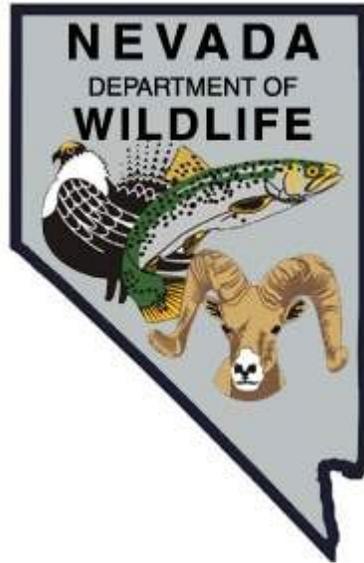


NEVADA DEPARTMENT OF WILDLIFE  
STATEWIDE FISHERIES MANAGEMENT



FEDERAL AID JOB PROGRESS REPORTS

F-20-54  
2018

RUBY LAKE NWR AND COLLECTION DITCH  
EASTERN REGION



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

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**NEVADA DEPARTMENT OF WILDLIFE, FISHERIES DIVISION  
ANNUAL JOB PROJECT REPORT**

**State:** *Nevada*  
**Project Title:** *Statewide Fisheries Program*  
**Job Title:** *Ruby Lake NWR and Collection Ditch*  
**Period Covered:** *January 1, 2018 through December 31, 2018*

**SUMMARY**

Ruby Lake National Wildlife Refuge (Ruby Lake NWR) is separated into the Collection Ditch and the marsh area, which includes Dike Units, South Lake, and South Springs. There were 29,425 trout stocked at Ruby Lake NWR in 2018. This included two different rainbow trout strains, tiger trout, and brown trout.

Between June and August, nine visits were made to conduct angler surveys, along with collecting 33 volunteer, drop-box questionnaires. Creel survey efforts contacted 129 anglers that put forth 509.5 hrs of effort to catch 1,939 fish. Catch rates came to 3.8 fish per hour and 15.0 fish per angler, which were nearly three times higher than 2017 success rates. All but two drop-box questionnaires were used for analysis, resulting in 50 anglers catching 823 fish in 294.5 hrs of fishing effort. Catch rates were 19.2 fish per angler and 3.0 fish per hour, almost double from 2017.

A thermograph placed in South Lake on May 1 indicated a spawn should have occurred around May 5. Multiple anglers and agency personnel observed a very high number of largemouth bass fry by late summer, suggesting a successful spawn. The largemouth bass ball survey was conducted in July along the south shore of Brown Dike and found three bass balls consisting of approximately 300 largemouth bass fry.

The electroshocking survey conducted at the end of August produced a good number of largemouth bass of all age classes. The survey caught 371 fish in 1,378 seconds (23 min) of actual electroshocking time, resulting in a capture rate of 569.2 fish per hour. The 332 measured fish averaged 7.2 inches (184.1 mm) and of these, 98 were weighed and showed averaged body condition of fair.

In 2018, quagga mussel veliger sampling occurred in May and resulted in a high positive detection for zebra mussels using PCR. After discovering the sampling pump was used in the Bruneau River prior to use at Ruby Lake NWR, the unit was properly disinfected. July and October PCR and microscopy samples then came back negative.

**BACKGROUND**

Ruby Lake National Wildlife Refuge (from here on called the Refuge) is a major warmwater fishery in northeastern Nevada, while also providing an excellent coldwater fishery during the cooler months of the year. It lies at an elevation of 6,000 ft and contains over 9,000 acres of lakes, ponds, and waterways that are intermixed with

islands, bulrush stands, and manmade dikes. The slow growth rate of largemouth bass is due to a short growing season and a limited food source combined with fluctuating water conditions that require close monitoring of this fishery. The yearly water level fluctuation, reproductive success, fish health, and angler use requires a thorough understanding to make adequate management decisions for improving the fishery. Working with the needs of the Fish and Wildlife Service at the Refuge is also necessary to reduce impacts to sport fish populations as well as angler use. Following four years of drought and low water levels, the 2015/16 and 2016/17 winters finally provided above average precipitation, however, the 2017/18 winter was well below average.

In January of 2007, it was found that quagga mussels might have been transported to Ruby Lake via hatchery-stocked fish from Lake Mead Fish Hatchery. Quagga mussel monitoring, which includes veliger plankton tows and tactile adult mussel surveys, began in the summer of 2007 and has continued annually at varying intensity levels.

## **OBJECTIVES and APPROACHES**

Objective: General Sport Fish Management

Approaches:

- Conduct a pre-stocking evaluation of water quality/quantity.
- Conduct a general fisheries assessment through opportunistic angler contacts.
- Maintain and check for returns of volunteer, angler drop-box surveys during the course of other duties.
- Conduct a single nighttime electroshocking survey at three established transects during summer.
- Monitor water temperatures during early spring to late fall with a thermograph in the South Lake to assess sport fish spawning activity.
- Visually assess overwinter fish mortality after spring ice-breakup.
- Monitor dissolved oxygen levels once a month throughout the ice-up period.
- Salvage largemouth bass from closed or drained ponds/areas as needed and stock in suitable waters within the Refuge.
- Conduct bass ball surveys in early summer in South Lake along Brown Dike.
- 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. Conduct visual and tactile surveys of artificial and natural substrates in conjunction with veliger sampling.

## **PROCEDURES**

Angling assessment at the Refuge was scheduled at periodic intervals on weekdays, three weekend days, and boating openers in an effort to sample anglers uniformly throughout the largemouth bass fishing season. Anglers contacted were questioned as to their residence, number of anglers in their party, hours fished, target

species, total fish harvested, and fish released. Harvested fish were identified, measured to fork length and total length, and weighed.

A temperature recording thermograph was placed in South Lake (UTM 628136 4442334) shortly after spring ice-breakup and pulled prior to winter ice-up. The timeframe for was expanded to include temperature collection throughout the quagga mussel breeding season.

The electroshocking survey was accomplished using the barge at three predetermined transects in South Lake. Fixed probes were used for the anode and the barge served as the cathode. Shocking settings were 500 volts, 60 Hz frequency, pulse width of 6 to 8 milliseconds, and output between 6 and 7 amps. All fish were netted and held in the live well until the completion of each transect. The fish were then measured, weighed, and released. Only fish over 200 mm were weighed for body condition analysis.

Water chemistry included measuring dissolved oxygen, temperature, ice thickness, snow depth covering the ice, current weather conditions, and water flow. Sites in North Dike Units were checked at water control structures along the dike system and South Lake near the main boat landing. Sites were sampled at regular intervals throughout the winter ice-up period.

The South Lake winterkill survey was accomplished by boat with a one or two-person crew. Preferred conditions included calm and clear weather, which provided for maximum visibility in the water and areas that previously experienced winterkills were monitored closely, as well as checking the shoreline throughout portions of the South Lake complex. North Dikes were periodically checked along the roadway borrow ditch. In units that revealed low dissolved oxygen and/or low water levels during the ice-up period, an in-depth search was done from canoe.

Bass fry surveys were conducted on the south side of Brown Dike using a two-person crew in a canoe. This transect started west of the control structure (UTM 11T 629819 4447910) and continued east for approximately 0.25 miles (UTM 11T 630201 4447863). Fry balls were identified and then categorized by their size. The number of fry was either counted or estimated, based on the size of the ball.

## **FINDINGS**

### **Stocking**

There were 29,425 trout stocked at Ruby Lake Refuge in 2018. This included two strains of rainbow trout, tiger trout, and brown trout (Table 1).

**Table 1.** Ruby Lake NWR Trout Stocking Summary.

	RB	TT	BN	
South Lake	13,084			
Collection Ditch	8,124	3,000	1,109	
South Springs	1,839			
Unit 21	2,269			
	25,316	3,000	1,109	<b>29,425</b>

### Angler Creel Surveys

Between June and August, 129 anglers were contacted on nine days. Anglers put forth 509.5 hrs of effort to catch 1,939 fish, which produced success rates of 3.8 fish per hour and 15.0 fish per angler (Table 2). Of the anglers, 118 (91.5%) fished only for largemouth bass and expended 479.5 hrs of effort to harvest 346 fish and release an additional 1,577. This resulted in success rates of 16.3 largemouth bass per angler and 4.0 largemouth bass per hour (Table 2). Eleven trout anglers (8.5%) put forth 30 hrs of effort, harvested three trout, and release an additional 13. Success rates were 1.5 trout per angler and 0.5 trout per hour (Table 2).

**Table 2.** Ruby Lake NWR Angler Catch Rates.

	T/A	T/H	B/A	B/H	F/A	F/H
<b>Creel</b>	1.5	0.5	16.3	4.0	15.0	3.8
<b>Angler Box</b>	9.9	1.7	31.8	5.0	19.2	3
<b>Combined</b>	7.9	1.6	18.0	4.2	15.4	3.4

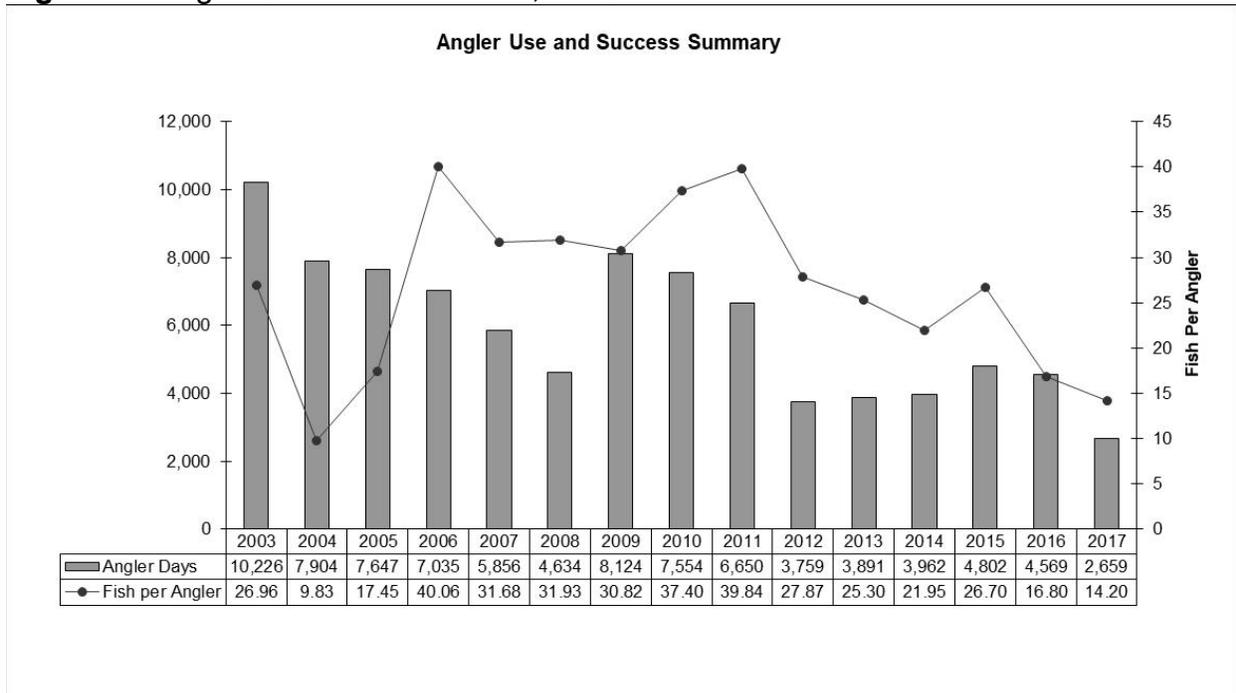
The average length of largemouth bass harvested from South Lake was 12.1 in (303.9 mm), which was larger than the management target length of 11 inches (279.0 mm) and an increase of 0.3 inches from 2017. No trout were measured during creel surveys. Management objectives for angler catch rates at the Refuge have been set at 1.0 trout per angler, 0.45 trout per hour, 4.0 bass per angler, and 1.5 bass per hour. In 2018, management objectives for largemouth bass were exceeded by nearly four times, while those for trout were at objective levels. Lower harvest rates by trout anglers could be in part due to a low sample size and that many anglers mostly target the lesser available, larger fish for which the fishery is known.

Supplemental angler information was received through angler drop-boxes installed at the main boat ramp and Gallagher Hatchery. The two drop-boxes produced 33 questionnaire returns, with 9 from the boat ramp box and the remaining 24 from the hatchery. Results showed 50 anglers caught 823 fish in 294.5 hrs of effort, producing catch rates of 19.2 fish per angler and 3.0 fish per hour (Table 2). At the boat ramp, 21 anglers fished for 124 hours to capture 12 trout and 539 bass. The hatchery drop-box showed that 35 anglers fished for 198.5 hours to capture 346 trout, resulting in capture rates of 9.9 fish per angler and 1.7 fish per hour (Table 2). Trout were comprised of 1 brown trout (0.3%), 16 tiger trout (4.6%), 174 rainbow trout (50.3%), and 155 unknown (unidentified) trout (44.8%). All fish identified as cuttbows and bowcutts were included as rainbow trout due to uncertainties and difficulties of anglers correctly identifying them.

Results from the expanded Mail-in Angler Questionnaire Survey for 2017 reported 1,070 anglers fished 2,659 days and had a success rate of 14.2 fish per angler. Data is only available up to 2017 due to the timing of the survey, the time it takes to collect angler responses, and the time it takes to process the data.

Figure 1 shows the 15-year trend for angler days and fish per angler. Angler use peaked in 2001 following five years of above average winter precipitation; however, as water levels dropped during drought from 2001 to 2004, harvest, angler days, and angler catch rates plummeted. Angler success showed a small increase in 2010 and 2011 before again dropping. Angler days have been relatively stable from 2012 to 2016, with only a slight increase followed by a decrease in 2017. However, during this same period, angler success showed a steady decline. The decline in angler use and success corresponds with four-years of drought and a significant change in Refuge management priorities that shifted water away from South Lake and the West Units. The last 10 years of data has shown an average of 5,060 angler days, which is well below the 25,000 observed during the late 1990s. The winters of 2015/16 and 2016/17 showed above average precipitation and improved the water situation, but the 2017/18 winter fell to below average again. The winter of 2017/18 provided below average spring recharge to the South Lake and West Units when it was most needed in the late summer and fall. This will have an impact on water levels going into the 2019/20 winter.

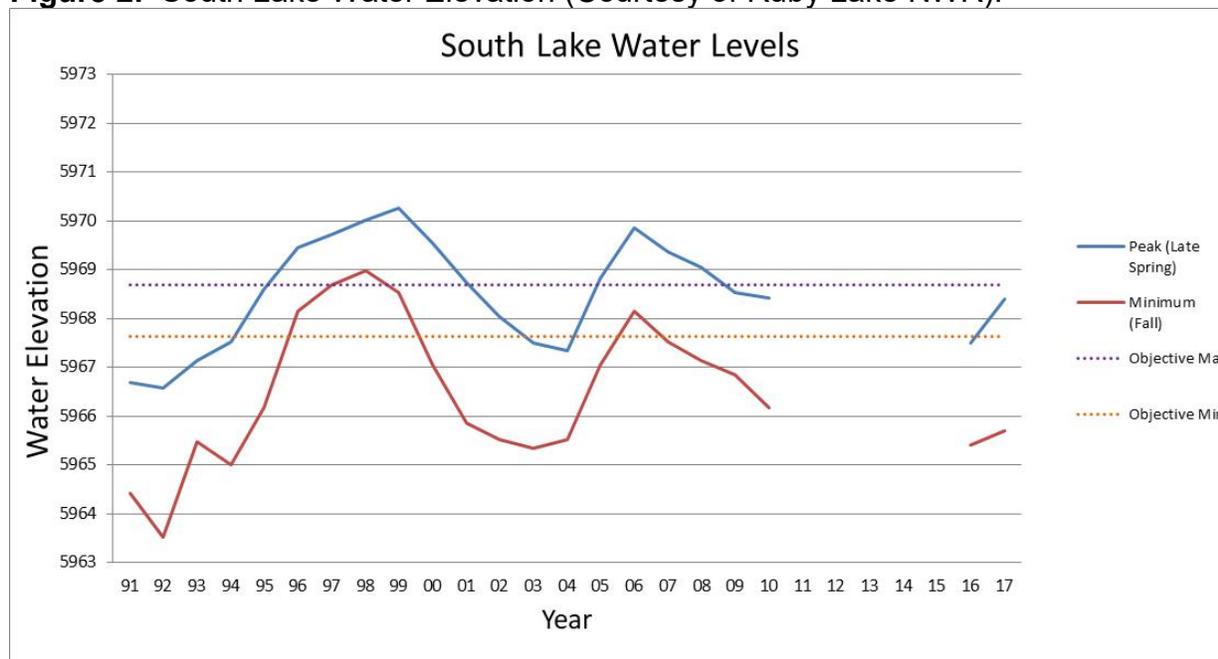
**Figure 1.** Angler Questionnaire Data, 2003 to 2017.



With South Lake being the primary draw for anglers, water levels play a major role in angler use and angling success. The refuge measures water elevations throughout the year and Figure 2 shows annual maximum and minimum elevations of in relation to Refuge water management objectives. Data from 2011 to 2015 was not collected. Between 1991 and 2018, 57.1% (16 of 28 years) of the time saw normal

precipitation in the Upper Humboldt River basin (NRCS SNOTEL data). Years of consecutive above average water years, such as from 1995 to 1999, 2005 to 2006, and 2016 to 2017 directly corresponded with the South Lake water levels reaching objective levels (Figure 2). Two consecutive good water years (2015/16 and 2016/17) created a substantial increase in the water level (three feet) at South Marsh from August of 2016 to March of 2017. An additional one-foot increase was observed from March of 2017 to March of 2018. The 2017/18 winter resulted in 77% of average precipitation and impacts to the water level will become apparent by late summer of 2019.

**Figure 2.** South Lake Water Elevation (Courtesy of Ruby Lake NWR).



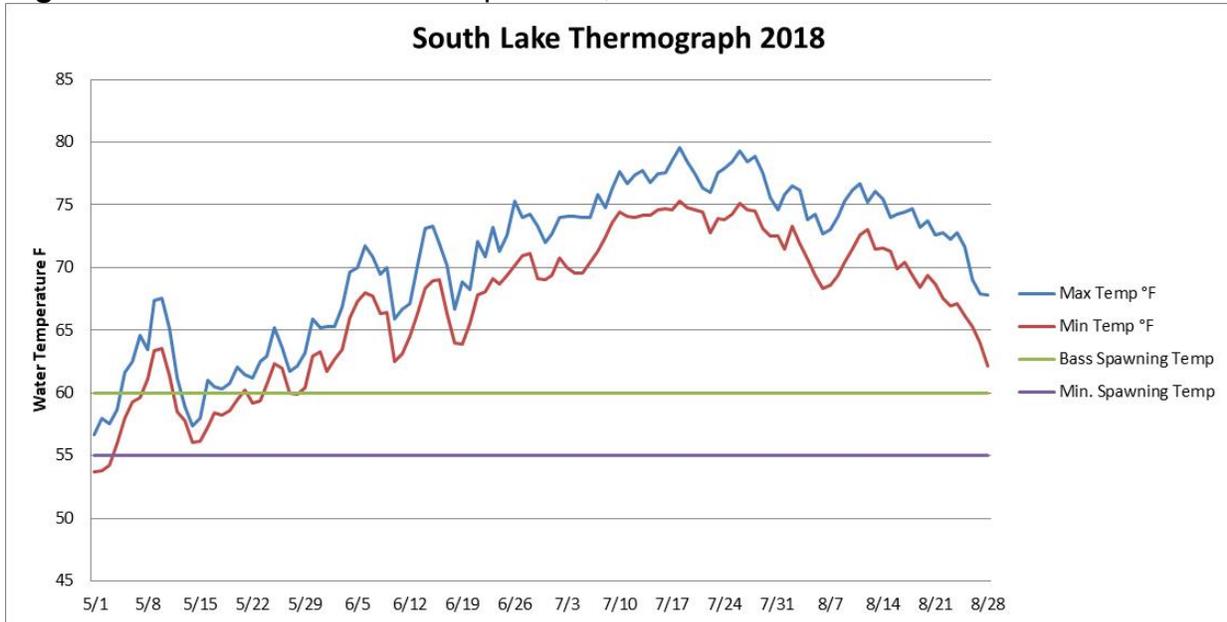
Water Temperature

Springtime water temperatures at the Refuge have demonstrated wide ranges of fluctuations. The severity in fluctuations has the ability to hamper largemouth bass spawning success and, in severe cases, an entire year class has been weakened. Largemouth bass at the Refuge begins its nesting activity when the water temperature approaches 60°F (15.5°C), with nest abandonment occurring most of the time when the temperature then drops below 55°F (12.8°C). Water temperature fluctuations are typically less varied in South Lake due its greater depth, as compared to North Dike Units.

A thermograph was placed in South Lake on May 1 and later pulled on August 28 (Figure 3). Temperature was measured later than usual due to abnormally wet and windy spring weather that hampered earlier efforts. The ambient water temperature exceeded the spawning temperature on May 5 for seven days before falling below the 60°F spawning temperature. This drop in temperature lasted only three days without dropping below the minimum nesting temperature of 55°F. The short cooling period

was expected to have minimal impacts to the largemouth bass spawn, which was substantiated by a large number of young-of-year bass observed throughout South Lake by anglers and agency personnel.

**Figure 3.** South Lake Water Temperature, 2018.



### Largemouth Bass Fry Ball Surveys

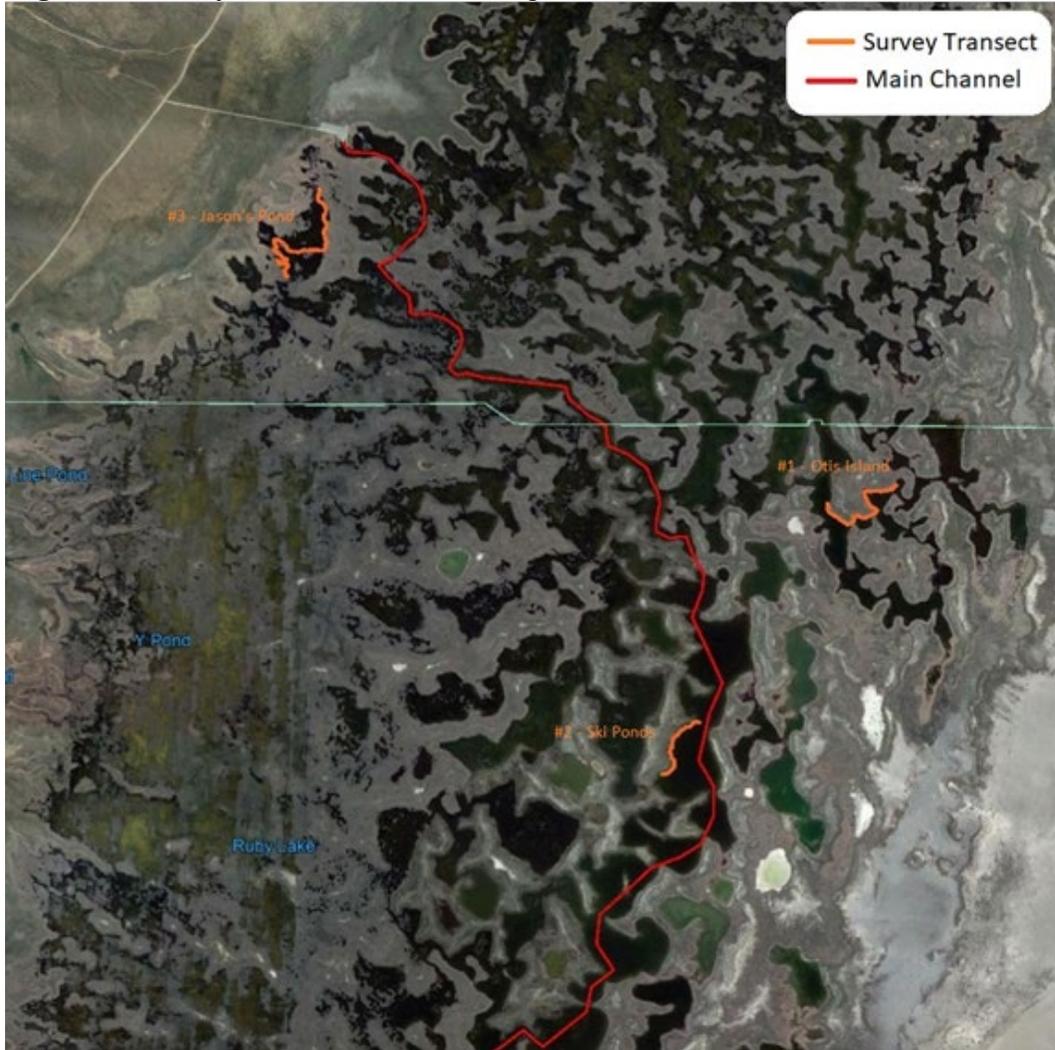
The survey was conducted on July 5 under clear and calm conditions between 1025 and 1055 hrs. Three fry balls were observed within the transect, with each ball consisting of approximately 200 to 400 largemouth bass fry. Fry were approximately one-inch and were associated with dense vegetation that allowed for quick dispersal into cover. Additionally, multiple older age classes of largemouth bass were observed throughout the transect, with most being from 6.0 to 9.0 in and several over 14.0 in. Based on survey results and multiple reports of largemouth bass fry throughout the marsh, the Ruby Lake largemouth bass spawn was considered successful. A more complete understanding of spawning success and survival is revealed in late summer when Age Class II and III fish are more readily tracked during electroshocking sampling.

### Largemouth Bass Population Monitoring

An electroshocking survey was conducted on August 29 under clear skies, a light wind, and a water temperature of 67°F (19.4°C). Due to adequate water levels, all three transects could be completed (Figure 4). The first transect, located on the west shoreline north of “Otis Island” produced 143 bass in 444 s of electroshocking. This resulted in a capture rate of 1,159.5 fish per electroshocking hour. The second transect, located along the west shoreline of the “Water Ski Ponds” produced a total of 103 largemouth bass in 293 electroshocking seconds and resulted in a capture rate of 1,265.5 fish per electroshocking hour. The final transect, located at “Jason’s Pond”

produced 117 bass and eight rainbow trout in 641 electroshocking seconds resulted in a capture rate of 702.1 fish per electroshocking hour. Capture rates, which were higher than previous surveys, were considered remarkable and due in part to good water levels. Additionally, new anodes added to the shocking barge in 2017 probably improved shocking efficiency. The majority of observed fish were captured, yet there were still numerous fish, mostly smaller than seven inches, that escaped. Overall, there were 371 fish captured in 1,378 electroshocking seconds, for an average catch rate of 969.2 fish per electroshocking hour.

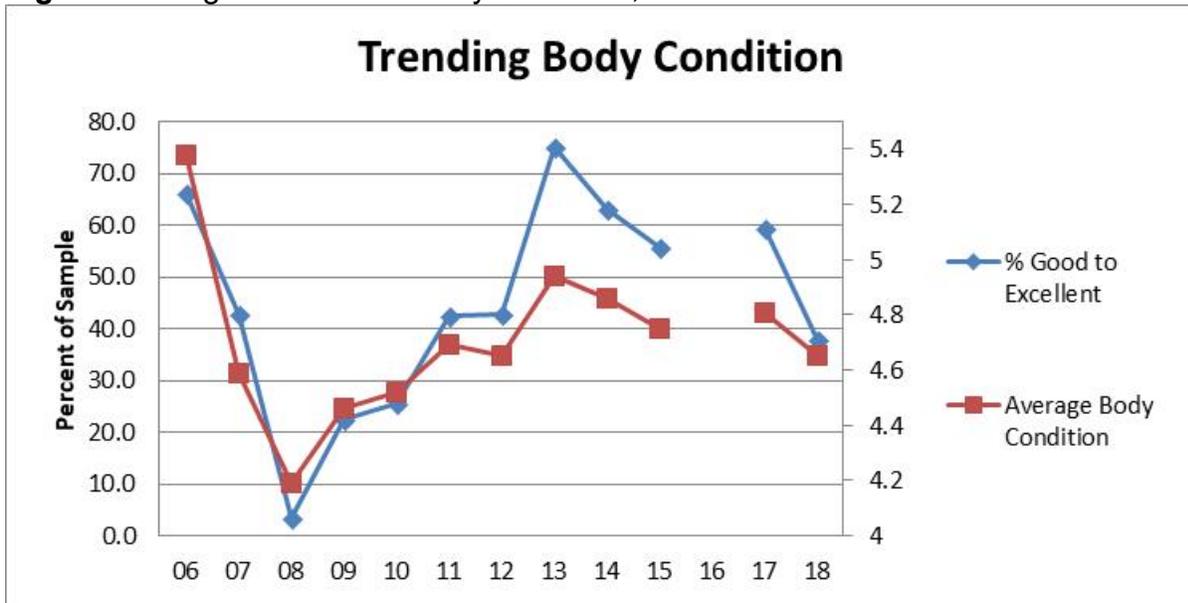
**Figure 4.** Ruby Lake Electroshocking Transects.



Total length was measured from 332 largemouth bass for evaluating age class strength and 98 were weighed to evaluate body condition. Largemouth bass averaged 7.2 inches (184.1 mm) TL and ranged in size from 2.5 to 13.6 in (64 to 345 mm). Body condition results showed 15 fish in poor condition (15.3 %), 46 in fair condition (46.9%), 33 in good condition (33.7%), and 4 in excellent condition (4.1%). The average body condition was 4.65, for a rating of fair.

Beginning in 2006, the percentage of sampled fish in good to excellent body condition dropped every year, bottoming out in 2008 with 3.5% of the sample being in good to excellent body condition. An upward trend started in 2009, with 22.5% in good to excellent condition and continued improving until peaking out in 2013 with 75% of the fish in good or better body condition. The previous three surveys (2014, 2015, and 2017) appeared to be relatively stable with 50 to 60% of the fish healthy, but in 2018, there was a noticeable drop (Figure 5). The 2018 survey found 37.8% in good to excellent condition, with no obvious reason for the decline. It is important to mention that this survey typically occurred in August/September, but the 2014 and 2015 surveys were conducted in July.

**Figure 5.** Largemouth Bass Body Condition, 2006-2018.



The 332 measured bass were separated into age classes to evaluate and follow cohorts through the years. To make year-to-year comparisons, Table 3 shows the age class breakdown from 2009 to 2018, with additional data on catch rates and sample size. Documentation of Class 0 and Class I fish is often difficult and inefficient; however, all age classes of fish were captured during this survey. The chart shows that cohorts from 2009 through 2012 spawning events have been making up the bulk of the keeper-sized fish that anglers have been harvesting. These fish produced the next influx of dominate cohorts that can be seen from 2015 and 2016 spawning events, with the 2015 cohort making up nearly 50% of the contacted fish in the last two surveys. These cohorts are predominately responsible for the large number of Age Class II and III fish (five to nine inches) that made up 66.9% of the sample. If the water level in South Lake stays close to objective level, large cohorts should continue to thrive in Ruby Lake and provide a much more successful fishery in the next two to three years.

**Table 3.** Largemouth Bass Age Class Distribution.

Percent of Catch										
Age Class	2018	2017	2016**	2015*	2014*	2013	2012	2011	2010	2009
Class 0	0.6	3.0	No survey, due to low water	0.0	0.0	0.0	0.5	1.1	5.9	0.5
Class I	16.9	23.2		1.7	0.0	3.2	2.5	17.2	1.5	2.3
Class II	20.5	49.8		5.0	11.0	26.3	14.9	22.5	7.4	4.5
Class III	46.4	12.6		26.7	29.0	39.2	36.6	26.2	30.0	53.4
Class IV	10.2	6.2		33.3	31.0	21.7	24.8	15.7	44.8	32.1
Class V	3.0	1.5		26.7	20.0	6.5	12.4	13.5	9.9	5.9
Class V+	2.4	3.9		6.7	9.0	3.2	8.4	3.7	0.5	1.4
N =	332	406		60	100	217	202	267	203	221
Small to Keeper	17.4	17.5		2.0	2.4	9.3	3.8	4.8	8.1	12.8
* July Sample Date, Due to Low Water										

Surveys in 2014 and 2015 showed a large number of largemouth bass greater than 10-inches, which were responsible for the current larger number of fish five to nine inches. This flip in cohort dominance has greatly increased the “Small to Keeper” ratio, while showing that the future of Ruby Lake is looking very good. As these cohorts continue to grow over the next two years, fishing at Ruby Lake should continue to improve for keeper-sized largemouth bass if water levels remain suitable. Future Refuge water management practices and precipitation amounts will play a critical role in the success of the largemouth bass fishery.

### Winterkill Survey

A winterkill survey in South Lake was not conducted in 2018. Ice started forming in December of 2017 and fluctuated throughout the rest of the winter. On January 15, 2018, South Lake was approximately 80% open and then cooler temperatures at the end of February once again created greater ice production. By the middle of March, the winter ice-up period was over, with ice depths never exceeding five inches. Based on this pattern and the observed high water level throughout the marsh prior to winter freeze up, lethal winter conditions were not expected and no survey was completed.

Ice conditions in West Units were similar to South Lake and lethal winter conditions were not expected. Fish loss for the winter of 2017/18 was considered very low at Ruby Lake, as good water levels and shallow ice provided a suitable environment for fish to overwinter.

### Largemouth Bass Salvage

After recent water management changes at the Refuge, the only units with largemouth bass are 10 and 13, although these populations are still recovering from past drawdowns and winterkill due to past water management practices. Units 14 and 20 have been manipulated and dried over the last two years and will continue to be impacted through 2019. When effective, fish salvages will continue to be conducted depending on which units are slated for draining.

## Quagga Mussel Monitoring

The first quagga mussel survey was conducted in May and resulted in a high positive for zebra mussels using PCR. The two follow-up surveys were negative and all microscopy samples analyzed were negative. After having a positive result for zebra mussel, it was discovered that the pump used for sampling had been unknowingly used for a different project in the Bruneau River. It is unclear if this played a part in the high PCR result, but it is peculiar that there appears to be an explanation for the result as the samples came back negative after the unit was properly disinfected. All visual and tactile surveys were also negative for quagga mussels. Due to positive PCR tests in 2012, Ruby Lake NWR is currently listed as a Watch List Water, which requires continued and increased monitoring.

### **MANAGEMENT REVIEW**

All approaches were completed at Ruby Lake NWR except the spring winterkill survey, which was not completed due to unsettled weather at the time of sampling and mild environmental conditions (i.e., ice production) during the winter, suggesting a low threat of a substantial winterkill. Although management objectives were met, anglers continue to be concerned with a smaller-sized largemouth bass. Considering a steady ten-year drop in water level in South Lake, the 2017 and 2018 water levels were at or above the Refuge management objective level and the fishery was able to respond favorably to increased habitat availability. If water levels continue to stabilize at or above objective levels, the fishery should continue an upward trend and anglers should see an improvement. Slow growth rates and varying levels of available habitat will always influence the success of this fishery, but good water levels are the single most important factor that allows this fishery to thrive.

### **RECOMMENDATIONS**

- Continue to assess angling pressure and angler success throughout the fishing season.
- Continue to utilize the angler drop-box, while possibly improving its visibility, with the intent of increasing angler participation.
- Recording thermographs should continue to be placed in South Lake to help predict timing and success of largemouth bass spawning.
- Periodic largemouth bass nest surveys and fry ball surveys should continue during spring to evaluate spawning success.
- An annual electroshocking survey in summer should be conducted to evaluate the status of the largemouth bass fishery.
- Winter water chemistries and associated spring winterkill surveys should be continued to aid in the assessment of projected angler success and fish loss. This information also justifies the need for supplemental trout stocking.
- Continue to assess angling pressure and angler harvest in the Collection Ditch as well as coordinate with the hatchery on trout stocking conditions and numbers.

- Salvage largemouth bass from closed or drained areas within Ruby Lake NWR and stock into suitable waters.
- Coordinate with Ruby Lake NWR on developing the Comprehensive Conservation Plan.

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Date: February 2019