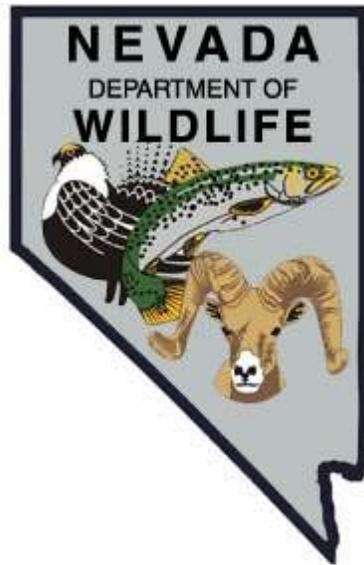


NEVADA DEPARTMENT OF WILDLIFE  
STATEWIDE FISHERIES MANAGEMENT



FEDERAL AID JOB PROGRESS REPORTS

F-20-53  
2017

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, 2017 through December 31, 2017*

**SUMMARY**

Ruby Lake National Wildlife Refuge (NWR) is separated into the Collection Ditch and the marsh area. The marsh area includes the Dike Units, the South Lake, and the South Springs. There were 21,891 trout stocked at Ruby Lake NWR in 2017. This included two different rainbow trout strains and brown trout.

Between June and August, six creel survey visits were made to Ruby Lake NWR, with an additional 28 voluntary, angler drop-box questionnaires received. Creel survey efforts contacted 126 anglers that put forth 534 hrs of effort to catch 667 fish. Catch rates came to 1.2 fish per hour and 5.3 fish per angler, which were nearly two times higher than the 2016 success rates. All but one drop-box questionnaire was used for analysis, resulting in 36 anglers catching 197 fish in 307 hrs of fishing effort. Catch rates were 8.5 fish per angler and 1.6 fish per hour, which were slightly higher rates than 2017.

A thermograph placed in the South Lake on May 10 indicated a spawn should have occurred in mid-May. Multiple reports from anglers and agency personnel were received on observing a very high number of largemouth bass fry by late summer, suggesting that a spawn was successful. The largemouth bass ball survey was conducted in July along the south shore of Brown Dike, which found 75 to 100 largemouth bass fry. It appeared this survey may have been conducted a little late and it is assumed that many more fry went unobserved due to dense vegetation.

The electroshocking survey was conducted at the end of August that produced a good number of largemouth bass of all age classes. A total of 501 fish were captured in 3,422 seconds (57 minutes) of electroshocking, which resulted in a capture rate of 527.1 fish per electroshocking hour. The 406 measured fish averaged 6.2 inches (158.3 mm), and the 69 weighed and measured fish had an averaged body condition of good. During this survey, five largemouth bass and four rainbow trout were collected for mercury and sent to EPA for analysis. These samples came back below the 0.3 ppm standard set by EPA, but there was an increase in mercury when compared to samples taken in 2007.

In 2017, AIS veliger samples were collected in June, July, and October, with all of the samples coming back negative for quagga/zebra mussel veligers.

## **BACKGROUND**

Ruby Lake NWR (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 feet 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 fluctuation of water level, reproductive success, fish health, and angler use requires a thorough understanding of the fishery to make adequate management decisions. Working with the needs of the Fish and Wildlife Service at the Refuge is also necessary to reduce impacts to 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 water years; however, the 2017 - 18 winter is currently less than 75% for snow pack.

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

## **OBJECTIVES and APPROACHES**

### 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 period.
- Salvage largemouth bass from closed or drained ponds/areas as needed and stock in suitable waters within the Refuge.
- Conduct largemouth bass ball surveys in early summer in the South Lake along Brown Dike.
- Collect largemouth bass and trout to be sampled for mercury.
- Install an angler drop-box near Gallagher Fish Hatchery.
- 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 solid substrates in conjunction with veliger sampling.

## PROCEDURES

Angler 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 recorded by species and measurement of fork length, total length, and weight.

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

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

Water chemistry data included measurements of dissolved oxygen, temperature, ice thickness, snow depth covering the ice, current weather conditions, and water flow. Sites in the North Dike Units were checked at water control structures along the dike system and the South Lake was checked near the main boat landing. These 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 have previously experienced winterkills were monitored closely, as well as a shoreline survey throughout portions of the South Lake complex. The North Dikes were periodically checked from 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 at UTM 11T 629819 4447910 and continued east for approximately 0.25 miles at UTM 11T 630201 4447863. Fry balls were identified and categorized based on their size and counts were actual or estimated, based on the size of the fry ball.

## FINDINGS

### Stocking

There were 26,391 trout stocked at Ruby Lake Refuge in 2017. This included two different rainbow trout strains and brown trout (Table 1).

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

	RB	TT	BN	
South Lake	11,620			
Collection Ditch	6,656		4,500	
South Springs	1,409			
Unit 21	2,206			
	21,891		4,500	<b>26,391</b>

### Angler Creel Surveys

Between June and August, 126 anglers were contacted on six separate days. They put forth 534 hrs of angling effort to catch 667 fish and produced success rates of 1.2 fish per hour and 5.3 fish per angler (Table 2). A total of 116 bass anglers (92.1%) expended 506 hrs of angling effort to harvest 152 largemouth bass and release an additional 510. This resulted in largemouth bass success rates of 5.7 per angler and 1.3 per hour (Table 2). Ten trout anglers (7.9%) put forth 28 hrs of angling effort to catch and release five trout. Success rates were 0.5 trout per angler and 0.2 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>	0.5	0.2	5.7	1.3	5.3	1.2
<b>Angler Box</b>	13.5	2	6.4	1.3	8.5	1.6
<b>Combined</b>	7.3	1.5	5.8	1.3	6	1.3

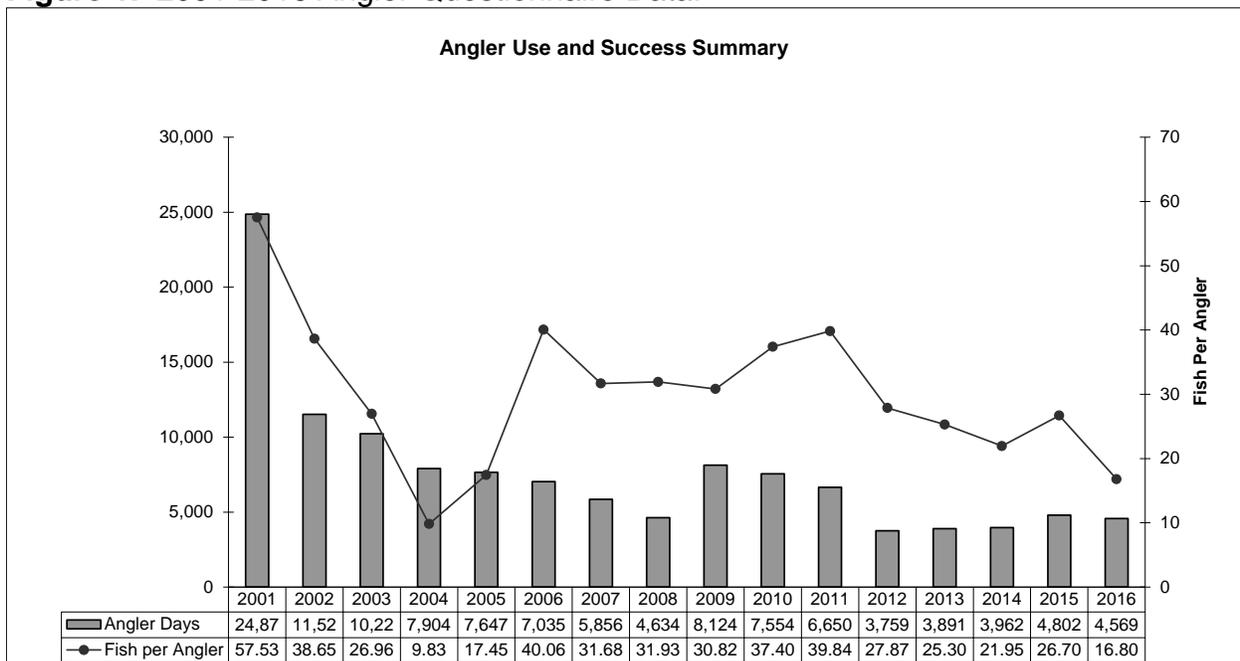
The average length of largemouth bass harvested from the South Lake was 11.7 inches (296.1 mm), which was larger than the management target length of 11 inches (279.0 mm) and an increase of 0.5 inches from 2016. The four rainbow trout that were measured averaged 19.2 inches (488 mm) and ranged from 15.4 to 22.2 inches (391 to 564 mm). The management objectives for angler catch rates at the Refuge are set at 1.0 trout per angler, 0.45 trout per hour, 4.0 bass per angler, and 1.5 bass per hour. In 2017, management objectives for largemouth bass were met, while those for trout were not. Lower success rates for trout anglers could be in part due to a low sample size and anglers targeting larger fish.

Supplemental angler information was received through an angler drop-box installed at the main boat ramp. An additional drop-box was installed at Gallagher Hatchery in September to capture angling effort at the Collection Ditch. With the addition of this second angler box, data will be separated as either the South Lake or

the Collection Ditch and South Springs (i.e., hatchery drop-box). The South Lake produced 20 questionnaire returns and showed 25 anglers catching 159 fish in 122.0 hrs of fishing effort and producing catch rates of 6.4 fish per angler and 1.3 fish per hour (Table 2). This data reflects anglers that captured all bass with the exception of two incidental trout catches. Seven questionnaires collected from the hatchery drop-box shows that 11 anglers fished for 75 hours to capture 148 trout, resulting in capture rates of 13.5 fish per angler and 2.0 fish per hour (Table 2). Trout were comprised of 1 brown trout (0.7%), 5 tiger trout (3.4%), 121 rainbow trout (81.8%), and 21 unknown trout (14.2%). All fish identified as cuttbows and bowcutts were included as rainbow trout count due to uncertainties and difficulties of anglers correctly identifying these fish.

The Department's Mail-in, Angler Questionnaire Survey for the 2016 calendar year reported 1,362 anglers fished 4,569 days and had a success rate of 16.8 fish per angler. Data is only available up to 2016 due to the time it takes to collect angler responses and to process data. Figure 1 shows the 16-year trend using expanded data for angler days and fish per angler.

**Figure 1. 2001-2016 Angler Questionnaire Data.**

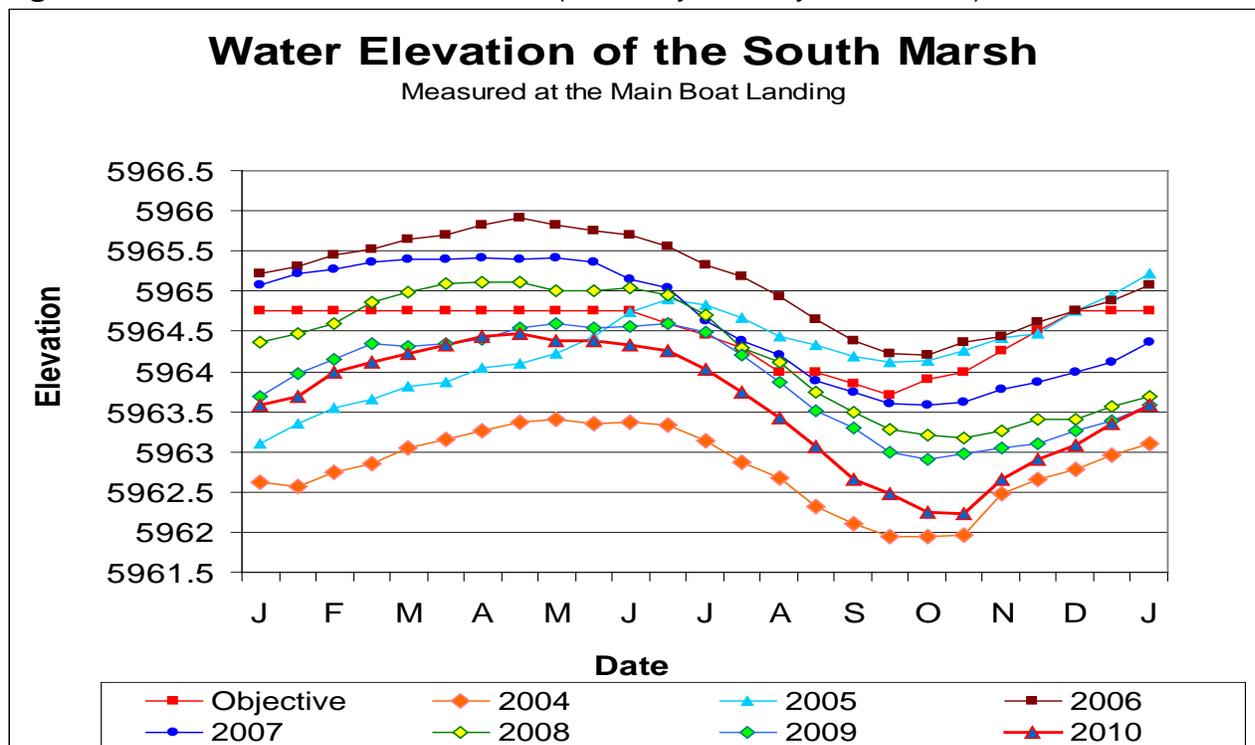


Angler use peaked in 2001 following five years of above average winter precipitation; however, as water levels dropped during poor water years from 2001 to 2004, harvest, angler days, and angler catch rates plummeted. Angler success showed a small increase in 2009 and 2010 before again dropping. Angler success has been relatively stable from 2012 to 2016, with only a slight increase; however, during this same period, angler use has shown a steady decline. This period corresponds with a four-year drought that occurred during this time, and it is expected that angler use and success will increase as the water level rises. The last 10 years of data have shown an average of 5,380 angler days, which is well below the 25,000 observed during the late

1990s. Decreasing water levels at the Refuge have been the trend since 2006, which can be attributed to below average water years and changes in the Refuge's water management practices. The winters of 2015/16 and 2016/17 showed above average water supply and provided a good boost to the water situation. This current winter (2017/18) is shaping up to be below average, which would have an impact on summer water levels in 2019.

Water levels not only fell below the objective level (see Figure 2) prior to 2016, but an overall decline has occurred since 2006 (Figure 2). No data was available for 2011 through 2015, but a serious drought occurred from 2012 to 2015 that continued this downward trend. Water reports were created by the Refuge in 2016 and 2017, but elevations were not compatible with older reports and there appears to be a discrepancy by a couple of feet. Two consecutive good water years (2015/16 and 2016/17) created a substantial increase in water level (three feet) at the South Marsh from August of 2016 to March of 2017. An additional one foot of increase was seen from March of 2017 to March of 2018. The 2017/18 winter is currently below average, which may show impacts to water levels by late summer of 2019.

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



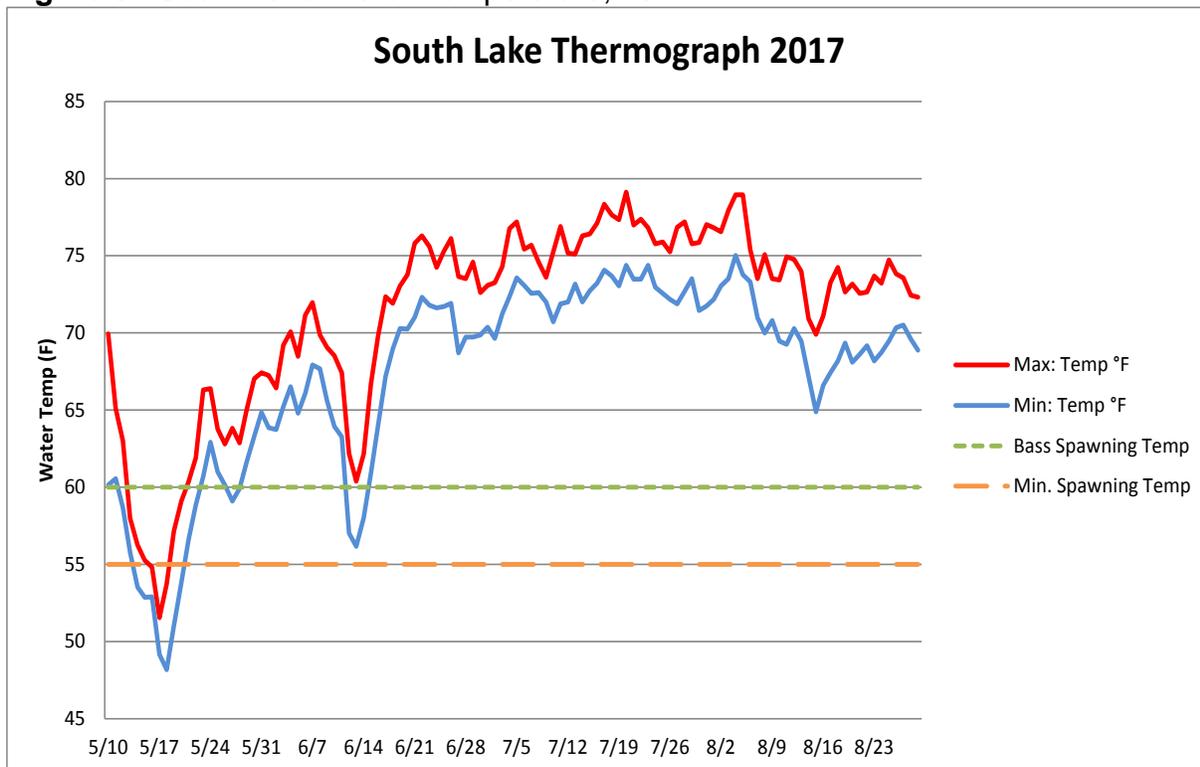
Contact creel surveys in the North Dike units were done secondarily to South Lake surveys and no anglers were contacted. Angler use in most units was minimal during 2017, resulting from water management that left units nearly dry and void of fish.

## Thermographs

Springtime water temperatures at the Refuge have demonstrated a wide range of fluctuations. The severity of these 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 begin nesting activities 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 the South Lake due to greater water depth, as compared to the North Dike Units.

A thermograph was placed in the South Lake on May 10 and later pulled on August 31 (Figure 3). The thermograph was put in later than usual due to abnormally wet and windy spring weather that hampered earlier efforts. Prior to the installation of the thermograph, the ambient water temperature appeared to have exceeded the preferred spawning temperature, but it very quickly dropped below the minimum spawning temperature by May 14. The temperature quickly reached spawning temperature again on May 21, where it stayed above the critical temperature. This short temperature drop did not appear to affect the spawn, suggested by the large numbers of young-of-year bass observed throughout the South Lake by anglers and agency personnel.

**Figure 3.** South Lake Water Temperature, 2017.



## Largemouth Bass Fry Ball Surveys

Because of low water conditions and water management practices that have left dike units nearly fishless, the bass ball survey has been moved to the south side of Brown Dike. The survey was conducted on July 12 under clear and calm conditions between 11:00 and 11:30 am. Approximately 75 to 100 bass fry were observed within the transect. These fish were individual fry as there were no “fry balls” observed. Fry were found in areas of dense vegetation and it was likely many more went uncounted. The survey may have been conducted late, as the fry were approximately 1.0 to 1.5 inches. Additionally, multiple age classes were observed throughout the transect, with most being from five to seven inches. Based on this survey and multiple reports of bass fry throughout the marsh, the Ruby Lake largemouth bass spawn was considered successful. A more complete understanding of largemouth bass spawning success and survival occurred during the late summer electroshocking survey, when Class II and III fish were more readily tracked.

## Largemouth Bass Population Monitoring

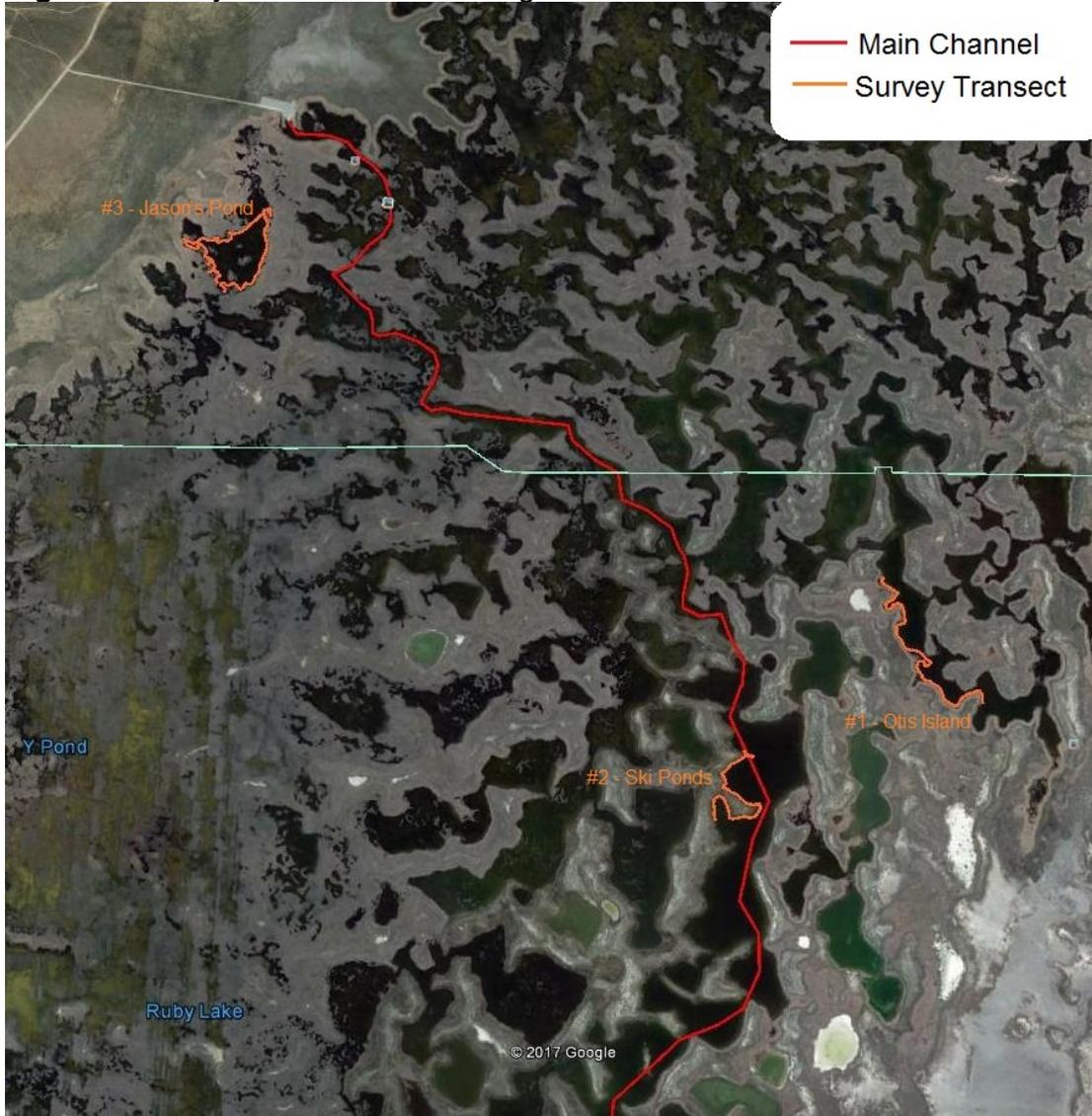
The electroshocking survey was conducted on August 31 under partly cloudy skies, a light wind, and a water temperature of 65.2°F (18.4°C). Since there was a high water level, all three transects were completed, see Figure 4 for transect locations. The first transect, located on the west shoreline north of “Otis Island,” produced 174 largemouth bass in 1,153 seconds of electroshocking, resulting in a capture rate of 543.3 fish per electroshocking hour. The second transect, located along the west shoreline of the “Water Ski Ponds” produced a total of 116 largemouth bass in 618 electroshocking seconds, resulting in a capture rate of 675.7 fish per electroshocking hour. The final transect, located at “Jason’s Pond” produced 207 largemouth bass and four rainbow trout in 1,651 electroshocking seconds, which resulted in a capture rate of 460.1 fish per electroshocking hour. These capture rates, which were higher than during the last couple of years during drought, were considered respectable, and were due in part to the high water levels and possibly new anodes recently added to the shocking barge. The majority of observed fish were netted, yet there were still numerous fish, mostly those smaller than seven inches, that went uncaptured. Overall, there were 501 fish captured in 3,422 electroshocking seconds, for an overall catch rate of 527.1 fish per electroshocking hour.

All but 91 largemouth bass caught were measured to total length (TL) for evaluating age class structure and, of these, 69 were weighed to evaluate body condition. The 406 largemouth bass measured averaged 6.2 inches (158.3 mm) TL and ranged in size from 2.2 to 15.4 inches (55 to 390 mm). Their body condition was as follows: 3 fish in poor condition (4.3 %), 22 fish in fair condition (36.2%), 39 fish in good condition (56.5%), and 2 fish in excellent condition (2.9%). The average body condition was 4.81, for a rating of good.

Beginning in 2006, the percentage of sampled fish in good to excellent body condition declined each year since, bottoming out in 2008 with 3.5% of the sample

being in good to excellent condition. An upward trend started in 2009 with 22.5% being in good to excellent condition, and condition continued to improve until 2013 with 75% of the fish in good or better body condition. The last years of three surveys have seen largemouth bass body condition decline mildly, but it also appears to be stabilizing (Figure 5). It is important to mention that electroshocking surveys typically occur in August/September and the 2014 and 2015 surveys were conducted in July. In addition, no survey was conducted in 2016 due to a low water level that restricted launching the electroshocking boat.

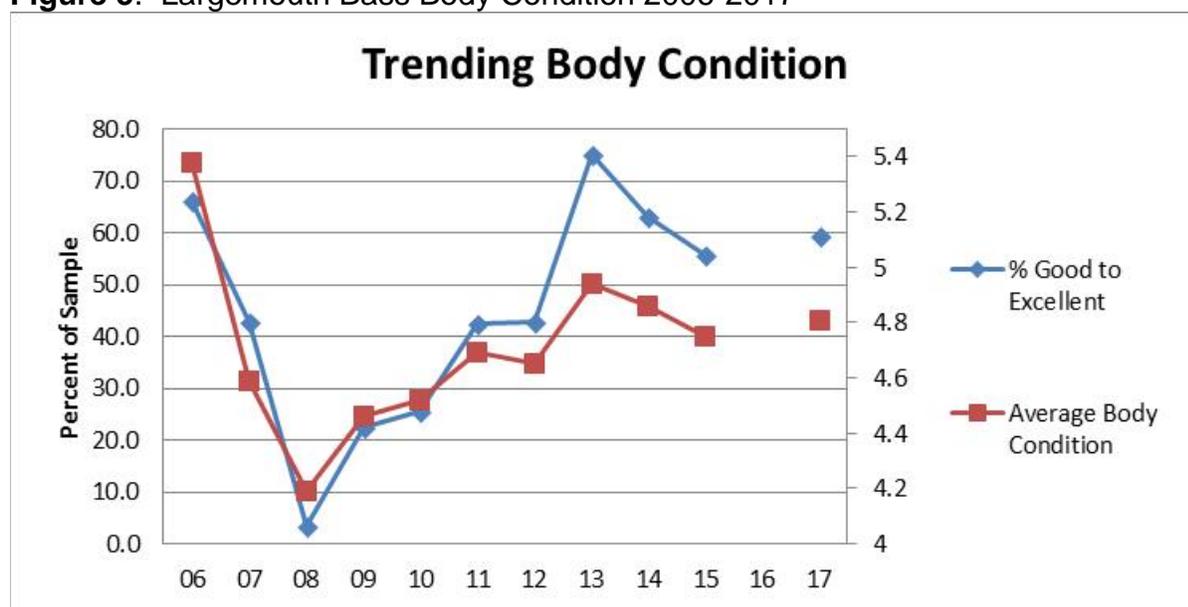
**Figure 4.** Ruby Lake Electroshocking Transects



The 406 measured bass were separated into multiple age classes to evaluate and annually follow cohorts. To make year-to-year comparisons, Table 3 shows the age breakdown from 2008 to 2017, with additional data on catch rates and sample size. Documentation of Class 0 and Class I fish is often difficult and inefficient; however, all classes of fish were contacted and captured during this survey. The table shows that

cohorts from 2009, 2010, and 2011 spawned successfully, as these cohorts were making up the bulk of the keeper-sized largemouth bass in 2017. These cohorts were predominately responsible for the large number of Class I and II fish (three to seven inches) that made up 73% of the largemouth bass caught in this survey. Class I and II fish were products of successful spawning in 2015 and 2016. It is expected that a similar trend will follow in the 2017 cohort since numerous bass balls were observed during summer surveys in 2017. If water in the South Lake stay near objective levels, these large cohorts should continue to thrive and provide a more successful fishery in the next two to three years.

**Figure 5.** Largemouth Bass Body Condition 2006-2017



Surveys in 2014 and 2015 showed an abundance of fish larger than 10 inches, which were responsible for large number of three to seven inch largemouth bass. This flip in cohort dominance has greatly increased the “Small to Keeper” ratio and suggested that the future of Ruby Lake is looking very good. As individuals in these cohorts continue to survive and grow over the next two years, high numbers of keeper-sized largemouth bass are expected to improve fishing at Ruby Lake. Refuge water management, along with precipitation, will play a critical role in the future of the largemouth bass fishery.

### Mercury Collection

During the electroshocking survey in August, five largemouth bass and four rainbow trout were collected for mercury testing. These fish were sent to the Environmental Protection Agency (EPA) lab in Richmond, CA for analysis. Results are reported in wet weight mercury measured in parts per million (ppm) and are presented in Figure 6, with data compared to the last time fish were sampled and analyzed (2007). Concentrations in largemouth bass went from 0.07 ppm in 2007 to 0.23 ppm in 2017. Rainbow trout also increased over time, with an average concentration of 0.07 ppm in

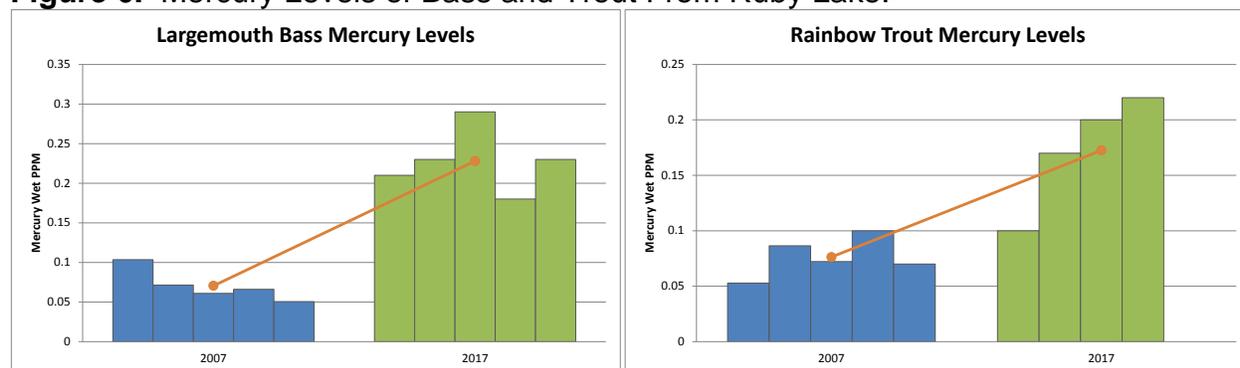
2007 and 0.17 ppm in 2017. It is difficult to speculate on why the concentration of mercury increased, but it is important to note that levels are still below the designation of “Impaired Water,” which requires a mercury concentration above 0.3 ppm.

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

Percent of Catch										
Age Class	2017	2016**	2015*	2014*	2013	2012	2011	2010	2009	2008
Class 0	3.0	No survey, due to low water	0.0	0.0	0.0	0.5	1.1	5.9	0.5	0.0
Class I	23.2		1.7	0.0	3.2	2.5	17.2	1.5	2.3	1.8
Class II	49.8		5.0	11.0	26.3	14.9	22.5	7.4	4.5	10.5
Class III	12.6		26.7	29.0	39.2	36.6	26.2	30.0	53.4	47.1
Class IV	6.2		33.3	31.0	21.7	24.8	15.7	44.8	32.1	35.1
Class V	1.5		26.7	20.0	6.5	12.4	13.5	9.9	5.9	4.3
Class V+	3.9		6.7	9.0	3.2	8.4	3.7	0.5	1.4	1.2
N =	406		60	100	217	202	267	203	221	325
Small to Keeper	17.5		2.0	2.4	9.3	3.8	4.8	8.1	12.8	17.6

\* July Sample Date, Due to Low Water

**Figure 6.** Mercury Levels of Bass and Trout From Ruby Lake.



Individual samples from 2007 (Blue) and 2017 (Green), with averages for each year in orange, including a trend line.

### Winterkill Survey

A winterkill survey in South Lake was not conducted in 2017. Ice levels fluctuated throughout early winter and never exceeded five inches. Additionally, due to warm weather and a wet and windy spring, the ice was melted off the marsh in mid-February. Based on this, and having a high water level throughout the marsh prior to winter freeze up, lethal winter conditions were not expected and no survey was completed.

On March 29, a winterkill survey was conducted in the dike units from 9:30 to 10:30 am, with no mortalities observed. Ice conditions were similar to South Lake and lethal winter conditions were not expected. Overall fish loss for the winter of 2016-17 was considered very low at Ruby Lake, as the good water levels and shallow ice provided adequate refuge for fish to overwinter.

## Largemouth Bass Salvage

Based on late winter coordination with the Wildlife Refuge, Dike Unit 14 was scheduled to be drained in 2017 and 2018. On May 10, a fish salvage was conducted using the electroshocking barge. The water level was high due to a wet spring and good winter precipitation. A majority of the largemouth bass habitat was restricted to the borrow ditch, yet a majority of the unit had a suitable water level. A total of 10 largemouth bass were captured and ranged in size from 3 to 14 inches. Another 10-15 largemouth bass were observed, but not netted. All captured fish were released into unit 10 to begin rebuilding its fishery. The low number of largemouth bass contacted fish was expected since water management practices over the last five years have had a detrimental impact to the dike units.

## Quagga Mussel Monitoring

Surveys were conducted on June 20, July 31, and October 5. Five individual samples were collected and evaluated for the presence of quagga mussel veligers. All samples were found negative for mussels using PCR and Microscopy techniques. Visual and tactile surveys also found no adult 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 to fish survival. Although management objectives were met at the Refuge, anglers continue to be concerned with the smaller size of largemouth bass. Considering a steady ten-year drop in water level in South Lake, the 2017 water level was at or above the 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 improve.

## **RECOMMENDATIONS**

- Continue to assess angling pressure and angler success rates throughout the fishing season.
- Continue to utilize the angler drop-box, while improving the visibility of the box, with the intent of increasing angler participation.
- Recording thermographs should continue to be placed in the South Lake to help predict timing and success of largemouth bass spawning.

- Periodic nest surveys and fry ball surveys should continue during spring to evaluate largemouth bass 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 the Ruby Lake NWR and stock into suitable waters.
- Coordinate with the Ruby Lake NWR on completing the Comprehensive Conservation Plan.

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Date: March 2018