting. However, one of the complaints continually voiced to NDOW is the small size of trout caught. Due to its morphological makeup and relative lack of traditional lentic macroinvertebrates that trout depend upon, stocked fish currently do not gain substantial growth and carryover. Crayfish are present but few stocked trout can reach a size to be able to forage on them.

Cold Creek Reservoir

Cold Creek Reservoir is a small spring-fed fishery that is located approximately 100 miles northwest of Ely in Newark Valley, Nevada. It is managed by NDOW under the General Fisheries Management Concept. At capacity, the reservoir covers 14 surface-acres and is situated on both private property and land administered by the Bureau of Land Management. The reservoir contains largemouth bass and a naturally reproducing population of rainbow trout that is augmented twice annually with approximately 4,000 hatchery-reared rainbow trout at 9.0 inches. The reservoir receives approximately 1,300 angler use days per year.

After being chemically treated in 1972 and 1984 to remove tui chub, tui chub numbers in Cold Creek Reservoir have rapidly increased to nuisance levels once again. Tui chub are currently in competition with rainbow trout for food resources. Because of this, angler visitation and satisfaction has suffered. In an effort to establish a means of biological control, 247 largemouth bass were augmented in Cold Creek Reservoir in 2008 and 2009. Bowcutt trout are known to be more piscivorous than rainbow trout and in the fall 2010, Cold Creek Reservoir was stocked with 1,610 Marlette-strain bowcutt trout. An additional 1,560 bowcutt trout were stocked in the fall of 2012. The stocking
of bowcutt trout and largemouth bass will hopefully create a multi-tiered fishery, increase angling opportunity, and provide a means of biological control of the tui chub population.

In 2013, bowcutt trout were not stocked into Cold Creek Reservoir due to the lack of eggs from a poor spawn at Marlette Lake in the spring.

In late June 2014, there was 69 largemouth bass augmented into the Cold Creek Reservoir to assist in the biological control of tui chub. The average size of the 69 largemouth bass that were stocked was 9.2 inches (234 mm). All 69 largemouth bass were captured during an annual survey of the Ruby Valley Marshes.

Illipah Reservoir

Illipah Reservoir is a privately owned irrigation reservoir managed as a public fishery under an agreement signed in 1981 between the NDOW and the owner, Robert E. Dickenson. As a result of this agreement, the State of Nevada built a new dam, enlarging its capacity and providing for a minimum pool of 160 acre-ft. At capacity, the reservoir is 72 surface acres with a storage capacity of 1,300 acre-ft. Due to irrigation and livestock watering needs by the adjacent Moorman Ranch and two other water right holders, water levels at Illipah Reservoir are highly dependent upon winter precipitation and fluctuate greatly.

Illipah Reservoir receives 15,000 rainbow trout annually, with allotments being delivered in the spring and autumn months.

Silver Creek Reservoir

Silver Creek Reservoir is a small, privately owned irrigation reservoir managed by NDOW as a put-and-take trout fishery. The reservoir was dredged in 1993, restoring some of its lost capacity and reestablishing a non-withdrawable minimum pool. It is managed as a public fishery under an informal agreement with the owner, Baker Ranches.

OBJECTIVES and APPROACHES

Bassett Lake

Objective: General Sport Fisheries Management

Approaches:
- Conduct a general fisheries assessment through opportunistic angler contacts.
- Visually assess water level fluctuations during the course of other duties.
- Set frame nets for two net-nights in spring.
- Introduce bluegill as a forage species for largemouth bass (approximately 500 will be stocked).
**Cave Lake**

Objective: General Sport Fisheries Management

Approaches:
- Conduct a general fisheries assessment through opportunistic angler contacts.
- Visually assess water quantity (lake level, inflow/outflow) and quality (clarity) for coordinating trout stocking.
- Set at least 10 crayfish traps overnight, 2 times each summer or fall.
- Set four thermographs to monitor the littoral water temperature pattern.
- Utilize boat electroshocking during one night in the late summer or fall to assess brown trout and rainbow trout abundance and size.
- Sample for occurrence of quagga mussel veligers through plankton net tows conducted two to four times between June and September at up to three sites.

**Cold Creek Reservoir**

Objective: Evaluate the health of the fishery and determine the success of largemouth bass at controlling tui chub.

Approaches:
- Examine carryover of sport fish, body condition, size structure, and relative abundance by utilizing 7 frame nets and about 30 minnow traps over a single night in the spring to assess tui chub populations.
- Electroshock one established transect during one night in the fall to assess largemouth bass recruitment and tui chub abundance and size structure.
- If necessary, augment the largemouth bass population with various sizes from nearby waters (Ruby Lake NWR).

Objective: General Sport Fisheries Management

Approaches:
- Maintain and check return of volunteer angler drop-box surveys during the course of other duties.
- Visually assess water quantity (lake level, inflow/outflow) and quality (clarity) for coordinating trout stocking.
- Conduct general fisheries assessment through opportunistic angler contacts.
- Provide anglers with an additional drop-box.
Illipah Reservoir

Objective: General Sport Fisheries Management

Approaches:
- Conduct a general fisheries assessment through opportunistic angler contacts.
- Maintain and check return of volunteer angler drop-box surveys during the course of other duties.
- Visually assess water quantity (lake level, inflow/outflow) and quality (clarity) for coordinating trout stocking.
- Set experimental gill nets for two net-nights in the spring.

Silver Creek Reservoir

Objective: General Sport Fisheries Management

Approaches:
- Maintain and check return of volunteer angler drop-box surveys during the course of other duties.
- Visually assess water quantity (lake level, inflow/outflow) and quality (clarity) for coordinating trout stocking.
- Gill net or frame net for one net-night in the spring.

PROCEDURES

Visits were made throughout 2017 to Bassett Lake, Cave Lake, Comins Lake, and Illipah Reservoir for the purpose of monitoring water quality and quantity. While present at each water body, Department personnel collected creel survey data. Information on angler harvest, effort, and origin were recorded on standard forms. Harvested trout were measured to total length in millimeters.

Prior to spring and fall stocking and during the course of other duties, trips were made to Cave Lake, Cold Creek Reservoir, Bassett Lake, Illipah Reservoir, and Silver Creek Reservoir for visually ascertaining water levels and water temperatures for trout stocking.

During the course of other duties throughout the year, volunteer angler survey boxes at Cold Creek Reservoir, Illipah Reservoir, and Silver Creek Reservoir were periodically maintained and restocked. At the end of the year, data was tallied using a standard computer spreadsheet.

Two 150 foot x 6 foot experimental gill nets were set at 1620 and 1630 hours respectively on 14 March 2017 at Bassett Lake. These nets consist of five panels of ½, ¾, 1, 1½, and 2 inch mesh. Both nets were set along the dam of the lake, with the first being set on the west end and the second being set on the east end. Both nets were set in similar water depths, with the narrowest mesh sitting in one foot of water and
extending out into eight feet of water. The two nets were fished overnight and pulled at 0930 and 0945 hours the following morning. All fish captured were identified and measured to total length. Live fish were returned to the reservoir.

The Eastern Region electroshocking barge was used to sample one transect at Cave Lake on the evening of September 20. With the new shocking unit, Smith-Root VVP-15B, the booms were set forward as the anode and the hull of the boat was the cathode. Voltage was set between 450 and 500, continuous pulse, and with an output of 4.5 amps. Pulse frequency was set at 60 Hz and a pulse width of 5-milliseconds. Attempts were made to capture all fish stunned during survey activities. Both trout species captured were measured (total length) and only brown trout were weighed with a spring-type hand scale. All trout were returned to the lake once processed.

The sampling design and trap placement has remained the same historically with the exception of number of crayfish traps. Only 15 traps were used during the 2014 - 2017 trapping sessions, whereas there were 17 used in 2009 and 2010. This change was made due to the absence of two custom-made traps in the inventory.

To produce a population estimate, Chapman’s version of the Peterson estimator was used:

\[ N = \frac{M + 1}{(R + 1)} \]

Where \( N \)=population estimate, \( M \)=number of individuals marked, \( C \)=number of individuals captured, \( R \)=number of individuals recaptured. The Poisson distribution was used to determine the 95% confidence limits (Ricker 1975). Ricker (1975) suggests using a Poisson distribution or binomial charts, which provide low and high ranges for \( R \), which are then substituted back into Chapman’s version of the Petersen estimator.

It should be noted that all confidence intervals were determined by utilizing Chapman’s method of determining variance of \( N \):

\[ \text{Variance of } N = \frac{N^2 (C - R)}{(C + 1)(R + 2)} \]

\[ \text{Standard error} = \sqrt{\text{Variance of } N} \]

Six frame nets and 28 minnow traps were deployed at 1800 hours on April 12, 2017 and pulled at 0715 on April 13, 2017 at Cold Creek Reservoir. Frame nets were distributed along the southern one-third of the eastern shoreline and the southern and western shorelines, with minnow traps being deployed among the frame nets. Frame nets were anchored to the shoreline and were set in depths between 8 feet and 12 feet. Minnow traps were used at water depths between 1-foot and 3-feet. The total length of all trout captured was measured, while a representative sample of tui chub was also measured (total length). Live trout were returned to the reservoir and all tui chub were
removed. At the time of the survey, the middle pond was filling and the lower pond was at capacity.

The Eastern Region electroshocking barge was used to sample one established transect at Cold Creek Reservoir on the evening of September 27. The new shocking unit, Smith-Root VVP 15B, was set up with the booms forward as the anode and the hull of the boat as the cathode. Voltage was set at 500 (DC) with an output of 7-amps. Pulse frequency was set at 60 Hz, with a pulse width of 5-milliseconds. Attempts were made to capture all fish stunned during survey activities. Excluding tui chub, all species of fish captured were measured (total length) and weighed with a spring-type hand scale. Largemouth bass and trout captured during survey activities were returned to the reservoir while tui chub were disposed of properly.

Two 150 foot x 6 foot experimental gill nets were set at 1500 and 1515 hours on May 1, 2017 at Illipah Reservoir. These nets consist of five panels of ½, ¾, 1, 1½, and 2-inch mesh. One net (deep set) was set along the east shoreline just south of the old dam in roughly 23 feet (7.0 meters) of water. The other net (shallow set) was set further south along the east shore of the south lake, approximately two thirds of the way between the old dam and current inflow in 10.0 feet (3.0 meters) of water. The nets were pulled at 1015 and 1035 hours, respectively, on May 2, 2017. All fish captured were identified and total length measurements recorded. Live fish were returned to the reservoir while crayfish captured were discarded.

**FINDINGS**

**Bassett Lake**

In the spring of 2017, Bassett Lake was at capacity and spilled over the dam until the middle of August. By then, water ceased to flow from Bassett Lake due to lack of water coming in from the upstream tributaries.

A total of 11 fish were captured during survey activities, consisting of five rainbow trout and six largemouth bass. The rainbow trout had an average length of 15.1 inches (383 mm), with a range from 12.8 inches (325 mm) to 17.7 inches (450 mm). The six bass captured averaged 5.6 inches (142 mm) and ranged from 3.7 inches (95 mm) to 7.1 inches (180 mm). Since there were so few fish captured, length frequency graphs were not completed. All rainbow trout were carryover from the trout stocked in November 2015. The largemouth bass captured represented at least two age classes, those being represented by an individual that measured 3.7 inches and another five bass that were between 5.2 inches (133mm) and 7.1 inches (180mm).

This gill net survey showed that there has been some reproduction in the largemouth bass population at Bassett Lake. The individuals that were in the five to seven inch range were fingerlings that were stocked into Bassett Lake in late 2015. The bass that were captured were all released and were noted as having excellent body condition. Although there were only a few fish captured during this survey, they have helped reveal that there is potential for a strong largemouth bass population and that all
fish will grow exceptionally well in Bassett Lake. Finally, these findings show that, following the 2015 chemical treatment, the productivity of the lake rebounded quickly.

Cave Lake

Between January and September 2017, seven checks were made contacting 22 anglers. Those anglers fished for 43 hours and caught 69 trout. Rainbow trout comprised 98% of the catch while brown trout represented 2% of the catch. Of the anglers contacted, 11 were from White Pine County, seven were from Clark County, and the rest were distributed among other Nevada Counties.

The water level at Cave Lake was at capacity all year until mid-September when the Cave Lake State Park manager released water from the lake. This was done on behalf of NDOW to clean the Cave Creek channel so larger brown trout could swim into Cave Creek and spawn. The water level dropped approximately 18 inches and by mid-October, the lake was full again. Water temperatures were taken to coordinate stocking efforts in the spring and fall; those temperatures were 49°F and 53°F, respectively.

Crayfish Population Study

The capture and mark session of crayfish was completed on consecutive days at two locations at Cave Lake. During each mark session, 15 standard minnow traps were utilized to capture crayfish. Each trap was baited with hotdogs, fished in 3.3 – 9.8 feet (1.0 – 3.0 m) of water near shore, and tethered by rope to a surface float. Traps were fished overnight and pulled in the early afternoon hours of the next day:

Set 1 – September 5 - 6, 2017. Traps were set along the western 1/3 of the dam face and along the west shoreline at the northwest end of the reservoir. Traps were set for a period of 20.1 hours.
Set 2 – September 6 - 7, 2017. Traps were set along the eastern 2/3 of the dam face and around the east end of the dam into the cove at the north end of the reservoir. Traps were set for a period of 21 hours.

A total of 565 crayfish were captured during 595.5 trapping hours and marked with a uropod clip (right or left side). Total catch rate for the marking effort was 0.95 crayfish per trap hour. Crayfish were released and were allowed to mingle within the rest of the population for about a week before traps were reset in Cave Lake.

After giving marked crayfish nearly a week to disperse and intermingle with unmarked crayfish, the capture/marking effort was duplicated. On two consecutive days, the same number of traps was set in the same two locations as the previous week:

Set 1 – September 5-6, 2017. Traps were set for a period of 23.25 hours.
Set 2 – September 12-13, 2017. Traps were set for a period of 22.75 hours.
A total of 736 crayfish were captured in 667.25 hours during the recapture effort, which took place one week after the mark session. Total catch rate for the recapture effort was 1.1 crayfish per trap hour. Of the 736 crayfish captured, 34 were marked with a uropod clip; the remaining 702 crayfish were captured for the first time.

After assessing the data at the conclusion of the 2017 sampling effort, it was noted that the modeling approach for this project was selected erroneously. Some of the basics assumptions that follow the modified Lincoln-Peterson estimator were violated such as the basic assumption that the population is a closed population. During sampling, particularly in 2017, there were anglers actively trapping crayfish for personal consumption, but no crayfish were found to have uropod clips in any trap. The other assumption that was violated was that all animals are equally likely to be captured in each sample. Since there were crayfish that were harvested from Cave Lake during the sampling period, the assumption was violated.

Given the above violations, a model such as the Jolly-Seber (J-S) model or the Cormack-Jolly-Seber (C-J-S) model should have been used. Both models address open populations and provide more accurate population estimates than the Lincoln-Peterson in those scenarios. The issues are that both, the J-S and C-J-S, need repeated events that capture marked individuals from the previous trapping event to produce an accurate population estimate. Unfortunately, in the years with consecutive trapping, 2009 - 2010 and 2014 - 2015, there were no crayfish captured from one year to the next.

The result of using Chapman’s version of the Peterson formula produced a population estimate of 11,917 (8,117 - 15,716, p=0.95) crayfish in Cave Lake (Table 1). Some of the same considerations must be taken into account for the 2017 survey as were done for other surveys. One consideration is that only a fraction of the suitable habitat was sampled. There is more crayfish habitat available throughout the lake, but it was not surveyed or represented in this survey, particularly deeper portions of the lake. It would be unreliable to extrapolate the current population estimate; however, it can be assumed that the population is underestimated.

Table 1. Population Estimates for Crayfish in Cave Lake.

<table>
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<tr>
<th>Year</th>
<th>M</th>
<th>C</th>
<th>R</th>
<th>Lower</th>
<th>Estimate</th>
<th>Upper</th>
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<td>2009</td>
<td>434</td>
<td>375</td>
<td>41</td>
<td>2789.3</td>
<td>3882.9</td>
<td>4976.6</td>
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<tr>
<td>2010</td>
<td>353</td>
<td>193</td>
<td>7</td>
<td>3092.5</td>
<td>8583.5</td>
<td>14074.5</td>
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<td>2014</td>
<td>101</td>
<td>127</td>
<td>5</td>
<td>602.0</td>
<td>2175.0</td>
<td>3748.0</td>
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<tr>
<td>2015</td>
<td>434</td>
<td>545</td>
<td>13</td>
<td>8489.8</td>
<td>16964.0</td>
<td>25438.2</td>
</tr>
<tr>
<td>2017</td>
<td>565</td>
<td>736</td>
<td>34</td>
<td>8117.9</td>
<td>11917.3</td>
<td>15716.8</td>
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Since the sampling methods remained the same among the sampling years, variation among sampling years should try to be explained. The abiotic parameters for Cave Lake have shown little to no fluctuation over the last eight years. In 2015, there was a change in the water level of Cave Lake before and during both the mark-recapture events. The outflow structure of Cave Lake was opened up to assist in recharging Comins Lake after the fish eradication project that was conducted in August.
of 2015. The water level was approximately 18 inches lower than normal and increased the size of the shoreline significantly. This allowed traps to be placed in areas that are deeper in the water under normal conditions, causing crayfish that may reside deeper in the lake to travel to the baited traps. This drop in water level happened again in 2017, which could explain the large increase in the crayfish numbers.

A population trend cannot be assessed because the model and sampling regimen used was incorrect. The population estimates that were derived using the Lincoln-Peterson estimator were inconsistent and unusable in any management decisions (Table 1). Anecdotal evidence suggests that the crayfish population has decreased over the last eight years due to the removal of fish carcasses along the shoreline. The fish cleaning station now captures a majority of the fish that used to be cleaned on the shorelines. However, the data speaks to the contrary in that the numbers of crayfish captured in 2009 were similar to the numbers captured in 2017. The poor capture on crayfish in 2014 could simply be an outlier and not reflect an actual change in the population itself.

As mentioned above, these analyses and all prior analyses should not be used in any management decision moving forward. The study should be redesigned using the appropriate models and sampling procedures.

Fish Population Sampling

Electroshocking activities at Cave Lake began at 1910 hours and concluded at 1955 hours. A total of 564 shocking seconds (9.4 min) were spent on the survey. Survey activities commenced at the north end of the lake and continued in a clockwise fashion around the shoreline. At the time of the survey, the lake was at capacity, with a water temperature of 52°F. Air temperature at the time of shocking was 45°F. Due to a strong wind out of the south, shocking was deemed poor to fair.

A total of 71 fish were captured during survey activities, consisting of 71 rainbow trout, 41 brown trout, and 7 largemouth bass. Rainbow trout made up 42% of the catch, brown trout comprised 57% of the catch, and less than 1% of the catch was largemouth bass. For the third consecutive year, brown trout has been captured in higher numbers than rainbow trout, which is unprecedented. A representative sample of 30 rainbow trout was measured, revealing an average total length of 11.1 inches (282.6 mm), with a range of 8.7 inches (221 mm) to 19.2 inches (487 mm). Body condition for rainbow trout was only visibly assessed, with most fish being in fair to poor body condition. The single larger rainbow trout was in excellent condition compared to the other rainbow trout. Length frequency analyses suggest that there were four age classes of rainbow trout present in Cave Lake (Figure 1). Age classes are represented with break points at 230 mm, 300 mm, 390 mm, and 487 mm.

The average length of 41 brown trout captured at Cave Lake was 10.7 inches (271.4 mm), with a range of 6.5 inches (165 mm) to 27.2 inches (690 mm). A length frequency analysis revealed five age classes present in Cave Lake (Figure 2). Age classes were determined to be at 165 mm, 220 mm, 300 mm, 583 mm, and 690 mm.
Body condition of the captured brown trout ranged from poor to excellent. It has been documented through fin clipping of hatchery rainbow trout that fish will decrease in size in Cave Lake due to poor forage conditions, particularly of aquatic invertebrates. Therefore, it was anticipated that most brown trout would be in poor body condition. Once again, it should be noted that there was a lack of mature age classes between 13 inches and 18 inches. A reason for this anomaly is still unknown at this time.

Figure 1. 
Rainbow Trout Length Frequency 
Cave Lake 2017 Fall Electrofishing

Figure 2. 
Brown Trout Length Frequency 
Cave Lake 2017 Fall Electrofishing

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Overall catch numbers were down compared to previous surveys due to the wind from a storm front coming in. It cut the survey short and made the shocking more difficult. Though documentation of a decent range of brown trout and rainbow trout were found, it is believed that more trout would have been found in the portion of the lake not surveyed. The reason this is an important fact to include in this report is that there is limited knowledge and data related to the brown trout population in Cave Lake. Lacking older age classes in the population could be the reason brown trout do not appear more abundant.

Cave Lake is an oligotrophic lake that is characterized by limited nutrients and limited primary production. The limited primary production in Cave Lake causes a ripple effect in the trophic system keeping fish from growing effectively. Below is a simplified illustration that corresponds to the different trophic levels in Cave Lake and the organisms that reside within each level (Figure 3).

**Figure 3.**

It was brought to the attention of NDOW personnel in 2014 that there was a fish species present in Cave Lake that was not a salmonid. An electroshocking survey was conducted that did not reveal any other fish species outside of rainbow trout and brown trout. In late August 2015, an angler reported that he had caught a 12-inch largemouth bass from Cave Lake. Since that time, there have been three additional adult largemouth bass harvested from the Lake. Reproduction among largemouth bass has been documented, with at least two dozen age class II individuals present in the lake. The seven largemouth bass captured during the 2017 electroshocking survey were all the same age class. They averaged 7.0 inches (178 mm) and ranged from 6.5 inches (166) to 7.4 inches (190 mm). All largemouth bass captured were placed into a transport tank and stocked into Comins Lake after the survey was completed.
The rainbow trout captured in this survey reflected the average size of the trout stocked in the fall of 2016 and spring of 2017. Since Cave Lake is managed as a “put and take” rainbow trout fishery, a large carry over population is not expected. The brown trout population is much stronger than what previous surveys found and from what creel surveys have shown. However, it should be conveyed that the brown trout population in Cave Lake does not hold near the individuals as the rainbow trout. The body condition of all trout in Cave Lake will remain poor to fair as long as nutrients and primary productivity remain low. The only tributary to Cave Lake is Cave Creek, which leaves limited potential for increasing nutrient loading and, thus, limiting energy transfer among trophic levels.

Cold Creek Reservoir

The water level at Cold Creek Reservoir was at capacity until mid-July at which point evaporation and water usage brought the lake to 75% of capacity. The water level remained at this level throughout the winter months. Water temperatures were taken in order to coordinate stocking efforts in the spring and fall; those temperatures were 53°F and 51°F, respectively.

Six frame nets were fished for a total of 79.5 hours, averaging 14.1 hours per net. Minnow traps (n=28) were fished for a total of 406 hours, averaging 14.5 hours per trap. A total of 172 fish were captured, consisting of 27 rainbow trout, 3 bowcutt trout, 1 largemouth bass, and 141 tui chub. Rainbow trout made up 15.7% of the catch while bowcutt trout accounted for 1.7%. The single largemouth bass was 0.6% of the catch and tui chub represented the remaining 81.9% of the fish captured during the survey (Figure 4). Rainbow trout were captured at a rate of 0.34 fish per net hour, bowcutt trout were captured at a rate of 0.04 fish per hour, and tui chub were captured at a rate of 1.77 fish per net hour. Total catch rate was 2.2 fish per net hour. It must be noted that the numbers of fish captured were those captured in frame nets. Utilization of the minnow traps during this survey resulted in the capture of five largemouth bass. These minnow traps, however, did not capture tui chub compared to 1,064 tui chub and one largemouth bass captured in 2015.

Of the 27 rainbow trout captured, the average total length was 10.6 inches (269 mm), with a range of 9.2 inches (234 mm) to 12.2 inches (311 mm). Length frequency analysis of the rainbow trout captured reveals three age classes currently inhabiting the reservoir (Figure 5). Length breakpoints for age classes were at 235 mm, 295 mm, and 311 mm.

The average total length of the three-bowcutt trout captured was 14.8 inches (378 mm), with a range of 9.8 inches (251 mm) to 24.8 inches (630 mm). Bowcutt trout have been stocked into Cold Creek Reservoir each fall from 2010 to 2016, with the exception of 2013 when Bowcutts were not available. This survey reflects two of the multiple age classes present in reservoir. The two-bowcutt trout that measured 9.8 inches and 9.9 inches were stocked in the fall of 2016. The single larger trout has likely inhabited Cold Creek Reservoir for at least four years. We know that the reservoir was
not stocked with bowcutt trout in 2013, and it is not likely this trout grew to this size between fall 2014 and spring 2016. Therefore, this trout was likely stocked in 2012.

Figure 4.

Species Percent Composition at Cold Creek Reservoir

Figure 5.

Length Frequency of Rainbow Trout Cold Creek Reservoir Spring 2017

Tui chub total length averaged 7.2 inches (183 mm) and ranged from 6.5 inches (164 mm) to 8.3 inches (212 mm). Length frequency analysis from 71 tui chub reveals three age classes currently inhabiting the reservoir (Figure 6). The three age classes are visible at break points of 165 mm, 205 mm, and 215 mm.
Spring surveys have not shown that biological controls have had a negative impact on tui chub populations. The previous two surveys resulted in the highest numbers of trout captured in spring netting surveys since 2000, with 78 found in 2016 and 76 in 2017. This year, the water level was higher than normal and two of the six nets did not capture any trout, suggesting there is uncertainty surrounding the condition of the trout fishery in Cold Creek Reservoir. The reservoir has the ability to grow large trout such as the 24.8-inch bowcutt trout captured this spring; however, most of the trout in the reservoir grow relatively slow and have poor body condition. Regardless, tui chub have averaged 71.2% of the species composition since 2010 (not including 2017 data). This year they comprised 81% of the total catch, which is above average. This could be an anomaly because the reservoir was higher than normal during sampling and tui chub prefer littoral areas. Trout generally prefer pelagic habitat, suggested by results of this survey. So species composition over time will represent a trend, but the higher tui chub composition found in 2017 is not cause for alarm.

The new survey strategy utilizing frame nets and minnow traps provides a two-fold benefit to the management of Cold Creek Reservoir. First, trout mortality was nearly zero during this survey, which allows individuals to be returned into the water to continue growing. Secondly, tui chub can be removed from the reservoir by utilizing minnow traps in conjunction with frame nets, allowing older and younger age classes of tui chub to be targeted. However, the minnow traps did not assist in removal of small tui chub this year. In fact, of the 28 baited minnow traps, no fish were captured in any of them. This was also the case in 2016 when minnow traps were found to be void of tui chub. However, minnow trapping will continue and possibly at some time become useful in removing younger age classes of tui chub. Perhaps this year was an anomaly.

Electroshocking activities at Cold Creek Reservoir began at 1910 hours and concluded at 1800 hours. A total of 1,152 seconds were spent on actual electroshocking. Survey activities commenced at the north end of the lower pond,
continued in a counter-clockwise fashion along the shoreline, and concluded back at the south end of the reservoir (Figure 7). After the shoreline transect was completed, the electroshocking boat returned to the northwestern corner of the reservoir in an attempt to contact more largemouth bass. At the time of the survey, the reservoir was at approximately 80% of capacity. Air temperature was 40°F with a 5 to 8 mph wind out of the northwest. Shocking efficiency was deemed good. Water temperature at the end of survey was 51°F. It should be noted that for the second time in two years, water levels were at capacity. The lower and middle ponds were at capacity and stayed that way through the middle of July.

Figure 7.

A total of 156 fish were captured during survey activities, consisting of 63 rainbow trout, 9 bowcutt trout, 70 largemouth bass, and 14 tui chub. Rainbow trout made up 40% of the catch, bowcutt trout accounted for 6%, and largemouth bass made up 45%. The remaining 9% of the catch was comprised of tui chub. Combined, trout accounted for 45% of the catch this year, which increased from last year and past years (Figure 8). A welcomed decrease in the number of tui chub captured during this year was observed. This is the fourth consecutive year of this survey that tui chub numbers have declined.

Abiotic and biotic factors such as habitat quality and competitive interaction, respectively, can be attributed to causing additional stress for both trout species resulting in poor body conditions. Since Cold Creek Reservoir is for irrigating the ranch below, water is withdrawn when water temperatures begin to increase. The increased water temperatures cause an increase in the maintenance metabolism in trout; therefore, they require a higher food intake to subsist, which translates to limited growth or none at all. The reservoir also contains a large tui chub population, with young-of-
year (YOY) continually being recruited. This large tui chub population presents direct competition with trout for available food resources. The accumulative effects of increased summer water temperature, resulting in a change in physiology of trout, and competition for food resources could be enough to cause poor body condition.

Figure 8.

Of the 63 rainbow trout captured in 2017, a representative sample of 24 trout revealed at least three age classes present in the reservoir (Figure 9). Length breaks were at 260 mm, 320 mm, and 343 mm. The measured fish averaged 11.3 inches (288 mm), with a range of 9.8 inches (250 mm) to 13.5 inches (343 mm). There were no young-of-year found this year. The average length for rainbow trout was nearly one inch longer (10.6 inches, 269 mm) than found in 2016. Based on spring frame net surveys and fall electroshocking surveys, there was a lack of older age classes. Once again, rainbow trout were found to have fair to poor body condition. This has become a common trend at Cold Creek Reservoir and, as mentioned above, competition for forage and the instability in late summer and early fall water levels contribute to poor growth.

Figure 9.
Nine bowcutt trout captured averaged 12.2 inches (309 mm), with a range from 11.4 inches (290 mm) to 13.4 inches (340 mm). In six years of stocking, there has never been enough bowcutt trout collected to determine age class structure. However, it is assumed there are individuals that survive long enough to reproduce and, therefore, it is likely there are three to four age classes of bowcutt trout in the reservoir. In early September 2016, an angler sent Reno NDOW staff pictures of a large bowcutt trout that was approximately 28 inches long and weighed nine pounds. This shows there is definitely age classes not represented in the fall electroshocking or spring frame net surveys. In addition, when bowcutt trout were captured during population surveys or recorded in creel surveys, they were generally the largest trout captured.

Compared to the number of largemouth bass captured in the 2016 survey ($n=140$), only 70 were captured in 2017. The higher number of largemouth bass captured in 2016 was due to an unusually high effort to locate more bass for taking measurements. Largemouth bass in 2017 averaged 7.1 inches (182 mm), and ranged from 3.5 inches (90 mm) to 11.9 inches (303 mm). Length frequency analysis shows that there are four age classes of largemouth bass present in Cold Creek Reservoir. Using break points at 115 mm, 190 mm, 250 mm, and 303 mm the four age classes are readily distinguishable (Figure 10). Of the 52 largemouth bass measured, 10 were weighed to determine body condition. The average weight was 0.32 pounds (146 grams) and they ranged from 0.21 pounds (95 grams) to 0.90 pounds (14.45 grams). Only two largemouth bass measured revealed a good body condition, the remaining eight were considered to be of fair body condition.

Although multiple age classes were present, older age classes were not represented by this survey. In 2016, older age classes were represented by individuals that were over 15 inches long and those fish were completely absent from the 2017 survey. Shocking was more difficult in 2017 due to the increase in thick mats of filamentous algae in the area that a majority of older age class largemouth bass like to inhabit. The age classes that were present should continue to carryover and develop into a strong spawning population over the next several years. Largemouth bass in 2016 were found to be mostly in excellent condition, whereas most fish in 2017 were found to be in fair body condition. Obviously, the lack of older age class largemouth bass resulted in the abrupt drop in body condition averages between 2016 and 2017.

A total of 14 tui chub ranged from 6.8 inches (172 mm) to 8.1 inches (205 mm), with an average length of 7.4 inches (188 mm). A length frequency was not generated, but there were several age classes of tui chub still present in Cold Creek Reservoir. For the second time since the Cold Creek Reservoir Study began, tui chub were not the dominant biomass in the reservoir. The continuous recruitment of tui chub, along with their competition for food resources add to the decline in trout body condition in the reservoir. Both rainbow trout and bowcutt trout are continuing to have poor body condition due to biotic and abiotic factors. So far, these factors have not kept rainbow trout from reproducing, which is evident by the smaller age classes. Even though trout have been able to reproduce successfully, the accumulative effect of a poor environment (i.e. warm temperature) and competitive interaction (i.e., with tui chub) could be enough to keep them from effectively controlling the tui chub population.
Figure 10.

Largemouth Bass Length Frequency
Cold Creek Reservoir 2017 Fall Electrofishing

![Graph showing largemouth bass length frequency.]

It should be noted that the 2017 spring survey of Cold Creek Reservoir revealed a very similar range and average size of tui chub. One interesting finding was that no young age class (class 1) tui chub was captured while using 28 baited minnow traps. During usual fall electroshocking surveys, tui chub YOY are numerous and easily observed. In 2017, this was not the case, with most of the smaller fish captured being largemouth bass YOY. It is not logical that tui chub did not spawn in 2016 or 2017, but a reduction in tui chub biomass could be the reason why so few were contacted.

In 2016, the largemouth bass length frequency revealed a very strong age class in the 175 mm to 205 mm range. This age class could possibly be represented up to 220 mm. If this is the case, this cohort will be a strong spawning class for Cold Creek Reservoir in the near future. If more age class groups could be identified such as they are above (Figure 10), it would mean a more stable largemouth bass population and could meet the goals of the Cold Creek Reservoir study. Largemouth bass appear to have some effect on the tui chub population, and their efforts will possibly be magnified using other fish sampling strategies. Springtime frame netting, minnow trapping, and predation should cause a shift in the tui chub population structure in the near future.

A total of 28 volunteer angler surveys from the drop-box were received from Cold Creek Reservoir in 2017. During months when surveys were received, nine anglers had fished for 60 hours and caught 118 rainbow trout and 70 largemouth bass. Resulting catch rates were 7.8 fish per angler and 3.1 fish per hour. Of the 118 rainbow trout caught, 43 were kept and the remaining 75 were released. Of the largemouth bass that were caught, only 10 bass were harvested and 60 were released. Angler satisfaction in
2017 was rated on a scale of 0 to 4, with 0 being unsatisfied and 4 representing satisfaction. Average ratings were 3.5 for total fishing experience, 2.5 for the number of fish caught, and 3.1 for the size of the fish caught.

For trout, the size reported was relatively well distributed among the less than 9.0 inch bracket, 9.0 to 10.9 inch bracket, and 11.0 to 12.9 inch bracket. Together those three brackets comprised 94% of the all trout caught. The 13.0 to 14.9 inch bracket retained 5% of the fish caught. The remaining 1% came from the length bracket 15 to 16.9 inches. Largemouth bass from 9.0 to 14.9 inches comprised 96% of the catch at Cold Creek Reservoir in 2017. The remaining 4% was 15 to 16.9 inches.

This year, the increased number of drop-box surveys provided more insight into the fishery at Cold Creek Reservoir than any since the drop-box was installed. From 2005 – 2014, the Cold Creek Reservoir drop-box data showed averages of less than eight surveys received per year. Catch rates, however, should not be compared to past years because the survey form has undergone numerous changes. Angler satisfaction is comprised of fishing experience, number of trout, and size of trout. Angler surveys reported that fishing experience, number of trout, and size of trout was rated as 3.5, 2.5, and 3.1, respectively.

**Illipah Reservoir**

The water level at Illipah Reservoir was consistent until mid-July at which point evaporation and drawdown brought the lake to 75% of capacity. Irrigation and livestock use caused the reservoir to have water withdrawn from it, lowering the water to approximately 35% of capacity. No water withdrawal in the late summer or fall allowed the reservoir to rise and enter winter at 70% of capacity. Water temperatures were taken to coordinate stocking efforts in the spring and fall; those temperatures were 63°F and 55°F, respectively.

A total of 26 anglers were contacted in 10 days of creel survey at Illipah Reservoir. A total of 42 hours were fished, capturing 129 trout. Anglers caught an average of 3.1 fish per hour, with 93% rainbow trout and 7% brown trout. Of the 22 anglers, 14 were from Clark County, 6 were from White Pine County, and 2 were from Churchill County.

A total of 33 volunteer angler surveys from the drop-box were received from Illipah Reservoir this year. This is the fourth consecutive year in which there were fewer volunteer angler surveys received than the previous year. Seven angler surveys were rejected for insufficient data. During the months when surveys were received, 33 anglers fished for 83.5 hours and caught 373 fish, consisting of 363 rainbow trout and 10 brown trout. Resulting catch rates (all fish) were 14.4 fish per angler and 4.5 fish per hour. Of the 363 rainbow trout caught, 93 were harvested and the remaining 270 released. In addition, four brown trout were harvested, while six were released. Harvest rates resulted in 3.7 fish per angler and 1.2 fish per hour. Shore anglers accounted for 44% (12 individuals) of all anglers, 19% (5 individuals) fished through the
ice, 22% fished from boats (6 individuals), and the remaining 15% fished from float
tubes (4 individuals).

Volunteer angler survey reports were analyzed, and of the rainbow trout caught, 86% of them ranged from less than 9.0 inches up to 12.9 inches. The remaining 14% were larger fish that ranged from 13.0 inches to greater than 16.9 inches. The length measurements for brown trout revealed lengths ranging from smaller than 9 inches to larger than 19 (n=1). Of the 10 brown trout caught in 2017, five were found to be 10.9 inches or smaller. Angler satisfaction was rated on a scale of 0 to 4, with 0 being unsatisfied and 4 representing satisfaction. For 2017, total fishing experience averaged 3.0, while number of fish averaged 2.5, and size of fish averaged 3.1. Overall, angler satisfaction was lower in 2017 due to a dry water year.

A total of 60 trout were captured in the two gill nets placed in Illipah Reservoir. Fish included 56 rainbow trout (93%) and 4 brown trout (4%). Rainbow trout were captured at a rate of 1.46 per net hour, while brown trout were captured at a rate of 0.21 per hour. Catch rates in 2017 were lower than the average catch rate over the last decade for rainbow trout (2.75) and brown trout (0.46).

The total length of rainbow trout captured ranged from 7.9 inches (201 mm) to 13.6 inches (346 mm), with an average length of 10.4 inches (263 mm). Length frequency analyses show there were four age classes present using the following break points of 7.9 inches (201 mm), 10.2 inches (260 mm), 12.2 inches (310 mm), and finally 13.8 inches (350 mm) (Figure 11).

**Figure 11.**

Length Frequency of Rainbow Trout at Illipah Reservoir, Spring 2017
The total length of four brown trout captured in 2017 was 10 inches (255 mm), 23.8 inches (606 mm), 28.9 inches (736 mm), and 32 inches (814 mm). Since there were only four brown trout captured, a length frequency analysis was not created. It is common in this survey to capture a small number of brown trout. In surveys over the years, as few as three brown trout have been captured, with the most caught being 32 in 1988.

Body condition was assessed on 24 rainbow trout, with 22 showing poor body condition and two having fair body condition. Body condition ratings for three of the four brown trout were rated as poor, the fourth trout was not weighed. The overwhelming number of trout in poor body condition could be a direct result of the recent drought and water withdrawal for livestock use and crop irrigation. Since 2012, Illipah Reservoir has only dropped to minimum pool once; however, the stresses of continual low water have noticeably affected the fishery. Body conditions for both species were similar to 2014 results.

Population structure for both rainbow trout and brown trout were worse than anticipated. Recruitment of wild spawned rainbow trout was noted during this survey. There seemed to be weak carryover of rainbow trout (from 2016), which was indicated by the lack of older age class trout. All brown trout in Illipah Reservoir are spawned in Illipah Creek and are recruited into the reservoir population. The results of the 2017 survey revealed a poor population structure, comprised of only several exceptionally large and a few small trout. Poor population structure of brown trout can be due to the same environmental factor influencing body condition as in rainbow trout, which is drought.

Both population characteristics mentioned above are being seen in other White Pine County reservoirs used for irrigation and livestock watering. Without an adequate amount of precipitation in the form of snowpack, Illipah Reservoir is going to continue to experience a low water level and increased water temperatures in the warmest months of the year. It will be necessary for NDOW personnel to look into water saving measures.

Silver Creek Reservoir

Six angler drop-box surveys were returned, of which four were usable. Anglers caught six tiger trout and harvested five of them. One angler recorded one trout being 19 inches or larger. Silver Creek was stocked with 4,000 tiger trout in May of 2016. No fish were stocked in Silver Creek Reservoir in 2015 due to low water conditions during the spring and fall. No tiger trout were stocked in 2017.

**MANAGEMENT REVIEW**

- All four approaches were completed for Bassett Lake
- Five of the six approaches were completed for Cave Lake in 2017. Thermographs were not set in 2017.
• All four approaches were completed in 2017 at Cold Creek Reservoir. It was determined that largemouth bass did not need to be moved into Cold Creek Reservoir in 2017.
• All of the four approaches for Illipah Reservoir were completed in 2017.
• Three of the four approaches for Silver Creek Reservoir were completed in 2017. The gill net survey will occur prior to the end of the fiscal year in 2018.

RECOMMENDATIONS

Bassett Lake

• Begin to discuss water plans with water right holders to maintain water levels in Bassett Lake.
• Develop stocking recommendations for Bassett Lake.

Cave Lake

• Crayfish surveys should be conducted to accumulate data and determine if they are a viable food source for smallmouth bass.
• Continue electroshocking surveys to establish a trend for brown trout at Cave Lake.
• Set four thermographs in Cave Lake.

Cold Creek Reservoir

• Electroshocking and gill net surveys should be continued in an effort to determine the success of the largemouth bass and bowcutt trout augmentations at Cold Creek Reservoir.
• Stock additional largemouth bass or bowcutt trout in Cold Creek Reservoir if deemed necessary.
• Continue gill net and electroshocking surveys during years scheduled for management activities at Cold Creek Reservoir.

Illipah Reservoir

• Conduct a general fisheries assessment through opportunistic angler contacts.
• Continue to maintain and check returns of volunteer angler drop-box surveys.
• Continue visual assessment of water quantity (lake level, inflow/outflow) and quality (clarity) for coordinating trout stocking.
• That a gill net survey be completed in spring 2018 to determine health and age class structure of trout in Illipah Reservoir.

Silver Creek Reservoir

• Continue to maintain and check return of volunteer angler drop-box surveys.
• Continue visual assessment of water quantity (lake level, inflow/outflow) and quality (clarity) for coordinating trout stocking.

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