Montana Department of Fish, Wildlife and Parks
Fisheries Division

Job Progress Report

STATE: Montana **PROJECT: Yellowstone River Drainage Investigations**

STUDY TITLE: Tongue River Reservoir Investigations

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ABSTRACT

Tongue River Reservoir provides a popular and unique fishing opportunity in Montana. Managed primarily as a crappie fishery, it attracts people from across Montana and Wyoming. Relative abundance of adult crappie was below the 20-year trend average (11.7 fish per gill net) in gill nets during august 2014 and 2015 but was above average in both 2016 and 2017. Catch rates of Walleye in gill nets continue to be above the 20-year average (4.7 fish per gill net). Modified fyke nets (trap nets) were added to the annual August trend sample methods beginning in 2010 because they are more effective for sampling crappie than gill nets. Trap nets have caught larger sample sizes than gill nets each year since 2010 while following a similar year to year pattern in relative abundance. Night electrofishing has been conducted since 2012 to target bass and diversify sampling methods. Trap netting and electrofishing efforts have improved data available for evaluating the Tongue River Reservoir fishery and should be continued and standardized. Age data was collected from crappie in 2013, 2014 and 2017 and from Walleye, Northern Pike, and Smallmouth Bass in 2014. Crappie age data demonstrates a pattern of variable year class recruitment with most of the sampled population belonging to a few well represented year classes. This finding is consistent with Stewart's aging effort in 1983 as well as scientific literature for the species. The presence of relatively old individuals suggest overharvest is not presently occurring at Tongue River Reservoir.

INTRODUCTION

Construction of Tongue River Dam was completed in 1939 and created a 3,500-surface acre impoundment known as Tongue River Reservoir. Flooding weakened the dam in 1978. The dam was rebuilt from 1996 to 1998 increasing reservoir size to 9,311 surface acres. Tongue River Reservoir provides a popular and unique fishing opportunity in Montana. Managed primarily as a crappie fishery, it attracts people from across Montana and Wyoming. Crappies are abundant, easy to catch, and with a liberal 30

crappie per day limit, the reservoir attracts anglers of all skill levels. It is particularly popular with families and sustains some of the highest angler days per surface acre of any reservoir in the state (McFarland and Meredith 2004; McFarland 2009). Overall angler satisfaction is moderate and comparable to Fort Peck Reservoir (McFarland 2009). Tongue River Reservoir offers angling opportunity in both summer and winter but use and satisfaction are higher in the summer (McFarland 2009). The popularity of Tongue River Reservoir with campers, anglers, and pleasure boaters has made the state park and reservoir prone to crowding. To reduce social conflicts (crowding at boat ramps and on the reservoir, competition for camping space) and minimize impacts to the fishery, fishing tournaments at Tongue River Reservoir are not permitted from May 1 to September 15. Fishing tournaments, including catch and release formats, during this period can lead to increased physiological stress (Suski et al. 2003; Ostrand et al. 2004) and nest abandonment (Philipp et al. 1997; Siepker et al. 2009; Diana et al. 2012) for some species, particularly Largemouth Bass.

Prior to 1996 crappie harvest was not limited. A daily limit of 15 fish was established from 1996 to 2000 to protect the population while the reservoir was held at a reduced pool level to rebuild the dam. Since 2001, the crappie daily limit has been 30 fish. After dam reconstruction, storage capacity increased from 68,040 acre-feet to the current capacity of 79,071 acre-feet. This increased capacity raised the maximum water level by approximately six vertical feet. The new maximum water level has increased both the reservoirs fishable surface area and the amount of submerged woody habitat especially in the upper half of the reservoir where the near shore areas were more densely vegetated.

Salinity has affected water management in the Tongue River drainage and Tongue River Reservoir. Irrigating crop lands with water high salt content results in a buildup of salt in the soil over time and decreases crop yields (Staten et al. 2016). During periods of reduced discharge out of the Tongue River Reservoir Dam salts build up in the reservoir. Irrigators concerned with water quality of irrigation water stored in Tongue River Reservoir have influenced dam operations, resulting in increased discharge during the spring to flush out the saline water prior to the start of the irrigation season. Montana Department of Environmental Quality is currently developing a water quality model to evaluate salinity in the Tongue River drainage and identify levels of contribution from different activities within the drainage (Staten et al. 2016). These activities include coal bed methane production, coal mining, irrigated agriculture, and reservoir operation. Coal bed methane development has greatly diminished in recent years as current natural gas prices are not providing incentive for widespread and rapid development in the Tongue River Drainage and based on projections may not within the next few decades (USEPA 2013). Coal mining is likely to expand in the future as the Youngs Creek Mine is nearing completion of the permitting process. Irrigation for agriculture continues to be the primary purpose of water withdrawn from the Tongue River and reservoir operations will be largely dictated by the recent settlement of the Wyoming and Montana water compact. Changes to fish populations because of increased salinity have not been identified but may exist as these changes are difficult to quantify.

Due to the importance of Tongue River Reservoir a monitoring program has been in place for several decades. Objectives for fisheries data collected in 2014, 2015, 2016 and 2017 at Tongue River Reservoir are:

(1) Track relative abundance, size and condition by species with emphasis on crappie and Walleye comparing current sampling results to the overall long-term data set
(2) Determine age structure characteristics of Black Crappie, White Crappie, Walleye, Smallmouth Bass, and Northern Pike
(3) Complete wild fish transfers of adult crappie to regional ponds to establish new or maintain existing crappie fishing opportunities.

METHODS

This report covers annual trend sampling and additional exploratory sampling efforts at Tongue River Reservoir completed between 2014 and 2017. Annual trend sampling was conducted during the months of August using experimental gill nets, beach seines, trap nets (i.e. modified fyke nets), and night electrofishing. Mini-fyke nets were used in August 2014 to compare this passive gear type to the active gear (beach seine) for collection of juvenile and small bodied fishes. Additional sampling to explore seasonal gear efficiency and/or complete crappie transfers was conducted in April, May, June and October using trap nets and night electrofishing. The results of additional sampling efforts will be used to determine the most effective and logistically concise protocol for future trend sampling. Adult fish were sampled using experimental sinking gill nets with 25 ft panels of 0.75, 1.0, 1.25, 1.5, and 2.0-inch mesh (bar measure) for an overall length of 125 feet. Gill nets were set at standardized locations and fished overnight for approximately 24 hours. Juvenile and forage-sized fish were sampled using a 100 ft beach seine, 8 ft deep, with 0.25-inch mesh (bar measure). The seine was set from a boat and hauled to shore in a quarter circle pattern to capture fish. Both gill-netting and seining consisted of 10 net sets/seine hauls per year and were distributed between the upper and lower halves of the reservoir taken at standardized locations. Trap nets used have 4 x 6 ft frames with 1/2-inch mesh (bar measure) and a 4 x 50 ft lead. Trap-net effort for annual trend sampling consisted of 10 net sets selected from a suite of 33 sample sites stratified by reservoir location (e.g. upper and lower halves). Additional trap-netting for Wild Fish Transfers generally consisted of 5 net sets per transfer. Mini-fyke nets had 2 x 4 ft frames with 1/8-inch mesh (ace) and a 2 x 15 ft lead. Night electrofishing was completed with an 18ft aluminum boat equipped with a Smith Root GPP 5.0 rectifier and two booms with cable dropper arrays. The unit of effort for gill-net, trap-net, and mini-fyke net sampling was one net night (approx. 24 hr. period). One seine haul was one unit of effort for seine sampling. Number of fish per hour of shock time was the unit of effort used for night electrofishing. All fish were identified to species and enumerated. Catch per unit effort (CPUE) was used to describe the relative abundance of sampled fish. All fish of game species (e.g. Black Crappie, White Crappie, Walleye, Smallmouth Bass, and Northern Pike) were weighed (g), and measured (total length, mm) whereas only a subsample of 25-50 individuals were weighed and measured

when appropriate (e.g. when processing non-target species like Shorthead Redhorse Sucker, or abundant small bodied fishes and young-of-the-year game fishes from the seine catch). Length and weight summary statistics were calculated for each species by gear type.

Black and White crappie catches were combined for some analyses. When 1) comparing trap net catch rates to gill net catch rates and 2) analyzing what time of year produces optimal trap-net catch rates of adult crappie suitable for wild fish transfers, crappie less than 100mm total length were excluded from analysis to eliminate the influence of young-of-the-year (YOY) crappie on catch rates. Relative abundance for crappie caught in trap nets and crappie caught in gill nets was compared using a two-sample *t*-test to determine if relative abundance differed as a function of gear using August 2010 to 2017 data (Excel 2007).

Observed trends in relative abundance or CPUE measured in fish per gill net were tested using two-sample *t*-tests comparing the mean CPUE by species from annual gill-net samples before and after Tongue River Dam was rebuilt (Excel 2007). The pre-dam rebuild period included annual gill-net data from 1975 to 1995 and the post-dam rebuild period included annual gill-net data from 1999 to 2017. Data from the three-year period (1996-1998) while Tongue River Dam was under reconstruction was excluded from analysis.

Proportional size distribution (PSD) and incremental PSDs were applied to describe the length structure of all game fishes sampled in gill nets, trap nets, and electrofishing. Relative weight (W_r) was calculated for all game fish to describe the body condition of all game fishes sampled with gill nets, trap nets, and electrofishing.

Age structures were collected according to Devries and Frie (1996). Otoliths were collected from a subsample of up to 10 individuals per 10mm length class of crappie caught during August 14-15, 2013. Otoliths from up to 15 individuals per 10mm length class per species of crappie were collected from a sub-sample of the crappie caught August 13-14 and October 14-15, 2014. Age structures were also collected from Smallmouth Bass, Walleye (dorsal spines), and Northern Pike (cleithra) in 2014. Otoliths from up to 20 individuals per 10mm length class per species of crappie were collected from a sub-sample of the crappie caught August 8-9, 2017. Age-length keys were used to apply age results from the subsampled population to the entire sampled population.

Reservoir storage (acre-ft) and water level (ft) were obtained from the Montana Department of Natural Resources and Conservation website and personnel (i.e. Sam Johnson; DNRC). Discharge (ft^3/sec) and specific conductance (µS/cm at 25º C) values for the Tongue River upstream and downstream of the reservoir were obtained from the United States Geologic Survey website (USGS). A Secchi disc tube was used to measure water clarity (i.e. transparency). A water quality meter (YSI 85) was used to record temperature, dissolved oxygen, specific conductance and salinity in Tongue River Reservoir. A Hanna pH meter was used to record pH. A Garmin hand held GPS unit

was used to record latitude and longitude in decimal degrees NAD 1983 projection for all fish and water quality sample locations.

RESULTS AND DISCUSSION

A summary of sample locations for each year (2014, 2015, 2016, 2017) can be found in figures 1 through 4. Gill-net catch ranged from 333 to 566 fish in August during the period 2014-2017 (Tables 1-4). Gill nets provided the largest samples of Walleye and Northern Pike. Night-electrofishing catch ranged from 125 to 270 fish per hour of shock time over the period 2014-2017 (Tables 5-8). Night-electrofishing provided the largest samples for Smallmouth and Largemouth Bass. Beach seine catch ranged from 786 to 2,797 fish in August during the period 2014-2017 (Tables 9-12). Beach seine hauls provided the largest samples of YOY bass, YOY crappie, and YOY perch as well as other small bodied fishes. Mini-fyke nets collected 2,607 fish in August 2014 (Table 13). Mini-fyke nets provided similar data to seine hauls for collecting a sample of annual production, juvenile, and small bodied fishes. Trap-net catch ranged from 375 to 790 fish in August during the period 2014-2017 (Tables 14-17). Trap nets provided the largest sample of Black and White Crappie. Mean total catch for all species combined (fish/gill net) did not differ between pre (1975-1995) and post (1999-2017) dam reconstruction periods (t = 0.13, df = 36, P = 0.89). Significant changes were observed between the two periods for individual species. This suggests the changes to reservoir habitat from increasing storage capacity has not changed the overall number of fish caught in gill nets but has influenced changes in the species composition within the catch. Comparison of gill-net data from the 19-year period before dam reconstruction and the 19-year period after dam reconstruction indicates decreases in average annual catch rates of crappie (t = 4.63, df = 36, P = 0.0001), White Crappie (t = 5.71, df = 30, P = 0.000003) and Yellow Perch (t = 2.37, df = 23, P = 0.03). The same comparison indicates increases in catch rates for bullheads (t = 4.21, df = 20, P = 0.0004), Pumpkinseed (t = 3.98, df = 18, P = 0.001), and Northern Pike (t = 5.09, df = 23, P = 0.00004).

Crappie

A trap-net component has been added to the annual trend sampling in August to improve relative abundance estimates and size structure analysis of Tongue River Reservoir crappie (Boxrucker and Plosky 1989; Schorr and Miranda 1991; Guy et al. 1996). Results of concurrent gill-net and trap-net sampling in August from 2010 to 2017 indicate trap nets provide larger sample sizes of Black Crappie than gill nets (t = 4.56, df = 8, P = 0.001) and similar sample sizes of White Crappie. The traps also sample a broader size distribution of the crappie population than gill nets, including YOY crappie (Figure 5). Additional sampling with trap nets was done in May, June, and October 2014, June 2015, and April 2017 to continue exploring temporal variation in catch rates and size structure as well as complete Wild Fish Transfers. Crappie catch rates for trap nets from 2010 to 2017 (47 per net, $\pm$ 1 SE) are higher than Elser found from 1972 to 1975 (13 per net, $\pm$ 1 SE; t = 3.38, df = 10, P = 0.01; Elser 1976). Elser also reported trap-net catch rates for the years 1976, 1978-1979 in various annual reports. Crappie

catch rates for trap nets from 1975 to 1979 (50 per net average) appear to be more comparable to catch rates from 2010 to 2017 but it is difficult to discern as effort (i.e. number of net sets) was not reported. Of crappie caught in trap nets from 2010 to 2017, 85% were Black Crappie. This dominance of trap-net catch by Black Crappie was not observed in Elser's 1972-1975 data summarized in the 1976 report. This could be explained by an overall lack of establishment of Black Crappie at the time, or a species-specific response to reservoir aging (Ney 1996). Ney reported Black Crappies are most abundant under more oligotrophic reservoir conditions while this condition does not appear to be optimal for White Crappie peak abundance (1996). Crappie catch rate was average in the May 2014 trap-net sample (26 crappie/net), and low in the October 2014 trap-net sample (9 crappie/net). The trap net sample on June 3, 2014 netted a record high trap-net catch of 111 crappie/net and the June 5, 2015 sample did not lag far behind at 75 crappie/net. May and June trap-net samples provided a targeted sample of older, larger crappie (Boxrucker and Ploskey 1989). May and June samples are ideal for collecting numbers of adult crappie for Wild Fish Transfers but with other regional responsibilities on the Yellowstone River, routine trend sampling this time of year is not feasible. However, August trap-netting is easily added to existing trend work and August catch rates are higher than October and July, as high as April and May and just slightly lower than June (Figure 6). Trap-netting for wild crappie transfers should be conducted during early June while catch rates are highest and water temperatures are around 16° C (60° F). Five wild crappie transfers were completed from 2014 to 2017 (Table 18).

Crappie catch rates in gill nets have differed between pre and post dam reconstruction time periods. The average crappie catch rate from 1975 to 1995 (22 per net, $\pm$ 1 SE) was greater than those observed from 1999 to 2017 (12 per net, $\pm$ 1 SE; t = 4.63, df = 36, P = 0.0001; Figure 7). White Crappie were the dominant species in gill-net catches comprising 89% of the combined crappie catch from 1975 to 1995. White Crappie were also the dominant species in gill-net catches from 1999 to 2017, comprising 74% of the combined catch. White Crappie gill-net catch rates were lower in the period 1999 to 2017 than they were from 1975 to 1995 (t = 5.7, df = 30, P = 0.00001), a decline that has driven a similar change for combined crappie species in gill nets (t = 4.63, df = 36, P = 0.00001) in an absence of any detectable change in Black Crappie gill-net catch rates. Long term gill-net data and verbal history from anglers seem to agree that crappie abundance was higher in the 1980's and early 1990's than it has been in recent decades. The decline in White Crappie catch rate in gill nets was not well explained by species that increased in relative abundance during the same period (R^2<0.17), nor by annual average water surface elevation (R^2=0.14; Figure 8). This suggests that some other factor or combination of factors, like the influence of reservoir aging, has had a greater influence on crappie catch rates in gill nets over the period than the abundances of other species captured in the same gear and the increase in pool level. No clear explanation for the change has yet been determined, but the trend appears to be stabilizing around a new equilibrium that is still offering quality angling (Figure 7). Some dissatisfaction with crappie catch rates was expressed by fishermen in 2011, but generally angler reports have been positive the last four years. The last creel survey conducted on Tongue River Reservoir ran from May 1, 2006 to April 30, 2007 (Riggs and Trickel 2007). Creel data

would be particularly helpful in connecting angler satisfaction to observed changes in sample data.

Seine hauls throughout the reservoir suggest annual crappie spawning success has been variable (Figure 10). Crappie YOY abundance is cyclic and is likely related to a combination of reservoir pool level and other environmental variables during the May-July spawning and nursery period. Correlations between crappie catch rates (adults from gill nets, YOY from seines) and water surface elevations (May, June, August, and annual average) were examined based on expected influence on catchability or production. Water surface elevations were a poor predictor variable for crappie abundance in gill nets ($R^2<0.15$), and YOY crappie abundance in seines ($R^2<0.05$). Vegetation in backwater areas important for spawning may be flooding too early and reducing the quality of the submerged spawning habitat (Dagel and Miranda 2012). Other environmental variables that may have disrupted spawning in recent years and reduced year class strength include fluctuating water temperature and increased turbidity from high rates of flow through the reservoir (Mitzner 1991). Comparing YOY abundance and recent age data suggests that high reproduction does not equate to high recruitment to adulthood for crappie at Tongue River Reservoir. This inability to predict adult crappie recruitment using YOY relative abundance was observed by Parsons et al. for lakes in Minnesota (2004).

Proportional size distribution (PSD) values indicate Black Crappie up to trophy size and White Crappie up to memorable size are available (Tables 19-22). However, fish of this size represent a small percentage of the catch with most of the catch for both species falling into stock, quality, and preferred size categories (Figures 11 and 13). Incremental PSD calculations for crappie from gill-net data, trap-net data, and electrofishing data were similar. Mean relative weight (W_r) values for Black Crappie were high, ranging from 84 to 127 except for memorable and trophy size fish in 2014 and 2015 (Figure 12). Mean relative weight (W_r) values for White Crappie were high, ranging from 91 to 114 except for preferred and memorable size fish in 2016 and 2017 (Figure 14). Although the two species of crappie are managed together in Tongue River Reservoir, other studies suggest they cannot be assumed to exist in equal abundances, grow at the same rate, prefer the same habitat, select the same food items, and respond homogenously to environmental conditions within the reservoir (Guy et al. 1996; Ney 1996; Ellison 1984).

Otoliths were collected from crappie in 2013, 2014, and 2017. In 2013 and 2017 otoliths were collected only during a sampling event in August. In 2014 otoliths were collected during a sampling event in August as well as an event in October. Reader agreement for crappie aged in the 2013, 2014, and 2017 studies was high. Readers agreed 89 to 96% of the time and were within 1 year 99 to 100% of the time (Appendix 1). Stewart found crappie from 1+ to 5+ years old in a 1983 age study (n=59). Results from the 2013, 2014, and 2017 age studies found crappie from 0+ to 10+ years old (Table 23). Stewart reported missing year classes and a population that was largely supported by a single strong year class in 1983. The results of aged crappie from 2013, 2014, and 2017 are similar (Table 23). Age frequency histograms demonstrate both Black Crappie and White Crappie had entire year classes missing and only one to three well represented

year classes per species in each year studied (Figures 15 and 16). Comparison of crappie length frequency histograms and results of aged otoliths suggests assigning age based on length frequency alone would be difficult. Age assignment of crappie under age 3+ by length frequency distribution alone may be fairly accurate but is made difficult by missing cohorts and crappie older than three years old cannot be accurately assigned by length frequency because overlap in mean length at age is common and sample sizes are low (Figures 17-22). Using methods described by Devries and Frie (1996) for allocating ages determined by hard part analysis for a sub-sample of fish to the entire sampled distribution based on the age-length relationship produces age-length keys (Appendix 2). Age-length keys allow for a less biased analysis of dominant year classes in the sampled population (Devries and Frie 1996). Age-length keys indicate the dominant age class for both Black Crappie and White Crappie in 2013 was 2+ or the 2011-year class (Appendix 2). The 2011-year class of crappie ranged in size from 6 inches (157mm) to 9 inches (232mm), with White Crappie mean length at age 2+ nearly an inch (21mm) longer than Black Crappie (Tables 23 and 24). Crappie that were 10 to 14 inches (237-357mm) were aged at 4+ to 10+ coming from the 2009 to 2003-year classes (Figures 17 and 18). Young-of-the-year size fish caught in the seine hauls and trap nets were not aged in the 2013 study. The 2011-year class was also the dominant year class in the 2014 age-length keys for both species of crappie (excluding young-of-the-year) at age 3+ (Appendix 2). In 2014 this cohort ranged in length from 7.5 inches (190mm) to 13 inches (330mm), with White Crappie mean length at age 3+ nearly an inch (21mm) longer than Black Crappie (Tables 23 and 24). Other less represented year classes present in the 2014 age study included ages 1+, 3+ to 7+, and 10+ coming from the 2013, 2010 to 2007, and 2004-year classes (Figures 19 and 20). Young-of the-year size fish were aged in the 2014 study and were well represented in the age-length keys (Appendix 2). There were three cohorts found in the 2013 age study that were no longer found in the 2014 age study, the 2006, 2005, and 2003-year classes. High natural mortality rates (greater than 30%) are common in crappie populations (Ellison 1984; Parsons and Reed 1998). These cohorts had the weakest representation in the 2013 age study so natural mortality may explain their absence in 2014. Angling mortality also may have been the cause for the three cohorts absent in 2014. They ranged in size from 10 inches (260mm) to 14 inches (350mm), within the size range that Miranda and Dorr found anglers select for with rod and reel (2000). Age-length keys indicate the dominant age class for both Black Crappie and White Crappie in 2017 was 2+ or the 2015-year class (Appendix 2). The 2015-year class of crappie ranged in size from 5.5 inches (136mm) to 9.5 inches (240mm), with White Crappie mean length at age 2+ about an inch (28mm) longer than Black Crappie (Tables 23 and 24). Age 5+ crappie or the 2012-year class was also well represented in the age-length key for the 2017 age study, although they did not show up in the 2013 or 2014 age studies as age 1+ and 2+ crappie (Appendix 2). Young-of the-year size fish were aged in the 2017 study and were well represented in the age-length key for Black Crappie (Appendix 2). The 2014-year class of crappie that was observed as young-of-the-year in the 2014 study was also observed at age 3+ in the 2017 study. The 2011-year class, which was the dominant year class of both species of crappie in the 2013 and 2014 age studies, was observed in the 2017 study but only as age 6+ Black Crappie (Appendix 2). There were three cohorts found in the 2014 age study that were no longer found in the 2017 age study, the 2010, 2007, and 2004-year classes. However, these year classes

were not expected to still be found in the 2017 study due to age (natural mortality) and size (angling mortality). There were older crappie found in the 2017 study (ages 8+ and 9+) which provides some indication that the Tongue River Reservoir crappie fishery is not currently threatened by angling exploitation. Maximum age and mean length at age observed in age studies at Tongue River Reservoir very closely match results from other age studies in northern states and Canadian provinces (Scott and Crossman 1973; Schneider 2000; McInerny and Cross 2008).

Walleye

Walleye have consistently been sought after by anglers at Tongue River Reservoir since conversion of the fishery to warm-water species (Bianchi 1969). Walleye were first stocked in Tongue River Reservoir as fry from 1950 to 1951 (Table 25). Anglers first reported catching walleye in 1969 following a second attempt at fry stocking from 1965 to 1969 and a fingerling stocking in 1969 (Bianchi 1969). Walleye were sampled with gill nets, trap nets, and electrofishing in each year covered by this report (2014-2017), but gill nets provided the highest catch rates (Tables 19-22). Sampling with electrofishing in October of 2014 collected a segment of smaller sized (5-10 inches, 137-264mm) Walleye not seen in other samples. Walleye were found up to preferred size in 2015 and up to memorable size in 2014, 2016 and 2017. The majority of Walleye in the gill-net catch ranged from quality to preferred and mean relative weight (W_r) values ranged from 75 to 120 (Tables 19-22). Lack of trophy sized Walleye in the gill-net catch is partially explained by the small mesh sizes used on the experimental gill nets and should not be interpreted as a complete absence from the Walleye population. Trophy size fish are inherently rare, low in abundance and infrequently handled in most populations (Wilde and Pope 2004). While larger mesh size gill nets could be used to target trophy Walleye at Tongue River Reservoir it is undesirable at this time due to the mortality rate associated with gill nets and low likelihood that capture data from this size class would be informative and useful. Trophy size Walleye in Tongue River Reservoir are periodically documented by anglers and that is sufficient evidence of their existence in the population.

Dorsal spines from a sub-sample of 113 Walleye caught during 2014 were used to determine age structure for the Tongue River Reservoir Walleye population. Readers agreed on age of Walleye 83% of the time and were within 1 year 97% of the time (Appendix 1). Walleye were aged from young-of-the-year (0+) to 16+ in the 2014 age study (Table 26). The dominant cohort of Walleye in the 2014 age study was 3+ or the 2011-year class (Table 26). While the 2011-year class was dominant by number in the age-length key (Appendix 2), many other year classes were represented and only one cohort from age 0+ to 12+ was missing (Table 26). This consistency in annual recruitment is likely influenced by annual augmentation of the population through hatchery stocking (Table 25). Age structure results are consistent with size structure results, both suggesting that overharvest is not currently an issue at Tongue River Reservoir. The length frequency histogram of the 2014 Walleye catch with markers for mean length at age suggests trying to use length frequency distribution alone to infer age would be ineffective (Figure 23). In 2014 dorsal spines were taken because they could be

collected non-lethally, however the most effective gear for collecting Walleye in Tongue River Reservoir has been experimental gill nets set overnight which have a high mortality rate. Therefore, the benefits described by Isermann et al. in reduced processing time and increased precision of reading provided by sagittal otoliths (2003) provides incentive to collect otoliths from Walleye for future aging efforts. Collecting age structures from a species over such a wide sample period (3 months) should be avoided in future aging studies at Tongue River Reservoir. Increasing sample size of aged Walleye and inclusion of known age fish should be goals for the next Walleye aging effort. Increasing sample size of aged Walleye should improve precision of length at age estimates. Inclusion of known age Walleye (i.e. hatchery reared Walleye fingerlings marked with Oxytetracycline) in the sample of aged fish will provide validation of aging methods over time as Walleye are caught and aged in multiple field seasons following the stocking. Age validation with known age fish is an important but often overlooked component of any age and growth study (Beamish and McFarlane 1983).

Northern Pike

After attempts to manage Tongue River Reservoir as a trout fishery for its first decades, including a chemical treatment of both the reservoir and part of the river in 1957 and trout stocking from 1939 to 1965, focus shifted toward management of warm-water species (Elser 1971). Northern Pike was one of the first species stocked to establish a naturally reproducing population of warm-water sport fish. Northern Pike fry and fingerlings stocked from 1963 to 1966 established the population. Intermittent stocking maintained a population characterized by low abundances but good growth, producing the standing State record fish (37.5 lbs.) in 1972. An intensive effort to augment the Northern Pike population was undertaken from 1978 to 1985 using a 21-acre spawning/rearing marsh constructed adjacent to the reservoir in 1977 (Elser 1980). This cooperative project between Decker Coal Company, United States Fish and Wildlife Service, Montana Cooperative Fisheries Unit, and FWP attempted to provide habitat that would facilitate natural pike reproduction. Northern Pike did not demonstrate use of the constructed marsh as intended for spawning habitat and focus of the project shifted toward growing up hatchery stocked fry to fingerling size, a sort of in situ rearing pond. This approach also proved unsuccessful. Hatchery stocking of Northern Pike fingerlings and/or fry continued when available until 1993. Since the dam was rebuilt, Northern Pike relative abundance in August gill-net surveys has been steadily increasing without hatchery augmentation (Figure 24). Relative abundance has ranged between 1.2 and 2.2 pike per gill net from 2014 to 2017 (Tables 1-4). Catch rates are low but are increasing and can be expected to continue to increase as it appears the new reservoir level now provides suitable spawning and rearing habitat. Size structure of adult fish from the modest sample sizes appears to be well balanced with Northern Pike up to memorable size and mean relative weight (W_r) values from 63 to 108 (Tables 19-22). Like Walleye absence of trophy size fish in gill-net catch is probably a result of the mesh sizes used on experimental gill nets and not an indicator of their absence from the population. This is a known and acceptable gear bias. Aging of Northern Pike collected in August and October of 2014 resulted in similar length at age as reported by Oele et al. (2015). The small sample aged from Tongue River Reservoir (n=30) had Northern Pike from ages 4+

to 8+ or from the 2010 through 2006-year classes (Table 28). Two independent readers from the University of Idaho lab determined age based on observation of sectioned cleithra, with methods adapted from Casselman (1974). The readers agreed on age within 1 year 76% of the time and within 2 years 93% of the time (Appendix 1). Despite these readers general agreement and their ages similarity to the Oele et al. study I found their results difficult to reproduce and the sections difficult to read. Objectives for future age study of Northern Pike at Tongue River Reservoir should include obtaining a larger sample size and aging whole cleithra which seems to be the more contemporary methodology (Laine et al 1991; Maceina et al 2007; Faust et al 2013).

Smallmouth Bass

Gill nets, trap nets, and electrofishing all captured Smallmouth Bass during the study period 2014 to 2017 (Tables 19-22). Gill nets and trap nets provided relatively low catch rates compared to electrofishing (Tables 19-22). Electrofishing gear is more effective for targeted samples of bass although it has known size related sampling bias (Beamesderfer and Rieman 1988). Beamesderfer and Rieman conducted a gear selectivity study on a Columbia River reservoir about five times as large as Tongue River Reservoir and found that while electrofishing provided larger sample sizes than gill nets, trap nets, and rod and reel; sampling efficiency gradually decreased as Smallmouth Bass size increased causing their size structure estimates to be biased low and their annual mortality estimates to be biased high (1988). At Tongue River Reservoir electrofishing is capturing primarily Smallmouth Bass with relatively few Largemouth Bass caught (Figure 25). Annual production was documented for both species by August seine hauls. Bass young-of-the-year along with crappie and perch young-of-the-year make up the majority of small forage fish sampled with the seine in Tongue River Reservoir (Figure 26). Mean relative weight (W_r) values for bass sampled in gill nets, trap nets, and electrofishing had consistently high relative weight values ranging from 86 to 148 for Largemouth Bass and 85 to 117 for Smallmouth Bass (Tables 19-22). Smallmouth Bass were sampled up to memorable size but relatively few were greater than stock size, which may be partially explained by the sampling efficiency phenomenon described by Beamesderfer and Rieman (1988). Relative weight values suggest Smallmouth Bass are not forage limited. Angler reports indicate that bass are increasingly a targetable species offering quality angling opportunity at Tongue River Reservoir. Increased submerged woody debris in the reservoir since the dam rebuild was expected to lead to the expansion of the Largemouth Bass population (Keith 1975) but sampling efforts have failed to detect any such response. Sampling efforts have not yet documented expansion in either Largemouth or Smallmouth Bass populations.

A sub-sample (n=181) of the Smallmouth Bass catch from August and October 2014 was aged by sectioned leading dorsal fin spines. Readers only agreed on age 63% of the time but were within 1 year 91% of the time (Appendix 1). The 2014 age study documented young-of-the-year through age 6+ Smallmouth Bass without any missing year classes (Table 29). The age-length key indicates age 1+ and age 2+ or the 2013 and 2012 year-classes were the best represented cohorts in the catch (Appendix 2). Length at age for Smallmouth Bass at Tongue River Reservoir suggests this population exhibits fast

growth (Scott and Crossman 1973; Beamesderfer and North 1995), which is consistent with the observed high relative weight values. The presence of these fast growers in each year class has caused mean lengths at age to align right of each peak in the length frequency distribution of the Smallmouth Bass catch from pooled gears (Figure 27). Validation of aging with known age fish or marginal increment analysis could help determine if the apparent bimodality in individual year classes (i.e. average growers and fast growers) is real in the population or results from errors in aging (Beamish and McFarlane 1983; Campana 2001). It is unclear if the maximum observed age of 6+ suggests older fish are not present in the population or simply is a result of sampling few large fish. Other studies suggest a maximum age for Smallmouth Bass at 15 (Scott and Crossman 1973). Continued exploration of temporal variation in electrofishing catch rates and size structure for Smallmouth Bass catch may provide an opportunity to age a larger sample size of above stock size bass and determine if bass live longer than 6 years in Tongue River Reservoir. Electrofishing in the spring when bass are in shallow water staging for spawning or on spawning beds may provide better samples of larger size fish.

Channel Catfish

Channel Catfish continue to be caught in small numbers in August gill-net samples, with 2 to 11 fish caught per net from 2014 to 2017 (Tables 1-4). Less than two dozen Channel Catfish were collected in seines from 1989 to 2011 and not all of those were YOY. Four Channel Catfish were collected in seines in 2011, the first sampled since 1996. Four yearling size Channel Catfish were collected in seines in 2012 and one YOY Channel Catfish was collected in seines in 2013. Only one adult catfish was caught in the seine from 2014 to 2017. Consistent relative abundance values for adults through the years indicate limited spawning and recruitment are occurring but it is unknown if this occurs in the river upstream or the reservoir itself (Figure 24). Sample sizes of Channel Catfish preclude analysis of size structure and body condition.

Sunfish

Pumpkinseed Sunfish, Green Sunfish, and Rock Bass were observed during the study period (2014-2017). Pumpkinseed Sunfish have increased in abundance over the last two decades in both gill nets and seine hauls in Tongue River Reservoir (Figure 28). Incremental PSD values calculated from gill nets, trap nets and electrofishing had Pumpkinseed up to memorable size but consistently in stock and quality size categories. Mean W_r values for Pumpkinseed were often greater than 100 indicating that they were in extremely good condition (Tables 19-22). A few adult Green Sunfish were observed with mini-fyke nets in 2014. Few YOY Green Sunfish were observed with seines and mini-fyke nets in 2014. Historically, Rock Bass have been present in low abundance in Tongue River Reservoir but have not been sampled in August gill nets or seines since 2000. No Bluegill Sunfish were collected during the study period making observations of YOY Bluegill in 2012 trap net set at the swim beach and a 2013 seine haul at Pearson Creek Bay appear to be misidentifications of YOY Pumpkinseed. Bluegill sunfish have not been consistently documented in Tongue River Reservoir but there are a few other

instances where they were recorded but may have been misidentifications of Green or Pumpkinseed Sunfish (Elser 1983).

Other Sport Fish

Adult Yellow Perch were abundant prior to completion of the dam rebuild (1980-1995) but declined after completion (2000-2009) and recently (2011-2017) experienced a modest increase in abundance (Figure 29). Catch rates of YOY Yellow Perch continues to be similar to YOY crappie which combined account for more than 86% of the seine haul catch by number in 2014, 89% in 2015, and 84% in 2017 (Tables 9-12).

One Sauger was collected during electrofishing in 2014. No Sauger were collected in other efforts from 2014 to 2017. Sauger are believed to be native to the Tongue River including above the present-day location of Tongue River Reservoir. Chuck Sowards, Wyoming fisheries biologist in Buffalo conducted electrofishing surveys in the reach of river from Ranchester, Wyoming to Tongue River Reservoir Dam from 1951 to 1955, no Sauger were found but he suggests angler accounts claim the species was abundant in that location some time previous (1956). Wyoming stocked 234 adult sauger in the Tongue River above the reservoir from 1962 to 1964 (Backes 2004). Elser et al. (1977) noted the first appearance of Sauger in the reservoir in 1973, and Riggs (1978) documented high abundance of Sauger in sampling efforts. However, Sauger abundance has been low since the late 1980s. Gill nets have only collected three Sauger in the last 10 years (Table 30). Sauger are a small component of the reservoir fishery. Sauger of this population likely prefer the Tongue River habitat above the reservoir through the growing season and overwinter in the reservoir. Catch rates from electrofishing methods in the reach of the Tongue River above the reservoir demonstrate a similar trend with consistent observations of Sauger in low abundance (M. Backes, MTFWP, personal communication). In 2011, the combined Sauger-Walleye bag limit was modified above Tongue River Reservoir Dam. The modification reduced the possible number of Sauger from 5 fish daily and in possession to 1 daily and in possession. This was done to protect the small remnant population that exists in the reservoir and the reach of the Tongue River above.

Bullhead catch rates have been low recently (<15 fish/net) in gill-net catches compared to catch rates during the 2000's that averaged 39 fish/net (Figure 29). Bullheads comprised a small percentage of the overall catch from each of the other gears (seines, mini-fyke nets, trap nets, and electrofishing). Mean relative weight (W_r) values for bullheads ranged from 38 to 115 but were most consistently in the 80's and 90's (Tables 19-22).

An angler caught a Tiger Muskie on January 14, 2018 through the ice near Rattlesnake Point. The fish was 42 inches long and weighed 15 pounds. Paul Mavrakis (Wyoming Fish Manager in Sheridan WY.) revealed a likely source of this fish. In 2013, Wyoming Fish and Game stocked fifty 10-inch-long Tiger Muskie into Ranchester Pond located in Ranchester, Wyoming. A couple of years later the pond flooded briefly (30 days at most) creating a potential escape route into the Tongue River. The pond is

approximately 300 to 400 feet from the Tongue River. Paul did not know how many of the original 50 fish escaped from or remain in the pond. The only other evidence of the original stocking was a dead fish that was 35 inches long observed in the spring of 2017.

Water

Reservoir storage was above the post-dam reconstruction (1999-2017) historical average in 2014, 2015, 2016, and 2017 except during April 2014, and July-August 2016 (Figure 30). Discharge as measured by USGS gauging station 06306300 Tongue River at State Line is dependent on mountain snowpack and local rainfall. Discharge as measured by USGS gauging station 06307500 Tongue River at Tongue River Dam is within control of dam operators until storage capacity is exceeded and water begins to flow over the spillway. Snowpack and/or rainfall was adequate in 2014, 2015, and 2017 for Tongue River discharge to exceed 2,000 cfs (cubic feet per second) at peak discharge. Tongue River Reservoir spilled during May each year exceeding storage capacity during peak runoff (Figure 30). Dam operations followed a consistent pattern for these good water years (Figure 31). Water released out of the reservoir closely matched the discharge rate of water coming into the reservoir from November to February. Water release rates exceeded the discharge rate entering the reservoir between March and April, providing a flush prior to the irrigation season. Runoff water was captured during May and June then used to augment the Tongue River below the reservoir from July through October. Dam operations followed a slightly different pattern in 2016, a relatively poor water year. In 2016 peak discharge for the Tongue River did not reach 1,000 cfs (Figure 32). The recent settlement of the Wyoming-Montana water compact will influence how Tongue River Reservoir Dam is operated. The compact will make it more difficult for the Tongue River Water Users and dam operators to dump water in April to flush out high salinity, high conductivity, water prior to the irrigation season. Specific conductance is inversely related to discharge, building during periods of low discharge and diminishing as discharge increases (Figures 31 and 32). Beam found floodwater releases can reduce crappie year class strength depending on timing, magnitude, and duration (1983). Mitzner found a positive relationship between young-of-the-year crappie abundance and the amount of floodwater stored from April through August in Rathburn Lake, a south-central Iowa reservoir similar to Tongue River Reservoir in both size and use (1991). Water temperatures were within the range described by Scott and Crossman (1973) as the crappie spawning window from roughly May 7 to June 10 in both 2016 and 2017 (Figure 33). Water temperature within that window was more erratic in 2017 with multiple dips in temperature that pushed Black Crappie out of the shallows and likely led to nest abandonment (Fayram et al. 2015). Mitzner also found turbidity to limit larval crappie production in Rathburn Lake with a geometric relationship when water clarity was less than 64cm and found no production when water clarity was less than 5cm (1991). A summary of water quality measurements taken during sampling at Tongue River Reservoir in 2014, 2015, and 2016 can be found in Table 31.

MANAGEMENT RECOMMENDATIONS

Survey and inventory of the Tongue River Reservoir fishery has been conducted since the 1950's. The sampling methodology and management objectives have remained relatively unchanged until the last few years with the addition of trap net and electrofishing methods. The change in sampling methodology has provided valuable data that enhances analysis of existing trend data collected with gill nets and seines and has started to fill data gaps for some important sport species. The addition of trap net sampling has increased sample sizes for analysis of size structure and condition factor of crappie. Trap nets are also providing samples of YOY fish to compare with seine haul data when estimating annual reproduction. Mini-fyke nets could be used as an alternative to seine hauls for assessing annual production and presence of juvenile and small bodied fishes. This gear will not be regularly incorporated into the annual trend sampling because it does not appear to offer any advantage over seine hauls. Seine data is available back to 1984 and as an active gear type is logistically compatible to completing the samples in between checking other passive gears (gill nets, trap nets). The addition of night electrofishing shows early signs that it will provide adequate sample sizes of Smallmouth Bass to evaluate relative abundance, size structure, and condition factor for this species that other methods do not. Incorporating collection of aging structures has allowed improved analysis of crappie population dynamics in Tongue River Reservoir. Scales were collected and aged in 1983, 1989, and 2001 with results presented in the 2001-2002 report. Scales were collected in 2003 and summarized but have not been reported. Otolith aging for a sample of White Crappie was summarized in Phil Stewart's 1983 report. Otoliths were collected again for this report in 2013, 2014, and 2017. Development of age-length keys allowed identification of dominant year classes and improved interpretation of size structure and condition indices. This latest round of age study with multiple years within a relatively brief period allowed tracking of dominant year classes as they moved through time. Otoliths are the preferred aging structure for accurate age and growth estimation (Hammers and Miranda 1991). It is recommended that crappie otoliths be collected again in 2018 and be analyzed and reported with age data from 2017. Efforts to get known age fish in the population to validate aging methods are likely unjustifiable (i.e. cost to benefit) however a good first step toward validation of aging methods could be using marginal increment analysis (Fowler 1990; Rugg et al. 2014). It is recommended that any collected age structures for any species be collected during a concise temporal period like was done in 2013 and 2017 for crappie. Collecting structures over a broader period (3 months) like was done with all species in 2014 confounds aging and increases variance of calculated length at age. It is recommended that one hour of night electrofishing become a permanent addition to the trend sampling methodology in August. Effort should continue to focus on finding appropriate transects throughout the reservoir for effective bass electrofishing. It is recommended that an hour of electrofishing for bass be completed during their spawning window (e.g. late May to early June) to explore if it could improve sample size for larger individuals. A sampling methodology including a suite of gear types (gill nets, seines, trap nets, and electrofishing) will increase the probability of accurately detecting shifts in the fish assemblage and will facilitate fisheries managers with the data needed to make sound decisions.

Waters referred to: Tongue River Reservoir 7-21-9000-06

Key Words: Crappie, Walleye, Trap net, Length at Age

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Table 1. Results of 10 overnight experimental gill-net sets at Tongue River Reservoir, August 2014.

Species	Number Caught	Average per Net	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Bullhead	19	1.9	246	233	200 - 320	100 - 500	5.7
Black Crappie	21	2.1	218	168	141 - 284	30 - 360	6.3
Channel Catfish	11	1.1	481	2076	288 - 820	120 - 6150	3.3
Common Carp	2	0.2	573	2315	570 - 575	2300 - 2330	0.6
Northern Pike	18	1.8	747	2656	484 - 1080	700 - 5700	5.4
Pumpkinseed	2	0.2	171	155	164 - 178	140 - 170	0.6
Shorthead Redhorse Sucker	31	3.1	422	929	267 - 550	140 - 1640	9.3
Smallmouth Bass	32	3.2	260	285	151 - 382	20 - 760	9.6
Walleye	66	6.6	364	480	264 - 680	160 - 3120	19.8
White Crappie	43	4.3	231	170	100 - 310	20 - 360	12.9
Yellow Bullhead	51	5.1	248	222	195 - 310	100 - 400	15.3
Yellow Perch	37	3.7	207	115	140 - 236	40 - 170	11.1

Table 2. Results of 10 overnight experimental gill-net sets at Tongue River Reservoir, August 2015.

Species	Number Caught	Average per Net	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Bullhead	16	1.6	278	344	198 - 321	130 - 500	4.8
Black Crappie	54	5.4	232	234	112 - 282	20 - 380	16.1
Channel Catfish	2	0.2	355	330	354 - 355	300 - 360	0.6
Common Carp	6	0.6	606	2973	553 - 640	2500 - 3600	1.8
Largemouth Bass	2	0.2	390	1000	315 - 465	500 - 1500	0.6
Northern Pike	12	1.2	733	2714	485 - 940	640 - 5585	3.6
Pumpkinseed	1	0.1	155	80	-	-	0.3
Shorthead Redhorse Sucker	16	1.6	414	898	260 - 515	180 - 1440	4.8
Smallmouth Bass	24	2.4	255	309	135 - 406	40 - 1040	7.1
Walleye	62	6.2	364	582	240 - 616	100 - 2270	18.5
White Crappie	32	3.2	217	185	118 - 375	20 - 900	9.5
Yellow Bullhead	40	4.0	260	273	200 - 310	100 - 480	11.9
Yellow Perch	69	6.9	191	96	137 - 252	30 - 220	20.5

Table 3. Results of 10 overnight experimental gill-net sets at Tongue River Reservoir, August 2016.

Species	Number Caught	Average per Net	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Bullhead	50	5.0	264	261	161 - 326	25 - 475	8.8
Black Crappie	96	9.6	159	61	103 - 300	10 - 350	17.0
Channel Catfish	4	0.4	400	644	298 - 424	150 - 1200	0.7
Common Carp	10	1.0	579	2754	294 - 675	325 - 2775	1.8
Largemouth Bass	3	0.3	274	367	240 - 304	220 - 500	0.5
Northern Pike	16	1.6	647	2021	518 - 993	800 - 5700	2.8
Pumpkinseed	8	0.8	170	90	144 - 277	80 - 120	1.4
Shorthead Redhorse Sucker	23	2.3	449	1022	370 - 522	580 - 1650	4.1
Smallmouth Bass	21	2.1	269	386	147 - 414	10 - 1100	3.7
Walleye	101	10.1	431	844	150 - 677	380 - 2900	17.8
White Crappie	130	13.0	177	76	126 - 340	10 - 450	23.0
White Sucker	2	0.2	454	1175	422 - 485	-	0.4
Yellow Bullhead	16	1.6	256	270	146 - 295	40 - 430	2.8
Yellow Perch	86	8.6	188	76	130 - 261	10 - 175	15.2

Table 4. Results of 10 overnight experimental gill-net sets at Tongue River Reservoir, August 2017.

Species	Number Caught	Average per Net	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Bullhead	5	0.5	292	365	242 - 342	160 - 580	1.2
Black Crappie	28	2.8	192	115	135 - 281	30 - 340	7.0
Channel Catfish	6	0.6	359	392	322 - 392	280 - 500	1.5
Common Carp	10	1.0	580	2814	323 - 702	480 - 4560	2.5
Northern Pike	22	2.2	686	2166	510 - 1010	800 - 5900	5.5
Pumpkinseed	3	0.3	175	127	167 - 181	110 - 140	0.7
Shorthead Redhorse Sucker	6	0.6	455	1044	403 - 515	800 - 1280	1.5
Smallmouth Bass	13	1.3	288	482	142 - 423	30 - 1200	3.2
Walleye	58	5.8	454	972	260 - 658	130 - 2900	14.5
White Crappie	141	14.1	210	120	127 - 305	20 - 360	35.2
Yellow Bullhead	58	5.8	263	279	163 - 352	50 - 670	14.5
Yellow Perch	51	5.1	177	56	146 - 213	30 - 120	12.7

Table 5. Results of night electrofishing at Tongue River Reservoir, in June, August, and October 2014 for a cumulative shock time of 2.5 hours.

Species	Number Caught	Average per Hour	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Bullhead	4	1.6	254	258	157 - 292	60 -380	0.7
Black Crappie	98	39.2	222	189	100 - 355	20 - 680	17.2
Common Carp	3	1.2	275	2380	548 - 601	2000 - 2760	0.5
Largemouth Bass	10	4.0	340	758	273 - 423	240 - 1300	1.8
Northern Pike	11	4.4	667	1958	475 - 910	600 - 4600	1.9
Pumpkinseed	2	0.8	130	60	105 - 155	20 - 100	0.4
Sauger	1	0.4	256	160	-	-	0.2
Shorthead Redhorse Sucker	7	2.8	349	733	196 - 549	100 - 1760	1.2
Smallmouth Bass	278	111.2	237	231	110 - 465	20 - 1380	48.8
Spottail Shiner	10	4.0	94	-	87 - 104	-	1.8
Walleye	49	19.6	290	401	137 - 645	20 - 2700	8.6
White Crappie	22	8.8	252	231	147 - 280	60 - 300	3.9
Yellow Perch	17	6.8	150	36	125 - 207	20 - 100	3.0
Crappie YOY	53	21.2	61	-	39 - 95	-	9.3
Largemouth Bass YOY	1	0.4	95	-	-	-	0.2
Pumpkinseed YOY	3	1.2	82	-	80 - 84	-	0.5
Smallmouth Bass YOY	1	0.4	87	-	-	-	0.2

Table 6. Results of night electrofishing at Tongue River Reservoir in August 2015 for a cumulative shock time of 1.4 hour.

Species	Number Caught	Average per Hour	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Crappie	10	7.4	237	247	195 - 256	140 - 300	5.9
Common Carp	2	1.5	621	3035	95 - 116	2000 - 2760	1.2
Largemouth Bass	8	5.9	223	234	164 - 342	70 - 680	4.7
Northern Pike	2	1.5	650	1830	564 - 735	1300 - 2360	1.2
Pumpkinseed	2	1.5	144	80	138 - 150	80	1.2
Shorthead Redhorse Sucker	5	3.7	446	1072	342 - 512	500 - 1500	2.9
Smallmouth Bass	88	65.2	210	210	112 - 511	20 - 1850	51.8
Spottail Shiner	2	1.5	95	-	92 - 97	-	1.2
Walleye	27	20.0	302	328	125 - 510	40 - 1200	15.9
White Crappie	2	1.5	260	280	250 - 270	260 - 300	1.2
Yellow Perch	7	5.2	139	36	122 - 175	20 - 80	4.1
Common Carp YOY	7	5.2	101	-	95 - 116	-	4.1
Crappie YOY	5	3.7	60	-	50 - 65	-	2.9
Largemouth Bass YOY	3	2.2	85	-	70 - 93	-	1.8

Table 7. Results of night electrofishing at Tongue River Reservoir in April and August 2016 for a cumulative shock time of 1.7 hours.

Species	Number Caught	Average per Hour	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Crappie	62	37.1	227	248	112 - 298	60 - 320	29.7
Green Sunfish	1	0.6	138	100	-	-	0.5
Largemouth Bass	1	0.6	219	200	-	-	0.5
Northern Pike	4	2.4	568	1713	410 - 953	530 - 5050	1.9
Pumpkinseed	1	0.6	120	80	-	-	0.5
Smallmouth Bass	35	21.0	269	467	117 - 398	60 - 1200	16.7
Spottail Shiner	9	5.4	92	-	76 - 115	-	4.3
Walleye	30	18.0	442	1104	276 - 685	630 - 3300	14.4
White Crappie	17	10.2	227	236	132 - 305	80 - 460	8.1
Yellow Perch	46	27.5	142	65	105 - 212	20 - 130	22.0
Crappie YOY	1	0.6	97	-	-	-	0.5
Smallmouth Bass YOY	1	0.6	86	-	-	-	0.5
Yellow Perch YOY	1	0.6	61	-	-	-	0.5

Table 8. Results of night electrofishing at Tongue River Reservoir in August 2017 for a cumulative shock time of 1 hour.

Species	Number Caught	Average per Hour	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Crappie	13	13.0	182	82	150 - 220	40 - 160	4.8
Channel Catfish	1	1.0	738	6100	-	-	0.4
Common Carp	7	7.0	617	3249	565 - 729	2100 - 5350	2.6
Largemouth Bass	1	1.0	320	440	-	-	0.4
Northern Pike	1	1.0	419	440	-	-	0.4
Pumpkinseed	11	11.0	128	42	112 - 142	20 - 60	4.1
Shorthead Redhorse Sucker	1	1.0	410	-	-	-	0.4
Smallmouth Bass	153	153.0	200	134	105 - 412	10 - 1080	56.7
Walleye	2	2.0	306	245	264 - 348	140 - 350	0.7
White Crappie	17	17.0	205	128	188 - 220	80 - 440	6.3
Yellow Bullhead	11	11.0	216	144	132 - 300	20 - 380	4.1
Yellow Perch	22	22.0	120	-	100 - 159	-	8.1
Crappie YOY	1	1.0	50	-	-	-	0.4
Pumpkinseed YOY	1	1.0	70	-	-	-	0.4
Smallmouth Bass YOY	21	21.0	70	-	50 - 82	-	7.8
Yellow Perch YOY	7	7.0	64	-	-	-	2.6

Table 9. Results of 10 seine hauls at Tongue River Reservoir, August 2014.

Species	Number Caught	Number per Seine Haul	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percent of Catch (%)
Black Crappie	1	0.1	220	220	-	-	0.1
Channel Catfish	1	0.1	521	2140	-	-	0.1
Pumpkinseed	6	0.6	123	55	107 - 138	40 - 70	0.4
Smallmouth Bass	8	0.8	207	168	119 - 321	40 - 500	0.6
Spottail Shiner	2	0.2	97	-	83 - 110	-	0.1
White Crappie	1	0.1	246	200	-	-	0.1
Yellow Perch	57	5.7	120	23	98 - 197	10 - 60	4.0
Crappie YOY	848	84.8	49	-	34 - 66	-	59.2
Common Carp YOY	5	0.5	90	-	85 - 95	-	0.3
Green Sunfish YOY	2	0.2	68	-	62 - 74	-	0.1
Largemouth Bass YOY	27	2.7	74	-	43 - 104	-	1.9
Pumpkinseed YOY	52	5.2	67	-	51 -98	-	3.6
Smallmouth Bass YOY	43	4.3	55	-	43 - 83	-	3.0
Yellow Perch YOY	379	37.9	62	-	49 -98	-	26.5

Table 10. Results of 10 seine hauls at Tongue River Reservoir, August 2015.

Species	Number Caught	Number per Seine Haul	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percent of Catch (%)
Largemouth Bass	1	0.1	165	100	-	-	0.1
Northern Pike	2	0.2	235	58	228 - 241	55 - 60	0.1
Pumpkinseed	9	0.9	113	27	103 - 124	10 - 40	0.5
Smallmouth Bass	13	1.3	158	69	109 - 246	30 - 250	0.7
Spottail Shiner	1	0.1	-	-	-	-	0.1
Yellow Perch	32	3.2	128	25	116 - 141	10 - 40	1.7
Crappie YOY	89	8.9	60	-	41 - 75	-	4.7
Common Carp YOY	3	0.3	86	-	58 - 113	-	0.2
Largemouth Bass YOY	62	6.2	63	-	42 - 92	-	3.3
Pumpkinseed YOY	13	1.3	86	-	67 -99	-	0.7
Smallmouth Bass YOY	79	7.9	64	-	41 - 97	-	4.2
Yellow Perch YOY	1589	158.9	64	-	51 -80	-	83.9

Table 11. Results of 10 seine hauls at Tongue River Reservoir, August 2016.

Species	Number Caught	Number per Seine Haul	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percent of Catch (%)
Black Bullhead	1	0.1	120	40	-	-	0.1
Black Crappie	8	0.8	188	150	120 - 268	40 - 350	1.0
Common Carp	5	0.5	165	80	160 - 170	-	0.6
Largemouth Bass	6	0.6	146	103	106 - 160	20 - 160	0.8
Northern Pike	8	0.8	188	44	150 - 216	30 - 50	1.0
Pumpkinseed	16	1.6	127	52	103 - 169	30 - 90	2.0
Smallmouth Bass	39	3.9	167	64	129 - 260	30 - 210	5.0
Spottail Shiner	6	0.6	58	-	55 - 61	-	0.8
White Crappie	2	0.2	166	55	161 - 170	50 - 60	0.3
Yellow Perch	238	23.8	116	17	97 - 180	10 - 70	30.3
Crappie YOY	68	6.8	44	-	33 - 54	-	8.7
Largemouth Bass YOY	40	4	61	-	43 - 94	-	5.1
Pumpkinseed YOY	54	5.4	52	-	20 - 95	-	6.9
Smallmouth Bass YOY	46	4.6	63	-	44 - 85	-	5.9
Sunfish YOY	19	1.9	23	-	17 - 29	-	2.4
Yellow Perch YOY	230	23	62	-	37 - 70	-	29.3

Table 12. Results of 10 seine hauls at Tongue River Reservoir, August 2017.

Species	Number Caught	Number per Seine Haul	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percent of Catch (%)
Northern Pike	1	0.1	250	100	-	-	0.1
Pumpkinseed	5	0.5	137	44	120 - 164	40 - 50	0.6
Smallmouth Bass	60	6	159	56	115 - 214	20 - 120	7.6
Spottail Shiner	3	0.3	49	-	48 - 49	-	0.4
White Crappie	1	0.1	210	110	-	-	0.1
Yellow Perch	200	20	126	21	99 - 178	10 - 60	25.4
Crappie YOY	627	62.7	55	-	44 - 76	-	79.8
Largemouth Bass YOY	49	4.9	72	-	45 - 94	-	6.2
Pumpkinseed YOY	11	1.1	79	-	63 - 98	-	1.4
Smallmouth Bass YOY	111	11.1	67	-	42 - 100	-	14.1
Yellow Perch YOY	1729	172.9	62	-	49 - 82	-	220.0

Table 13. Results of 10 overnight mini-fyke net sets at Tongue River Reservoir, August 2014.

Species	Number Caught	Number per Seine Haul	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percent of Catch (%)
Black Bullhead	3	0.3	217	183	183 - 277	80 - 380	0.1
Black Crappie	24	2.4	196	155	105 - 239	40 - 240	0.9
Green Sunfish	2	0.2	129	50	122 - 135	40 - 60	0.1
Pumpkinseed	11	1.1	128	45	107 - 164	20 - 90	0.4
Shorthead Redhorse Sucker	1	0.1	518	1580	-	-	0.0
White Crappie	6	0.6	205	155	122 - 257	30 -220	0.2
Yellow Perch	10	1	128	33	98 - 197	20 - 40	0.4
Crappie YOY	2024	202.4	52	-	34 - 66	-	77.6
Common Carp YOY	1	0.1	103	-	-	-	0.0
Green Sunfish YOY	4	0.4	90	-	83 - 100	-	0.2
Largemouth Bass YOY	17	1.7	72	-	56 - 110	-	0.7
Pumpkinseed YOY	75	7.5	72	-	20 - 100	-	2.9
Smallmouth Bass YOY	45	4.5	58	-	40 - 97	-	1.7
Yellow Bullhead YOY	1	0.1	40	-	-	-	0.0
Yellow Perch YOY	383	38.3	61	-	50 - 70	-	14.7

Table 14. Results of 10 overnight trap net sets at Tongue River Reservoir in May and August 2014.

May

Species	Number Caught	Average per Net	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Bullhead	46	4.6	284	342	210 - 330	100 - 500	12.1
Black Crappie	232	23.2	220	180	180 - 344	80 - 520	61.2
Channel Catfish	2	0.2	407	670	335 - 478	290 - 1050	0.5
Common Carp	1	0.1	-	-	-	-	0.3
Largemouth Bass	2	0.2	347	915	283 - 410	390 - 1440	0.5
Northern Pike	16	1.6	698	2346	490 - 880	800 - 5500	4.2
Pumpkinseed	10	1.0	145	62	106 - 161	10 - 100	2.6
Rock Bass	1	0.1	165	80	-	-	0.3
Shorthead Redhorse Sucker	1	0.1	246	180	-	-	0.3
Smallmouth Bass	5	0.5	364	846	245 - 423	180 - 1400	1.3
Walleye	16	1.6	478	1193	360 - 724	440 -3580	4.2
White Crappie	27	2.7	251	213	210 - 330	120 - 490	7.1
Yellow Bullhead	16	1.6	254	241	195 - 328	100 - 440	4.2
Yellow Perch	4	0.4	185	90	180 - 194	60 - 100	1.1

August

Species	Number Caught	Average per Net	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Bullhead	2	0.2	271	290	250 - 292	210 - 370	0.5
Black Crappie	266	26.6	222	180	185 - 360	100 - 680	70.9
Common Carp	1	0.1	645	3210	-	-	0.3
Northern Pike	1	0.1	930	4800	-	-	0.3
Pumpkinseed	1	0.1	113	30	-	-	0.3
Shorthead Redhorse Sucker	6	0.6	493	1268	460 - 527	1040 - 1550	1.6
Walleye	3	0.3	423	1105	140 - 630	25 - 2260	0.8
White Crappie	26	2.6	237	185	172 -264	60 - 230	6.9
Yellow Bullhead	1	0.1	290	350	180 - 266	80 - 280	0.3
Yellow Perch	23	2.3	117	20	106 - 133	30-Oct	6.1
Crappie YOY	43	4.3	57	-	50 - 70	-	11.5
Largemouth Bass YOY	2	0.2	83	-	65 - 100	-	0.5

Table 15. Results of 10 overnight trap net sets at Tongue River Reservoir, August 2015.

Species	Number Caught	Average per Net	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Crappie	306	30.6	249	267	125 - 388	20 - 850	45.5
Northern Pike	3	0.3	867	3857	821 - 940	3420 - 4400	0.4
Pumpkinseed	13	1.3	120	35	111 - 147	30 - 70	1.9
Smallmouth Bass	8	0.8	210	186	120 - 316	20 - 460	1.2
Shorthead Redhorse Sucker	6	0.6	481	1120	378 - 520	520 - 1500	0.9
Spottail Shiner	1	0.1	-	-	-	-	0.1
Walleye	6	0.6	407	650	285 - 492	210 - 1020	0.9
White Crappie	22	2.2	264	250	238 - 288	220 - 330	3.3
White Sucker	1	0.1	470	1500	-	-	0.1
Yellow Perch	2	0.2	158	60	132 - 184	30 - 90	0.3
Common Carp YOY	2	0.2	80	-	78 - 82	-	0.3
Crappie YOY	262	26.2	65	-	52 - 75	-	38.9
Largemouth Bass YOY	27	2.7	76	-	62 - 98	-	4.0
Pumpkinseed YOY	1	0.1	96	-	-	-	0.1
Smallmouth Bass YOY	13	1.3	65	-	57 - 72	-	1.9

Table 16. Results of 10 overnight trap net sets at Tongue River Reservoir, August 2016.

Species	Number Caught	Average per Net	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Crappie	587	58.7	227	217	102 - 320	10 - 580	77.2
Channel Catfish	1	0.1	540	1620	-	-	0.1
Common Carp	1	0.1	582	2940	-	-	0.1
Largemouth Bass	1	0.1	160	60	-	-	0.1
Northern Pike	3	0.3	405	560	185 - 520	40 - 840	0.4
Pumpkinseed	14	1.4	148	70	121 - 173	10 - 120	1.8
Rock Bass	2	0.2	204	205	200 - 207	200 - 210	0.3
Shorthead Redhorse Sucker	8	0.8	490	1235	465 - 505	1100 - 1400	1.1
Smallmouth Bass	21	2.1	212	168	128 - 346	40 - 700	2.8
Walleye	11	1.1	434	947	265 - 655	150 - 3100	1.4
White Crappie	52	5.2	198	129	120 - 310	20 - 280	6.8
Yellow Bullhead	1	0.1	324	320	-	-	0.1
Yellow Perch	21	2.1	126	25	115 - 143	20 - 40	2.8
Crappie YOY	2	0.2	64	-	60 - 67	-	0.3
Largemouth Bass YOY	25	2.5	74	-	60 - 88	-	3.3
Pumpkinseed YOY	3	0.3	99	-	92 - 103	-	0.4
Smallmouth Bass YOY	7	0.7	78	-	65 - 97	-	0.9

Table 17. Results of 10 overnight trap net sets at Tongue River Reservoir, August 2017.

Species	Number Caught	Average per Net	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)	Percentage of Catch (%)
Black Crappie	444	44.4	215	174	146 - 323	40 - 510	56.2
Common Carp	4	0.4	562	2483	550 - 571	2210 - 2710	0.5
Green Sunfish	1	0.1	146	70	-	-	0.1
Northern Pike	1	0.1	955	4160	-	-	0.1
Pumpkinseed	11	1.1	135	54	122 - 150	40 - 70	1.4
Shorthead Redhorse Sucker	7	0.7	482	1151	455 - 522	920 - 1510	0.9
Smallmouth Bass	11	1.1	231	227	153 - 380	40 - 770	1.4
Walleye	12	1.2	518	1340	372 - 639	460 - 2550	1.5
White Crappie	161	16.1	210	117	171 - 305	60 - 300	20.4
Yellow Perch	3	0.3	132	20	107 - 156	10 - 20	0.4
Crappie YOY	126	12.6	61	-	45 - 78	-	15.9
Largemouth Bass YOY	2	0.2	56	-	55 - 56	-	0.3
Pumpkinseed YOY	2	0.2	87	-	77 - 97	-	0.3
Smallmouth Bass YOY	4	0.4	71	-	61 - 80	-	0.5
Yellow Perch YOY	1	0.1	77	-	-	-	0.1

Table 18. Tongue River Reservoir Wild Fish (Crappie) Transfers completed during period 2014-2017.

Transfer location	Date	Number	Status	Mean Length (mm)	Mean Weight (gm)	Length Range (mm)	Weight Range (gm)
Rattlesnake	6/4/2014	215	Complete	217	155	180 - 370	100 - 820
Rieger Pond	10/16/2014	100	Complete	250	265	164 - 385	60 - 840
Kreider #3	6/5/2015	126	Complete	250	266	150 - 388	20 - 850
Chamberlain #2	6/5/2015	249	Complete	250	266	150 - 388	20 - 850
Chamberlain #2	4/18/2017	22	Complete	246	279	155 - 413	40 - 1240

Table 19. Summary of proportional size distribution (PSD), incremental PSDs, and mean relative weight (W_r) values for game fish sampled with gill nets (August), trap nets (May, June, August, and October) and electrofishing (May, August, and October) 2014.

Gill nets

		PSD					Wr				
Species	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
Black Bullhead	19	21	74	5	-	-	78	88	88	-	-
Black Crappie	21	10	81	10	-	-	98	100	98	-	-
Channel Catfish	11	64	-	-	36	-	86	-	-	103	-
Northern Pike	18	6	33	56	6	-	93	91	89	63	-
Pumpkinseed	2	-	100	-	-	-	-	142	-	-	-
Smallmouth Bass	31	74	19	6	-	-	111	102	93	-	-
Walleye	66	80	15	2	3	-	87	84	82	87	-
White Crappie	41	7	73	17	2	-	74	94	85	79	-
Yellow Bullhead	51	12	88	NA	NA	NA	88	95	NA	NA	NA
Yellow Perch	36	22	78	-	-	-	96	89	-	-	-

Trap nets

		PSD					Wr				
Species	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
Black Bullhead	78	8	63	28	1	-	84	87	84	38	-
Black Crappie	672	8	86	5	<1	<1	109	105	102	79	78
Channel Catfish	2	50	50	-	-	-	88	99	-	-	-
Largemouth Bass	2	50	-	50	-	-	124	-	136	-	-
Northern Pike	20	10	45	25	20	-	95	96	92	100	-
Pumpkinseed	46	93	7	-	-	-	84	109	-	-	-
Smallmouth Bass	32	47	31	19	3	-	97	108	107	97	-
Walleye	35	9	37	34	20	-	96	95	93	89	-
White Crappie	145	4	70	21	5	-	98	99	97	91	-
Yellow Bullhead	20	25	75	NA	NA	NA	97	87	NA	NA	NA
Yellow Perch	10	100	-	-	-	-	91	-	-	-	-

Electrofishing

		PSD					Wr				
Species	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
Black Bullhead	4	25	75	-	-	-	95	80	-	-	-
Black Crappie	95	5	86	6	2	-	112	104	101	85	-
Largemouth Bass	10	10	80	10	-	-	86	134	111	-	-
Northern Pike	11	27	36	18	18	-	88	90	92	91	-
Pumpkinseed	5	80	20	-	-	-	87	123	-	-	-
Sauger	1	100	-	-	-	-	105	-	-	-	-
Smallmouth Bass	236	78	17	4	1	-	98	101	98	91	-
Walleye	20	30	55	10	5	-	92	97	95	89	-
White Crappie	22	9	18	73	-	-	128	99	96	-	-
Yellow Perch	15	93	7	-	-	-	68	80	-	-	-

Table 20. Summary of proportional size distribution (PSD), incremental PSDs, and mean relative weight (W_r) values for game fish sampled with gill nets, trap nets and electrofishing during August 2015.

Gill nets

		PSD					Wr				
Species	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
Black Bullhead	16	6	63	31	-	-	101	87	93	-	-
Black Crappie	50	16	36	48	-	-	99	109	106	-	-
Channel Catfish	2	100	-	-	-	-	83	-	-	-	-
Largemouth Bass	2	-	50	50	-	-	-	112	94	-	-
Northern Pike	12	17	25	25	33	-	84	86	89	90	-
Pumpkinseed	1	-	100	-	-	-	-	98	-	-	-
Smallmouth Bass	18	50	39	11	-	-	107	95	101	-	-
Walleye	60	60	32	8	-	-	93	92	89	-	-
White Crappie	26	38	8	50	4	-	94	110	98	105	-
Yellow Bullhead	40	10	90	NA	NA	NA	115	97	NA	NA	NA
Yellow Perch	65	54	45	2	-	-	90	95	94	-	-

Trap nets

		PSD					Wr				
Species	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
Black Crappie	304	2	47	50	1	<1	127	107	105	70	77
Northern Pike	3	-	-	67	33	-	-	-	90	75	-
Pumpkinseed	14	100	-	-	-	-	104	-	-	-	-
Smallmouth Bass	5	60	40	-	-	-	117	106	-	-	-
Walleye	6	33	67	-	-	-	96	80	-	-	-
White Crappie	22	-	14	86	-	-	-	114	91	-	-
Yellow Perch	2	100	-	-	-	-	105	-	-	-	-

Electrofishing

		PSD					Wr				
Species	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
Black Crappie	10	10	70	20	-	-	127	116	107	-	-
Largemouth Bass	3	33	67	-	-	-	129	116	-	-	-
Northern Pike	2	-	50	50	-	-	-	108	86	-	-
Pumpkinseed	2	50	50	-	-	-	143	109	-	-	-
Smallmouth Bass	49	65	29	2	2	-	115	108	99	85	-
Walleye	25	84	12	4	-	-	98	92	84	-	-
White Crappie	2	-	-	100	-	-	-	-	110	-	-
Yellow Perch	12	100	-	-	-	-	102	-	-	-	-

Table 21. Summary of proportional size distribution (PSD), incremental PSDs, and mean relative weight (W_r) values for game fish sampled with gill nets, trap nets and electrofishing during August 2016.

Gill nets

		PSD					Wr				
Species	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
Black Bullhead	50	14	70	16	-	-	*	*	*	-	-
Black Crappie	70	83	6	10	1	-	*	*	*	*	-
Channel Catfish	4	50	50	-	-	-	71	97	-	-	-
Largemouth Bass	3	67	33	-	-	-	125	126	-	-	-
Northern Pike	15	20	47	20	13	-	89	98	91	94	
Pumpkinseed	8	50	38	-	13	-	*	*	-	*	-
Smallmouth Bass	18	44	28	28	-	-	100	101	114	-	-
Walleye	98	19	60	17	3	-	80	84	89	75	-
White Crappie	127	80	5	12	3	-	*	*	*	*	-
Yellow Bullhead	15	13	87	NA	NA	NA	*	*	NA	NA	NA
Yellow Perch	70	61	37	1	-	-	*	*	*	-	-

* smaller bodied fish weighed with scale that upon later inspection was out of calibration, data subsequently not used for analysis

Trap nets

		PSD					Wr				
Species	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
Black Crappie	549	24	14	62	1	-	103	103	97	100	-
Channel Catfish	1	-	100	-	-	-	-	102	-	-	-
Northern Pike	2	100	-	-	-	-	90	-	-	-	-
Pumpkinseed	17	59	41	-	-	-	85	106	-	-	-
Smallmouth Bass	14	79	21	-	-	-	92	104	-	-	-
Walleye	11	36	45	9	9	-	90	86	87	97	-
White Crappie	51	57	18	20	6	-	100	102	91	76	-
Yellow Bullhead	1	100	-	NA	NA	NA	58	-	NA	NA	NA
Yellow Perch	6	100	-	-	-	-	100	-	-	-	-

Electrofishing

		PSD					Wr				
Species	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
Black Crappie	55	15	15	70	-	-	215	114	108	-	-
Largemouth Bass	1	100	-	-	-	-	148	-	-	-	-
Northern Pike	4	75	-	-	25	-	107	-	-	83	-
Pumpkinseed	1	100	-	-	-	-	225	-	-	-	-
Smallmouth Bass	26	31	31	38	-	-	112	115	112	-	-
Walleye	30	50	27	10	13	-	120	97	92	92	-
White Crappie	17	41	6	47	6	-	165	111	112	106	-
Yellow Perch	29	97	3	-	-	-	154	97	-	-	-

Table 22. Summary of proportional size distribution (PSD), incremental PSDs, and mean relative weight (W_r) values for game fish sampled with gill nets, trap nets and electrofishing during August 2017.

Gill nets

		PSD					Wr				
Species	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
Black Bullhead	5	-	60	40	-	-	-	71	80	-	-
Black Crappie	25	80	8	12	-	-	99	95	95	-	-
Channel Catfish	6	100	-	-	-	-	93	-	-	-	-
Northern Pike	22	5	73	18	5	-	91	95	93	81	
Pumpkinseed	3	-	100	-	-	-	-	105	-	-	-
Smallmouth Bass	10	40	20	40	-	-	95	85	105	-	-
Walleye	57	28	47	23	2	-	88	84	84	90	-
White Crappie	139	31	62	6	1	-	90	93	84	83	-
Yellow Bullhead	57	23	77	NA	NA	NA	98	92	NA	NA	NA
Yellow Perch	39	82	18	-	-	-	69	75	-	-	-

Trap nets

		PSD					Wr				
Species	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
Black Crappie	443	57	8	35	1	-	116	97	89	84	-
Northern Pike	1	-	-	-	100	-	-	-	-	68	-
Pumpkinseed	12	92	8	-	-	-	104	96	-	-	-
Smallmouth Bass	9	78	-	22	-	-	94	-	93	-	-
Walleye	12	8	42	42	8	-	87	78	83	87	-
White Crappie	161	23	73	3	1	-	94	92	80	75	-
Yellow Perch	1	100	-	-	-	-	60	-	-	-	-

Electrofishing

		PSD					Wr				
Species	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
Black Crappie	13	77	23	-	-	-	89	89	-	-	-
Channel Catfish	1	-	-	-	100	-	-	-	-	137	-
Largemouth Bass	1	-	100	-	-	-	-	94	-	-	-
Northern Pike	1	100	-	-	-	-	92	-	-	-	-
Pumpkinseed	11	100	-	-	-	-	92	-	-	-	-
Smallmouth Bass	85	81	12	7	-	-	89	90	96	-	-
Walleye	2	100	-	-	-	-	81	-	-	-	-
White Crappie	17	24	76	-	-	-	105	108	-	-	-
Yellow Bullhead	10	60	40	NA	NA	NA	80	86	NA	NA	NA
Yellow Perch	5	100	-	-	-	-	65	-	-	-	-

Table 23. Age and size at age of White Crappie collected in August of 1983, 2013, and 2017 and August and October of 2014 at Tongue River Reservoir.

1983 (P.Stewart)

Age	Number Aged	Mean Length (mm)	Standard Error of Mean	Length Range (mm)
1+	1	127	-	-
2+	11	175	-	120 - 202
3+	42	212	-	191 - 240
4+	3	252	-	250 - 255
5+	2	263	-	261 - 295

2013

Age	Number Aged	Mean Length (mm)	Standard Error of Mean	Length Range (mm)
2+	20	213	3	182 - 232
3+	3	250	4	243 - 254
5+	2	275	3	272 - 278
6+	1	311	-	-
7+	2	299	1	298 - 300

2014

Age	Number Aged	Mean Length (mm)	Standard Error of Mean	Length Range (mm)
0+	26	71	3	40 - 96
1+	10	177	3	118 - 195
3+	47	245	3	200 - 330
4+	1	254	-	-
5+	2	303	12	291 - 314

2017

Age	Number Aged	Mean Length (mm)	Standard Error of Mean	Length Range (mm)
1+	2	127	-	-
2+	86	207	2	171 - 240
3+	3	246	4	242 - 254
5+	15	291	2	276 - 305
8+	1	285	-	-

Table 24. Age and size at age of Black Crappie collected in August of 2013, August/October of 2014, and August of 2017 at Tongue River Reservoir.

2013

Age	Number Aged	Mean Length (mm)	Standard Error of Mean	Length Range (mm)
2+	51	192	2	157 - 228
3+	8	236	3	227 - 251
4+	4	251	5	237 - 259
5+	1	263	-	-
6+	4	274	13	259 - 313
7+	1	263	-	-
8+	1	283	-	-
9+	2	297	28	269 - 324
10+	2	333	24	309 - 357

2014

Age	Number Aged	Mean Length (mm)	Standard Error of Mean	Length Range (mm)
0+	38	69	4	31 - 108
1+	7	122	6	105 - 143
3+	56	224	2	190 - 267
4+	2	265	8	257 - 272
5+	5	259	5	244 - 270
6+	6	272	5	256 - 284
7+	1	300	-	-
10+	4	321	22	281 - 362

2017

Age	Number Aged	Mean Length (mm)	Standard Error of Mean	Length Range (mm)
0+	7	66	3	52 - 74
2+	80	179	2	136 - 225
3+	16	235	6	209 - 303
4+	1	310	-	-
5+	40	269	2	237 - 316
6+	5	291	10	263 - 323
9+	1	302	-	-

Table 25. Stocking history for Tongue River Reservoir 1939-2017.

Species	Initial Year of Stocking	Size (in)	Stocking Years
Rainbow Trout	1939	2-8	1939, 1958-1960, 1965
Brown Trout	1940	2	1940
Walleye	1950	0.2-0.3	1950-1951, 1965-1968, 1980, 1984, 1986-2017
	1969	1-2	1969, 1985-1986, 1990-2017
Northern Pike	1951	0.3-0.5	1951, 1969, 1970-1971, 1978, 1986, 1991-1993
	1963	1-4	1963-1966, 1969, 1972-1977, 1986, 1990
Channel Catfish	1963*	2-3	1963-1964,
Largemouth Bass	1964	1-2	1964, 1972-1973
Spottail Shiner	1990	4	1990**
White Crappie	1990*	1	1990
Sauger	2003*	0.1-0.2	2003-2004
		1-2	2003-2004

*Species present prior to stocking effort

**Wild Fish Transfer from Ft. Peck Reservoir

Table 26. Age and size at age of Walleye collected in August and October of 2014 at Tongue River Reservoir.

2014				
Age	Number Aged	Mean Length (mm)	Standard Error of Mean	Length Range (mm)
0+	31	196	5	137 - 245
1+	2	304	16	288 - 320
2+	11	340	19	264 - 490
3+	60	377	6	320 - 456
4+	12	449	41	340 - 524
5+	6	588	16	550 - 635
6+	4	573	39	469 - 645
7+	4	604	44	515 - 650
8+	2	641	39	602 - 680
9+	1	660	-	-
11+	1	640	-	-
12+	1	781	-	-
16+	1	745	-	-

Table 27. Summary of proportional size distribution (PSD), incremental PSDs, mean relative weight (W_r) values, mean length (inches), max length (inches), and max weight (pounds) for Walleye sampled with gill nets during August 2005-2017.

		PSD					Wr					Size		
Year	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T	Mean Length (in)	Max Length (in)	Max Weight (lb)
2005	15	73	7	13	7	-	85	78	85	84	-	14.4	26.0	6.1
2006	30	53	43	-	3	-	86	96	-	96	-	14.6	27.4	8.2
2007	23	87	9	-	4	-	84	95	-	90	-	12.1	25.4	6.0
2008	27	77	23	-	-	-	83	90	-	-	-	13.4	19.3	2.6
2009	18	67	28	6	-	-	80	84	82	-	-	14.3	21.3	3.1
2010	11	64	36	-	-	-	89	83	-	-	-	12.2	20.0	2.8
2011	51	73	22	6	-	-	88	86	89	-	-	14.4	22.0	3.7
2012	59	42	54	2	2	-	84	86	99	88	-	14.8	26.2	6.5
2013	77	75	9	13	3	-	88	80	82	86	-	14.6	29.4	9.7
2014	66	80	15	2	3	-	87	84	82	87	-	14.3	26.8	6.9
2015	60	60	32	8	-	-	93	92	89	-	-	10.4	24.3	5.0
2016	98	19	60	17	3	-	80	84	89	75	-	17.0	26.7	6.4
2017	57	28	47	23	2	-	88	84	84	90	-	17.9	25.9	6.4

Table 28. Age and size at age of Northern Pike collected in August and October of 2014 at Tongue River Reservoir.

	2014			
Age	Number Aged	Mean Length (mm)	Standard Error of Mean	Length Range (mm)
4+	7	576	31	484 - 695
5+	7	759	34	605 - 853
6+	12	701	30	530 - 856
7+	2	989	92	897 - 1080
8+	2	894	37	857 - 930

Table 29. Age and size at age of Smallmouth Bass collected in August and October of 2014 at Tongue River Reservoir.

	2014			
Age	Number Aged	Mean Length (mm)	Standard Error of Mean	Length Range (mm)
0+	20	123	11	67 - 188
1+	58	214	5	150 - 287
2+	73	279	4	207 - 388
3+	22	302	11	225 - 436
4+	5	424	8	401 - 450
5+	1	420	-	-
6+	2	397	17	380 -413

Table 30. Sauger gill-net catch rates from 1980-2015.

Year	Count	CPUE (fish/gill net)
1980	9	0.5
1981	8	0.5
1982	5	0.3
1983	0	0.0
1984	0	0.0
1985	8	0.7
1986	3	0.3
1987	2	0.2
1988	8	0.8
1989	2	0.2
1990	0	0.0
1991	0	0.0
1992	0	0.0
1993	0	0.0
1994	0	0.0
1995	0	0.0
1996	0	0.0
1997	2	0.2
1998	3	0.3
1999	0	0.0
2000	0	0.0
2001	2	0.2
2002	0	0.0
2003	0	0.0
2004	0	0.0
2005	1	0.1
2006	0	0.0
2007	1	0.1
2008	0	0.0
2009	1	0.1
2010	0	0.0
2011	0	0.0
2012	1	0.1
2013	0	0.0
2014	0	0.0
2015	0	0.0

Table 31. Summary of water quality measurements including water temperature (°C), clarity measured with Secchi tube (cm), specific conductivity (µS/cm at 25º C), salinity (ppt), dissolved oxygen (mg/L) taken during sampling effort 2014, 2015, and 2016.

Date	Water Temperature (°C)	Clarity (Secchi Tube cm)	Conductivity (µS/cm at 25º C)	Salinity (ppt)	Dissloved Oxygen (mg/L)	Sample Size N
6/3/2014	17.8 - 19.4	65 - 110	282 - 321	0.1 - 0.2	5.9 - 6.5	5
8/12/2014	24.3 - 25.3	90 - 229	347 - 464	0.2	NA	10
10/14/2014	10.1 - 13.3	15 - 125	502 - 637	0.2 - 0.3	6.5 - 8.9	10
8/10/2015	22.7 - 26.1	25 - 120	NA	NA	NA	10
4/20/2016	10.6 - 11.7	42 - 46	612 - 688	0.3	7.2 - 10.4	5

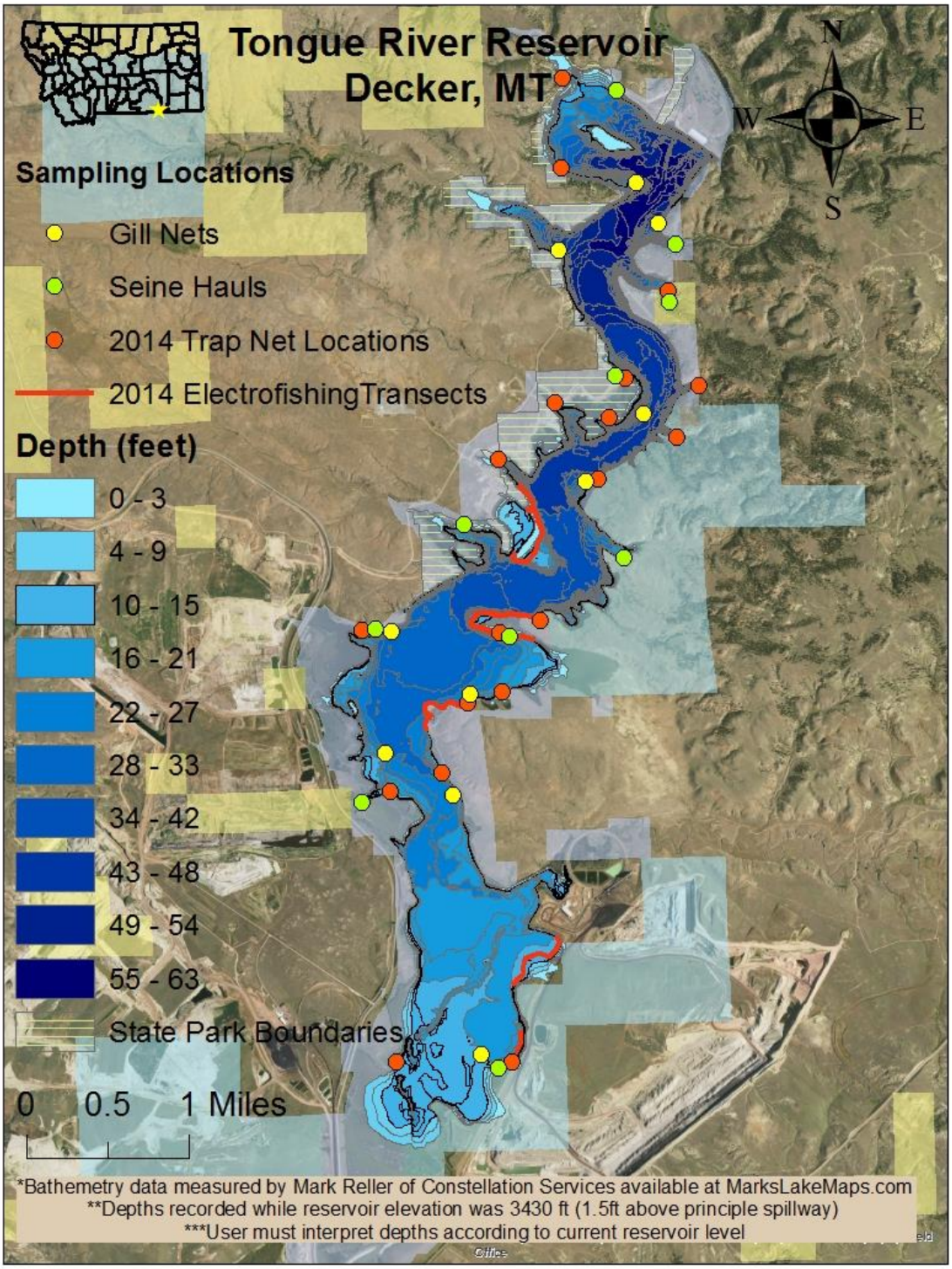

Figure 1. Map of Tongue River Reservoir, Decker, MT with sample locations from June and August 2014.

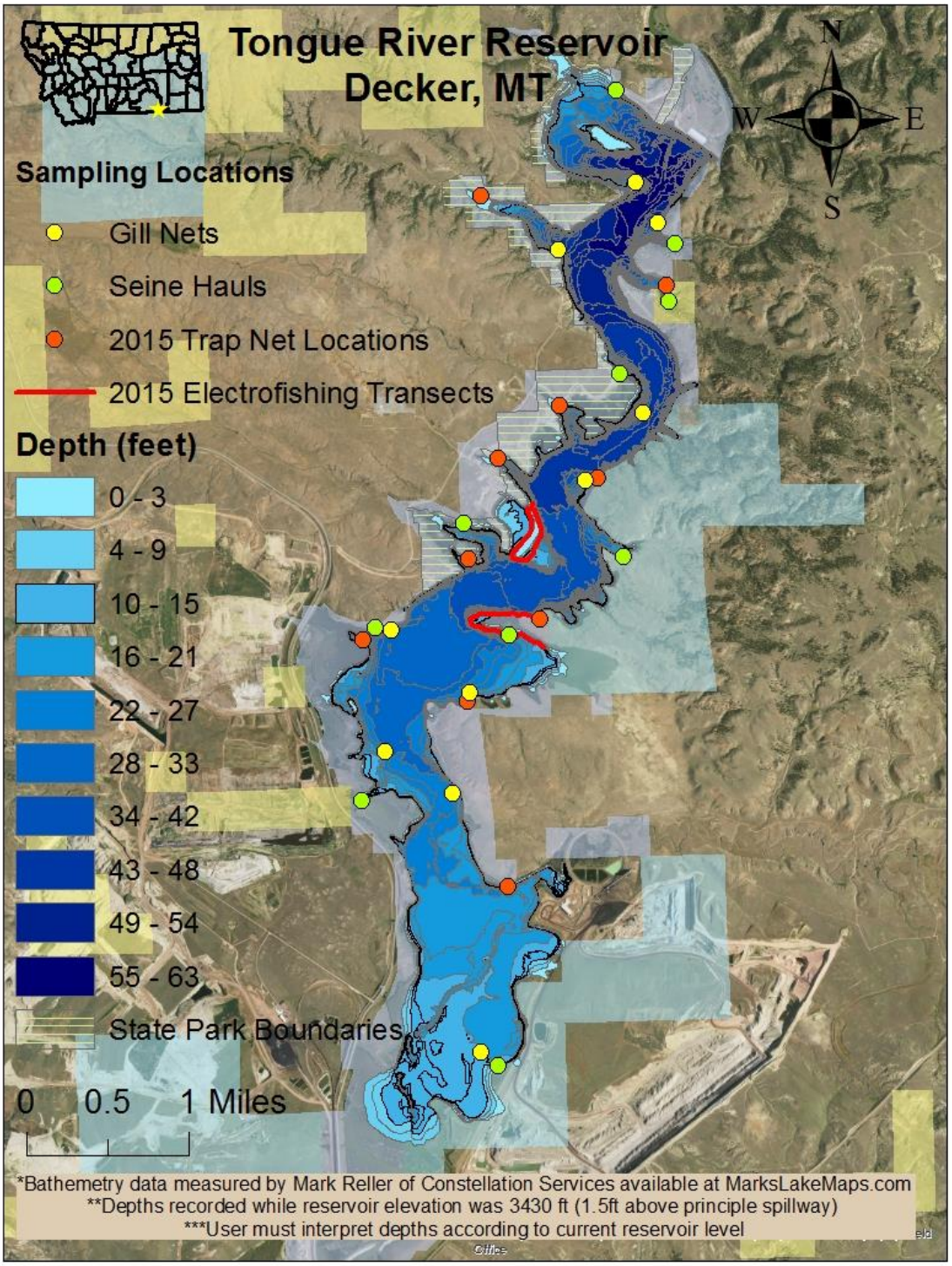

Figure 2. Map of Tongue River Reservoir, Decker, MT with sample locations from August 2015.

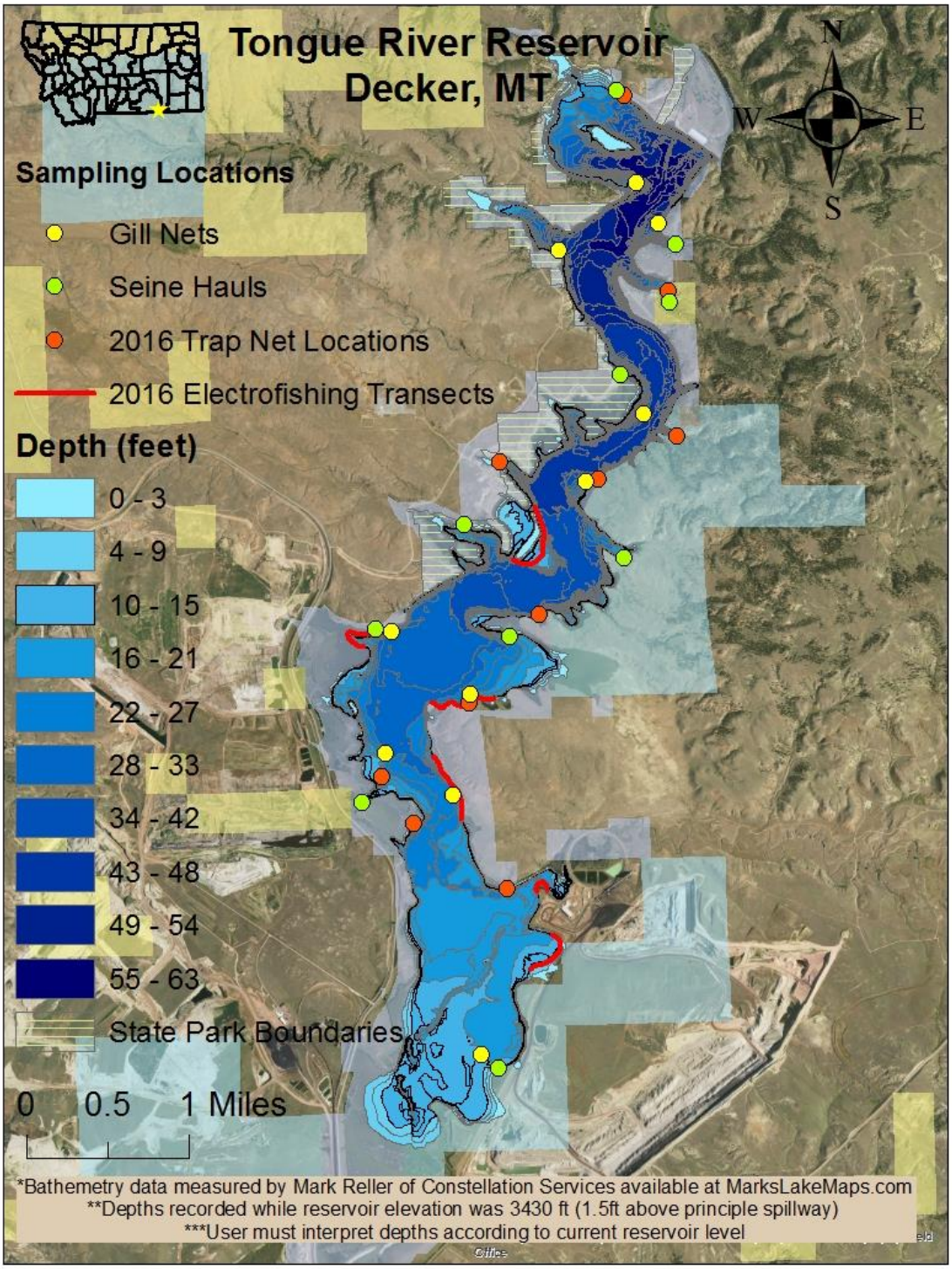

Figure 3. Map of Tongue River Reservoir, Decker, MT with sample locations from April and August 2016.

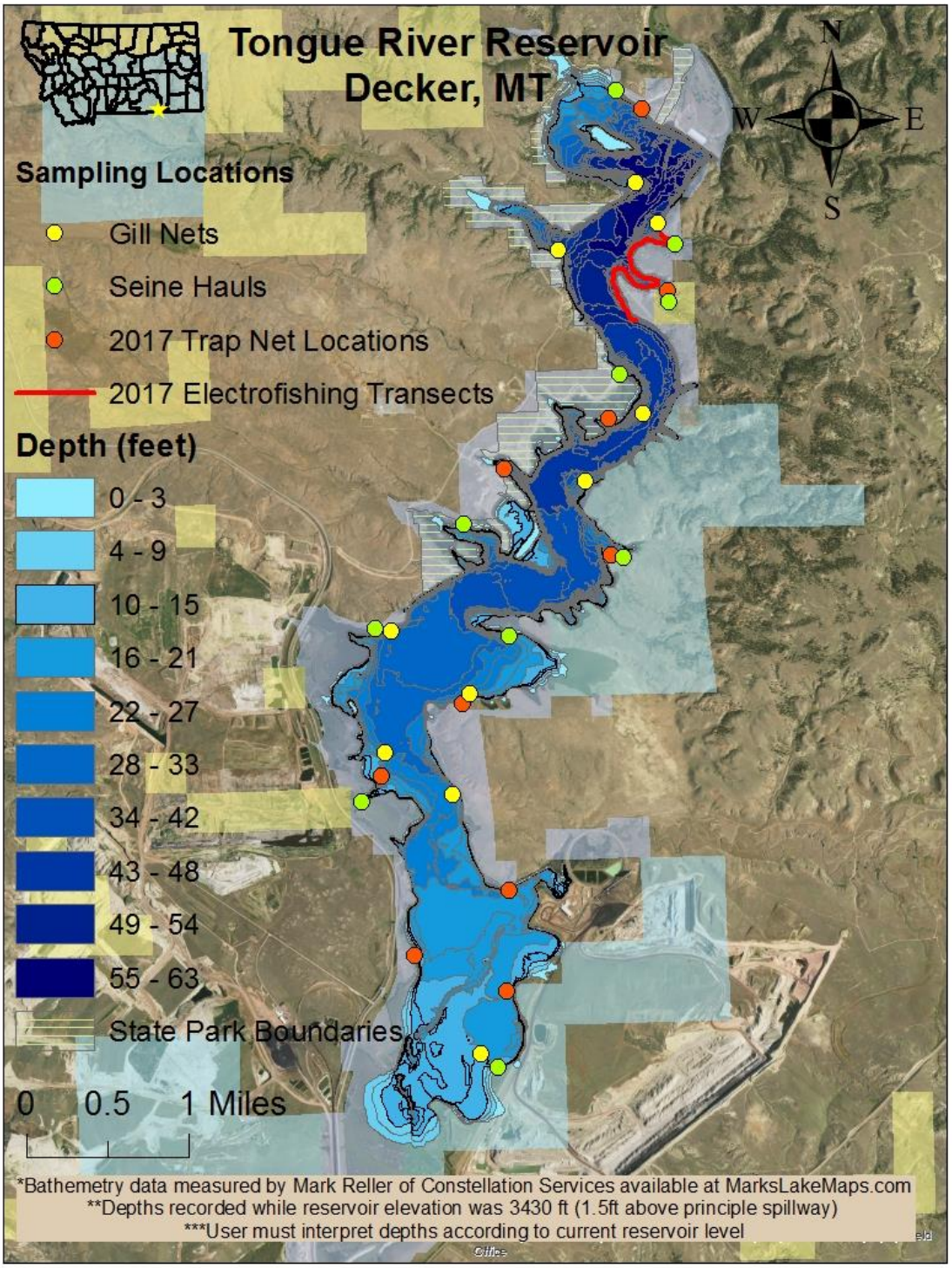

Figure 4. Map of Tongue River Reservoir, Decker, MT with sample locations from April and August 2017.

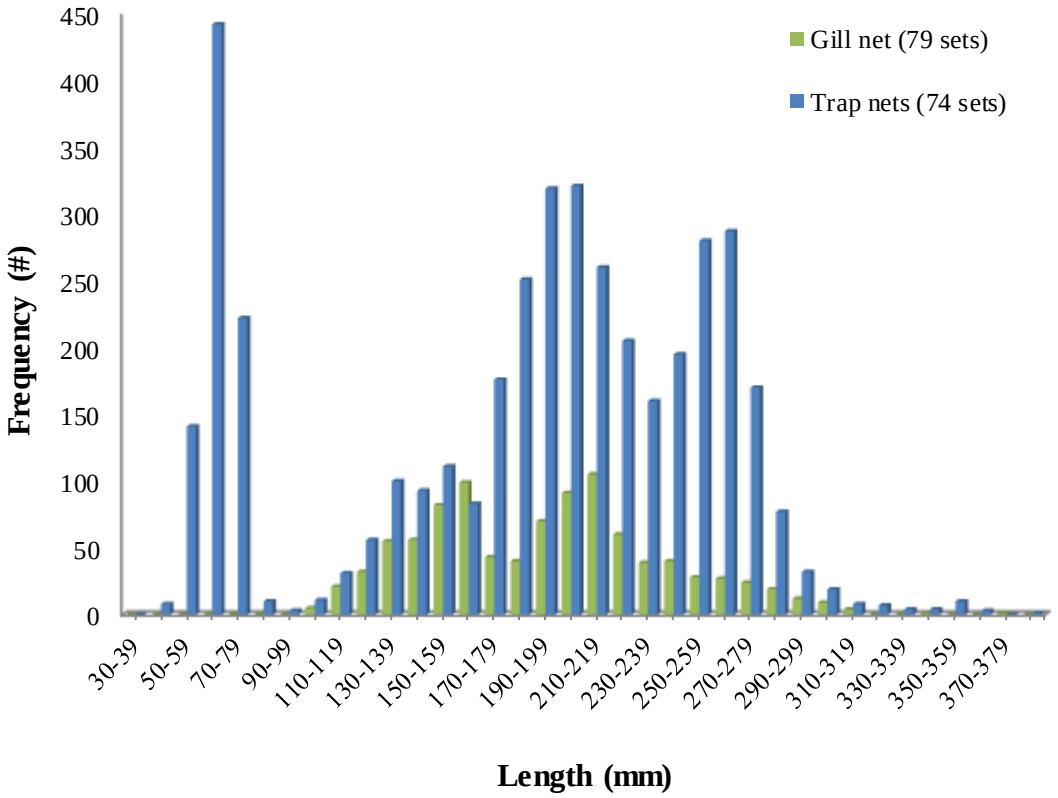

Figure 5. Length frequency distribution of crappie caught in gill nets and trap nets in the month of August 2010-2017.

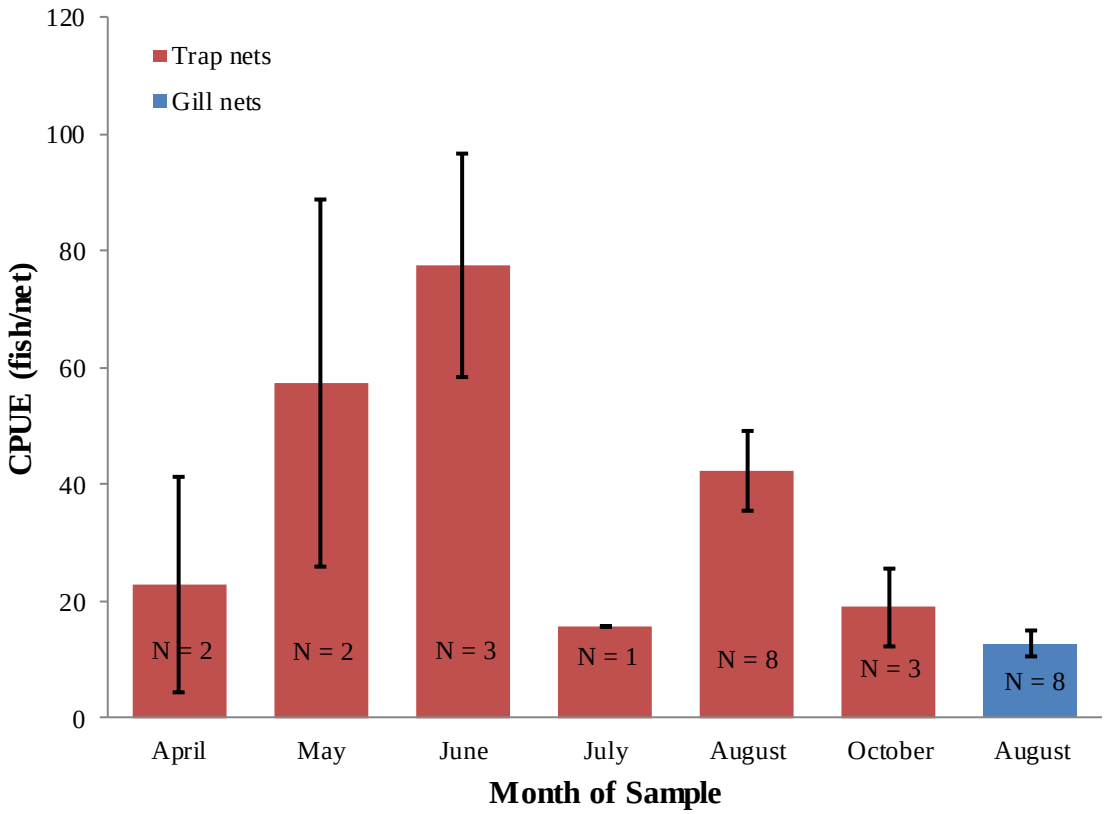

Figure 6. Relative abundance of crappie (Y-axis) captured in trap nets (red bars) and gill nets (blue bar) with standard error and sample size (N) as a function of month of sample (X-axis) in Tongue River Reservoir 2010-2017.

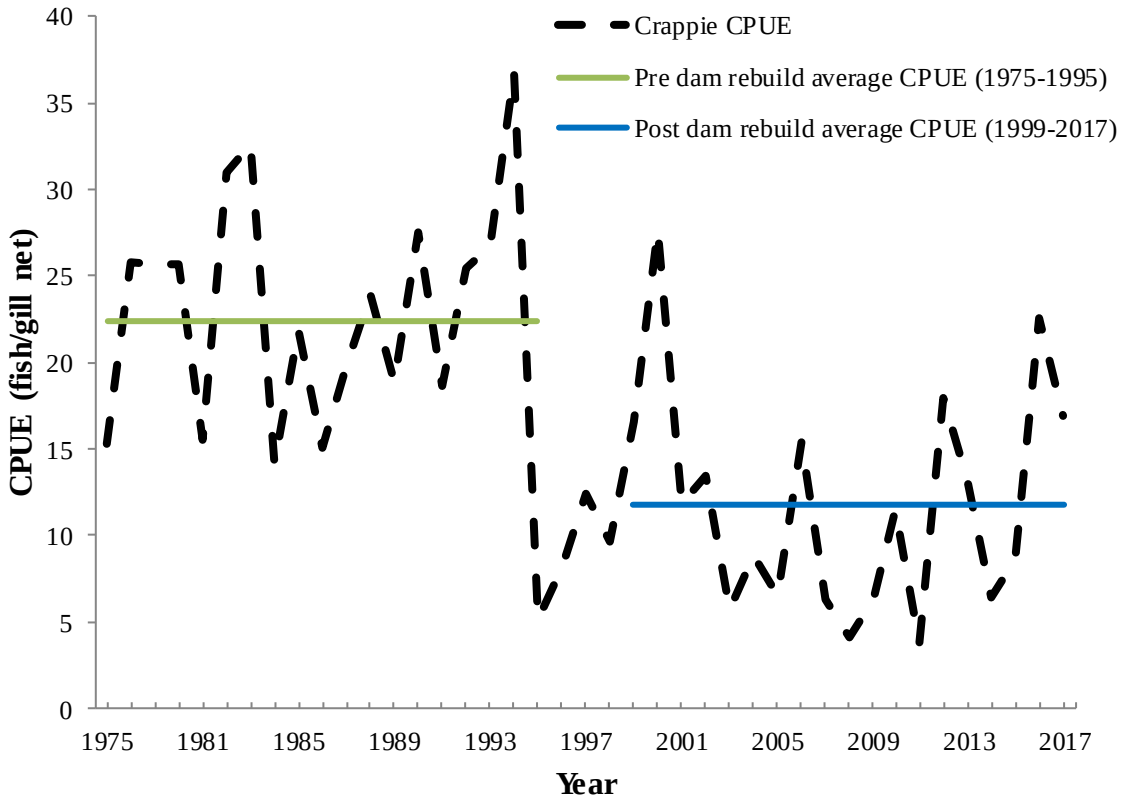

Figure 7. Relative abundance measured in CPUE (fish/gill net) of crappie (dashed black line) on the Y-axis as a function of year on the X-axis from Tongue River Reservoir gill nets, 1975-2017 with indicator lines for average CPUE pre (1975-1995) and post (1999-2017) dam reconstruction.

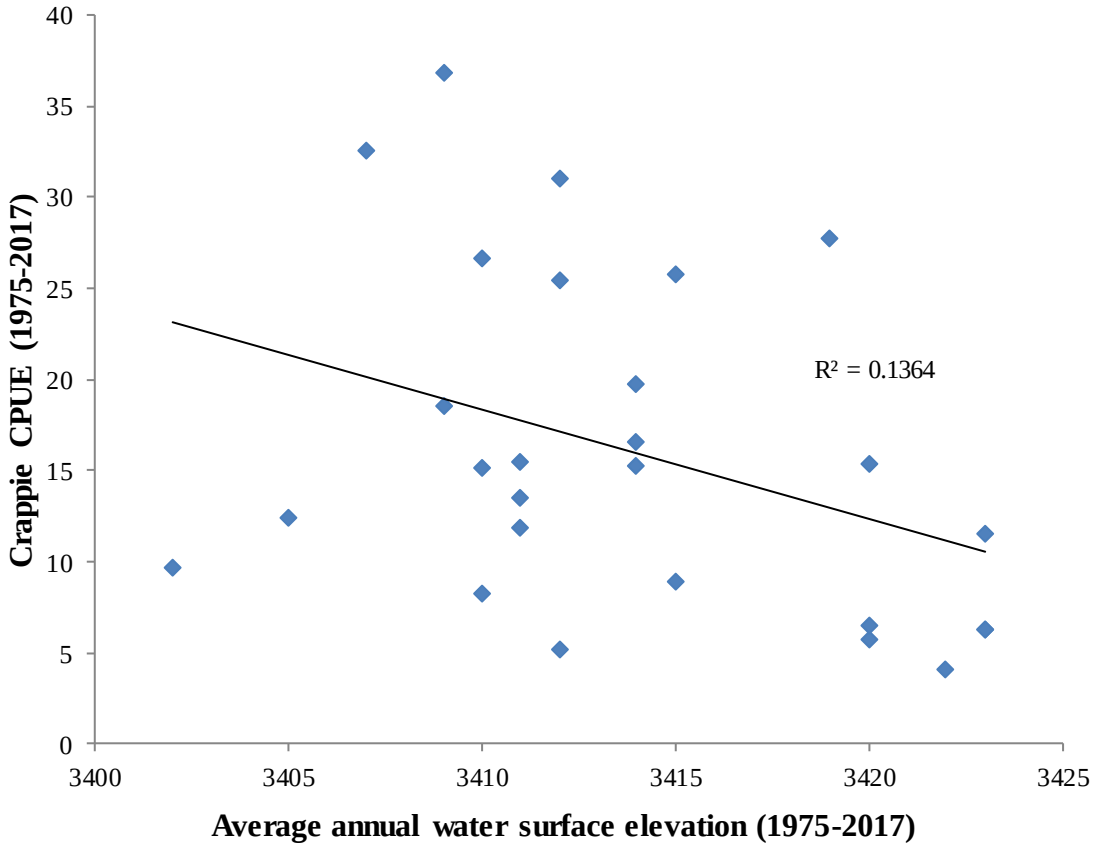

Figure 8. Relative abundance measured in CPUE (fish/net) of crappie from gill-net samples as a function of Tongue River Reservoir average annual water surface elevation 1975-2017.

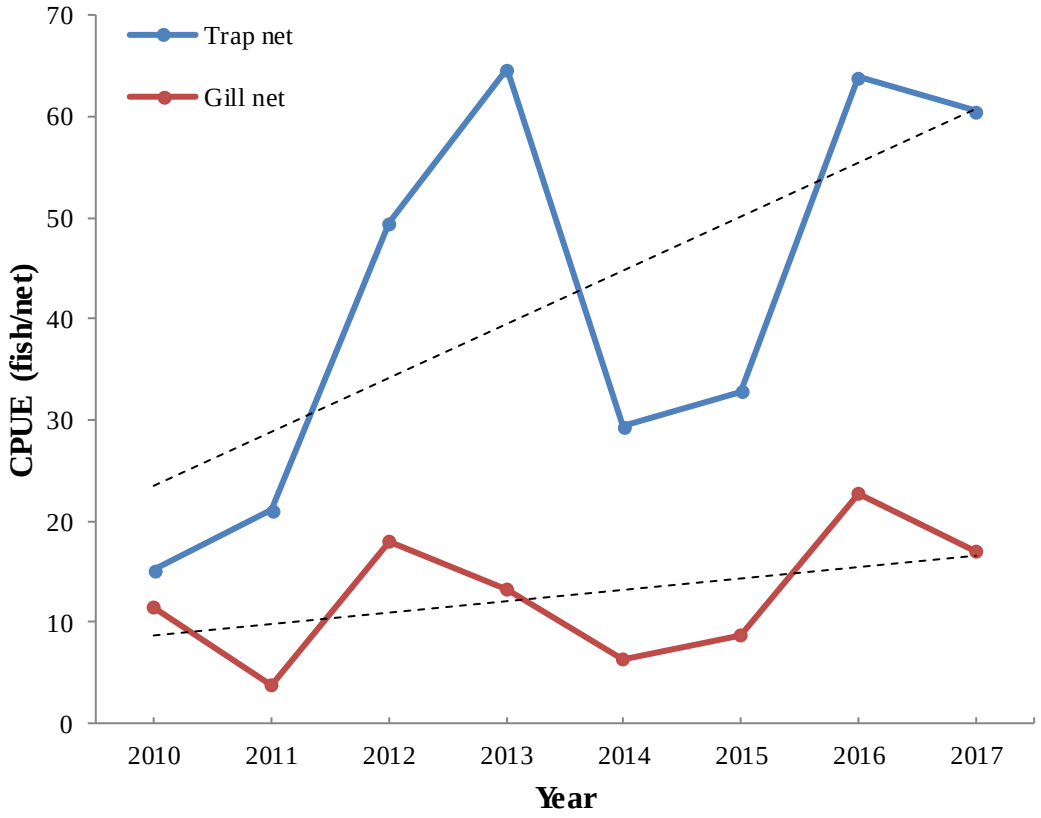

Figure 9. Relative abundance measured in CPUE (fish/net) of crappie from Tongue River Reservoir August gill-net (red) and trap net (blue) samples, with linear trend lines (dashed) 2010-2017.

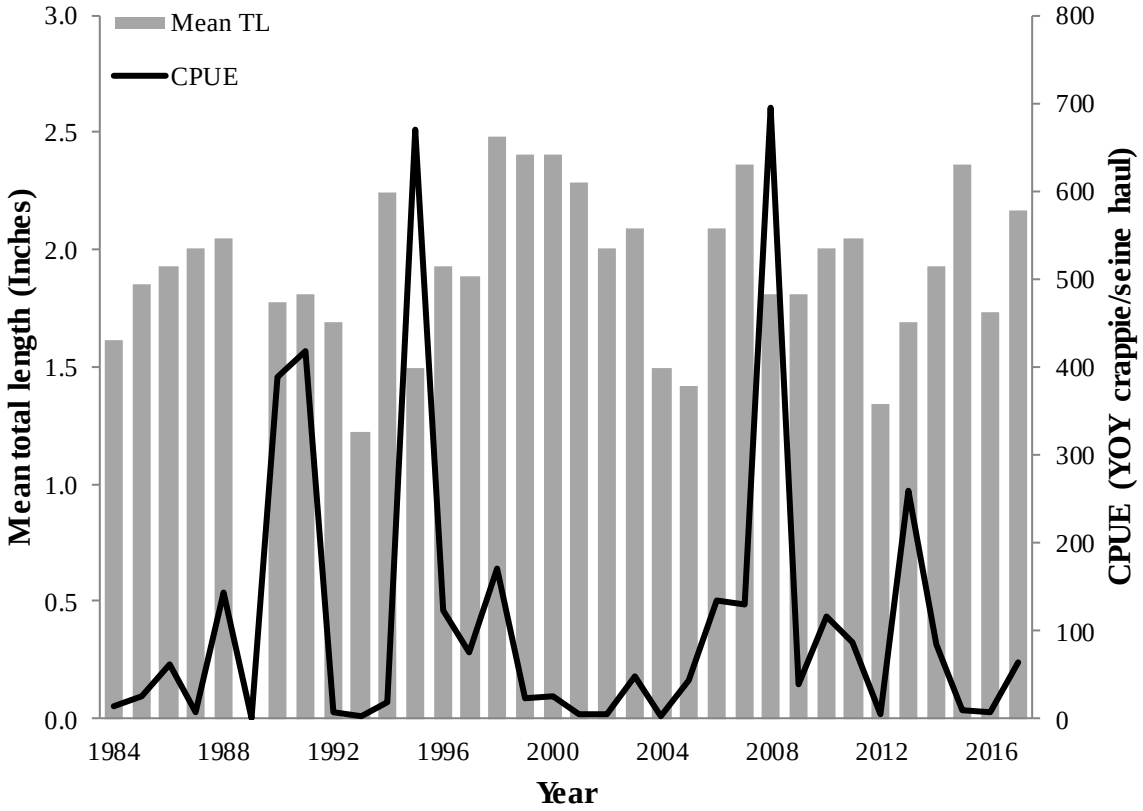

Figure 10. Mean total length (mm) of young-of-the-year (YOY) crappie (primary Y-axis) and relative abundance of YOY crappie measured in CPUE (crappie per seine haul) (secondary Y-axis) as a function of year (X-axis) from Tongue River Reservoir 1984-2017.

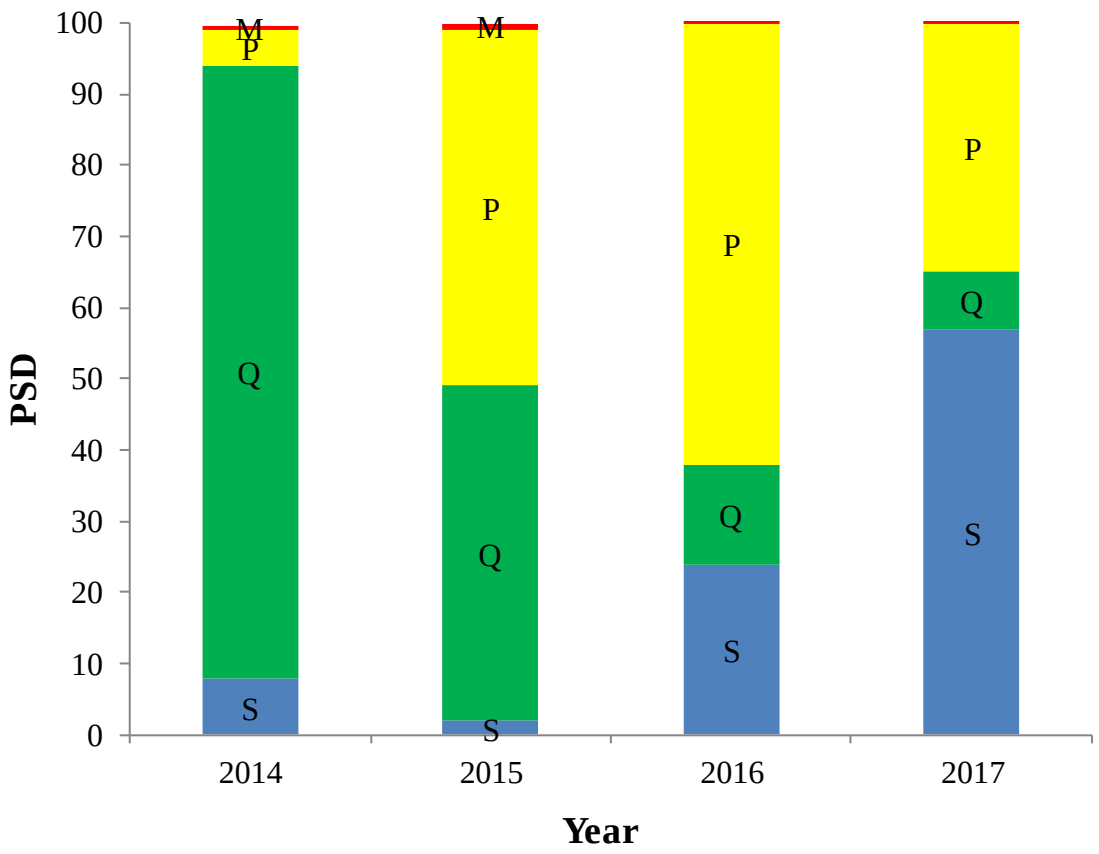

Figure 11. Black Crappie proportion size distribution (PSD) by year 2014-2017. S=Stock 5-8”, Q=Quality 8-10”, P=Preferred 10-12”, and M=Memorable 12-15”.

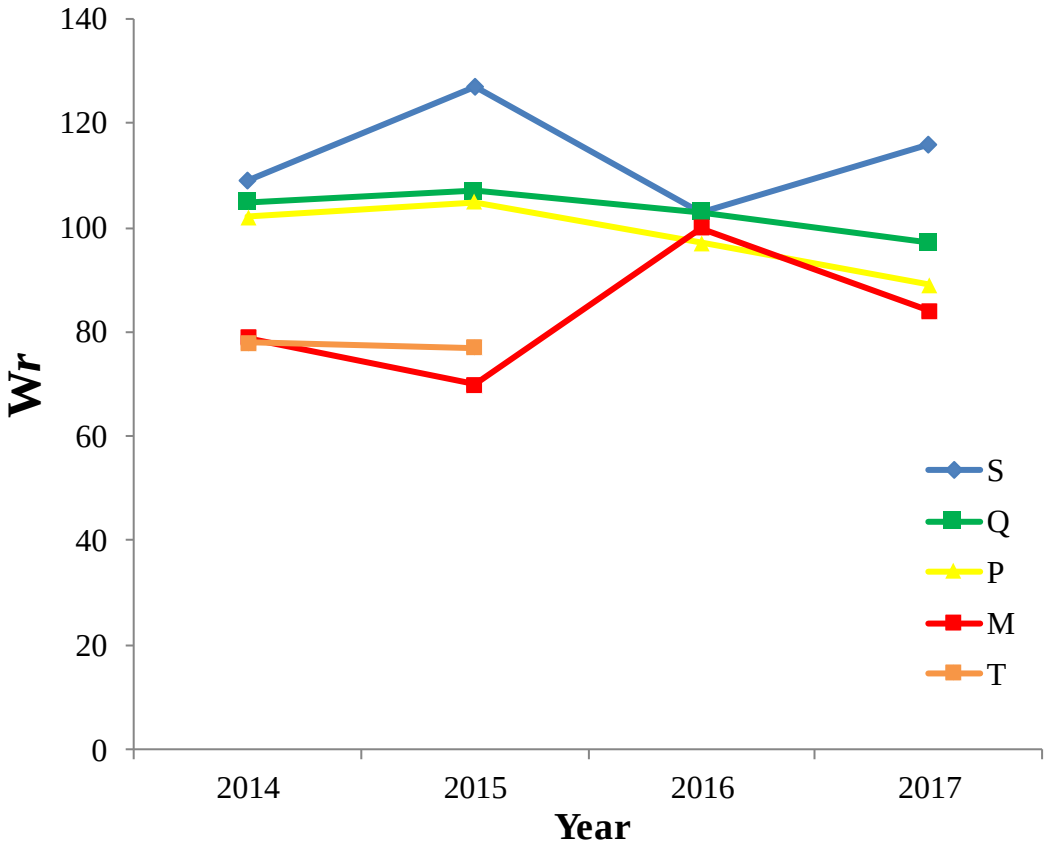

Figure 12. Black Crappie relative weights by year 2014-2017.

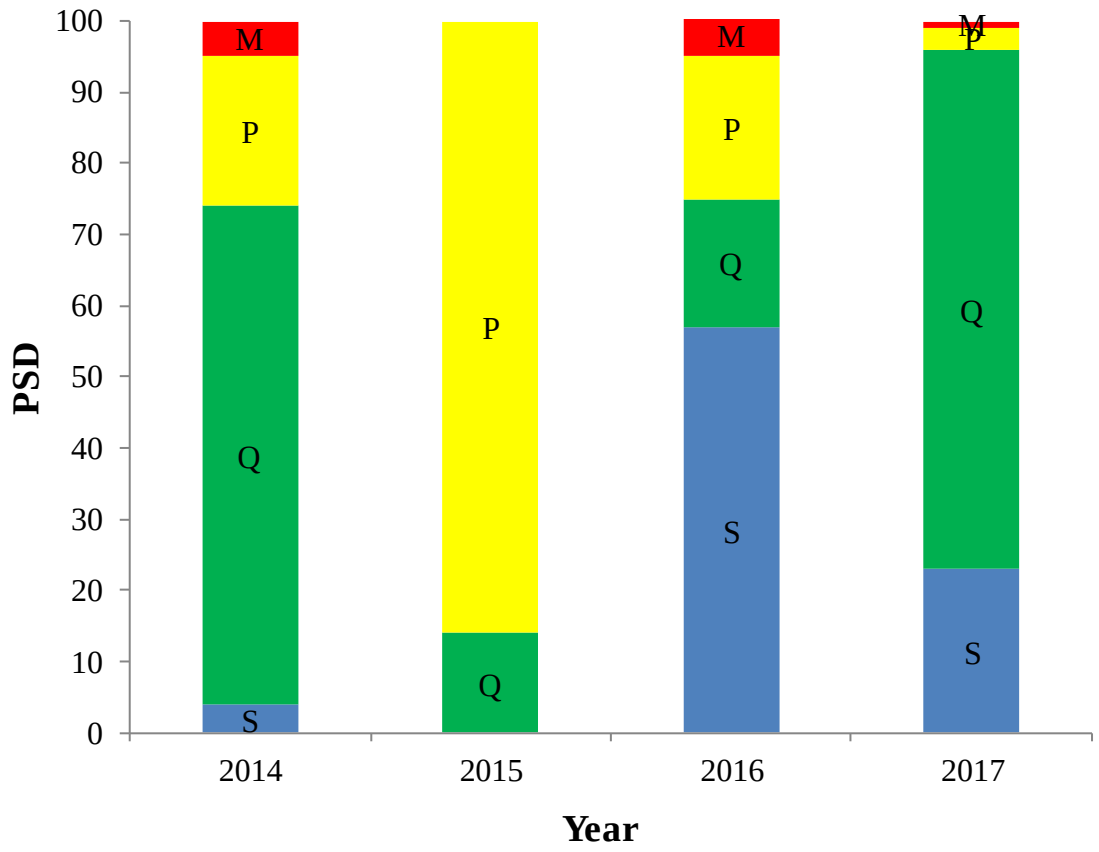

Figure 13. White Crappie proportion size distribution (PSD) by year 2014-2017. S=Stock 5-8”, Q=Quality 8-10”, P=Preferred 10-12”, and M=Memorable 12-15”.

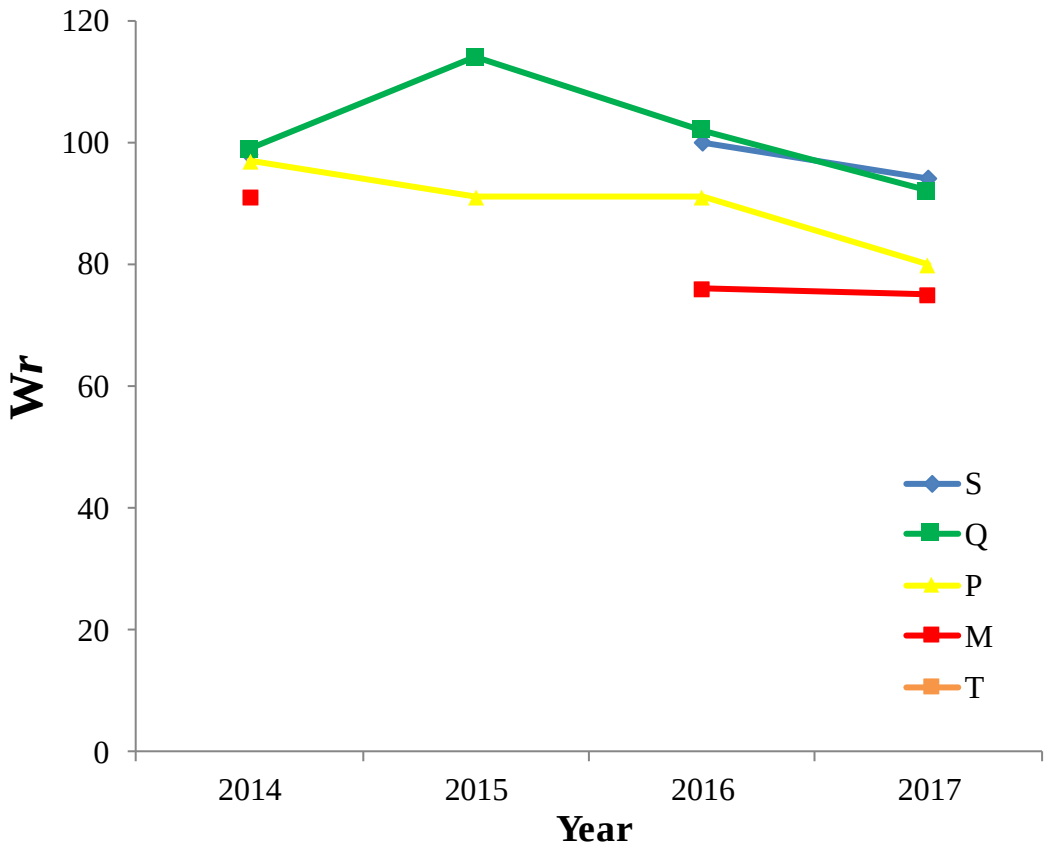

Figure 14. White Crappie relative weights by year 2014-2017.

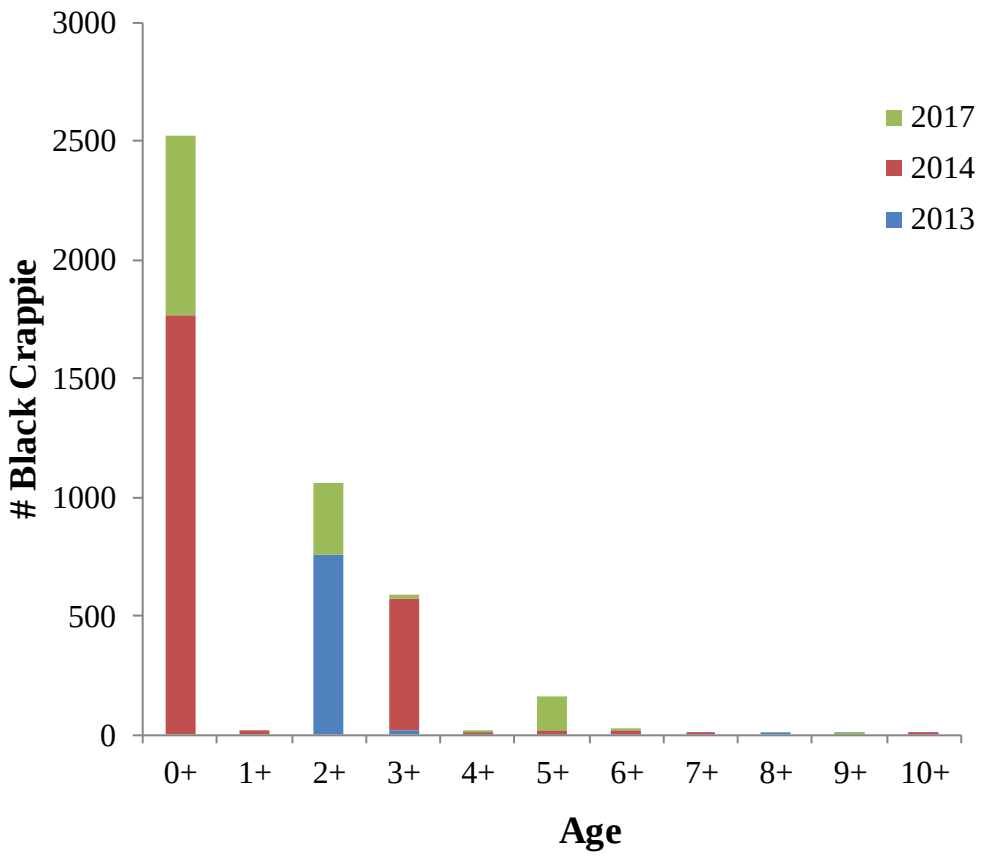

Figure 15. Age frequency histogram for Black Crappie from aging studies at Tongue River Reservoir in 2013, 2014, and 2017. Frequencies calculated from age-length keys (Appendix 2).

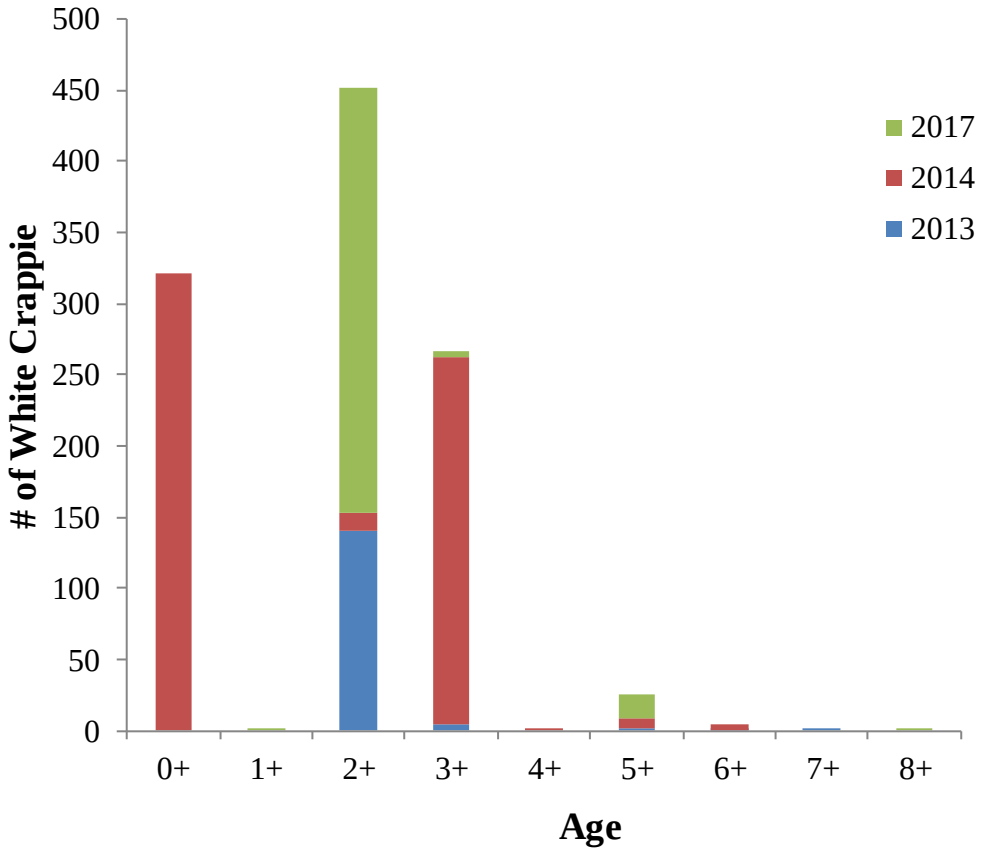

Figure 16. Age frequency histogram for White Crappie from aging studies at Tongue River Reservoir in 2013, 2014, and 2017. Frequencies calculated from age-length keys (Appendix 1).

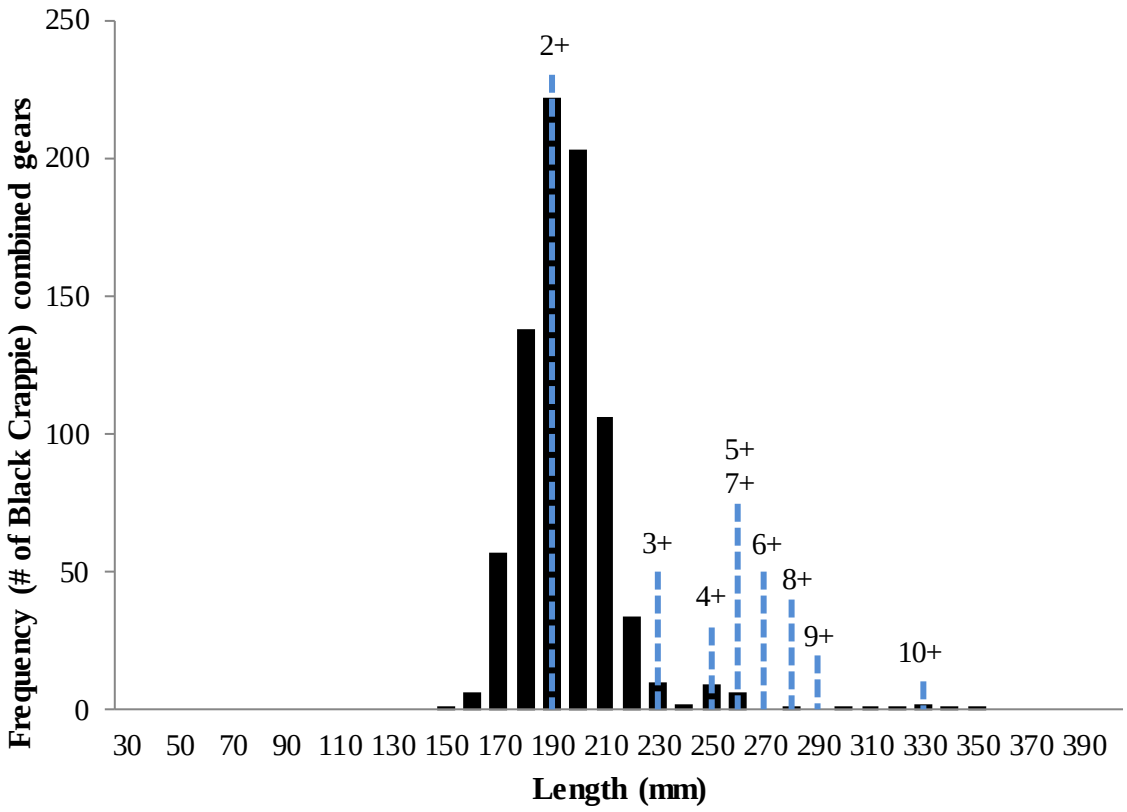

Figure 17. Length frequency histogram of Black Crappie (#) sampled in August 2013 with mean length at age markers from subsample of otolith aged crappie. Gill-net, trap-net, and electrofishing catches combined.

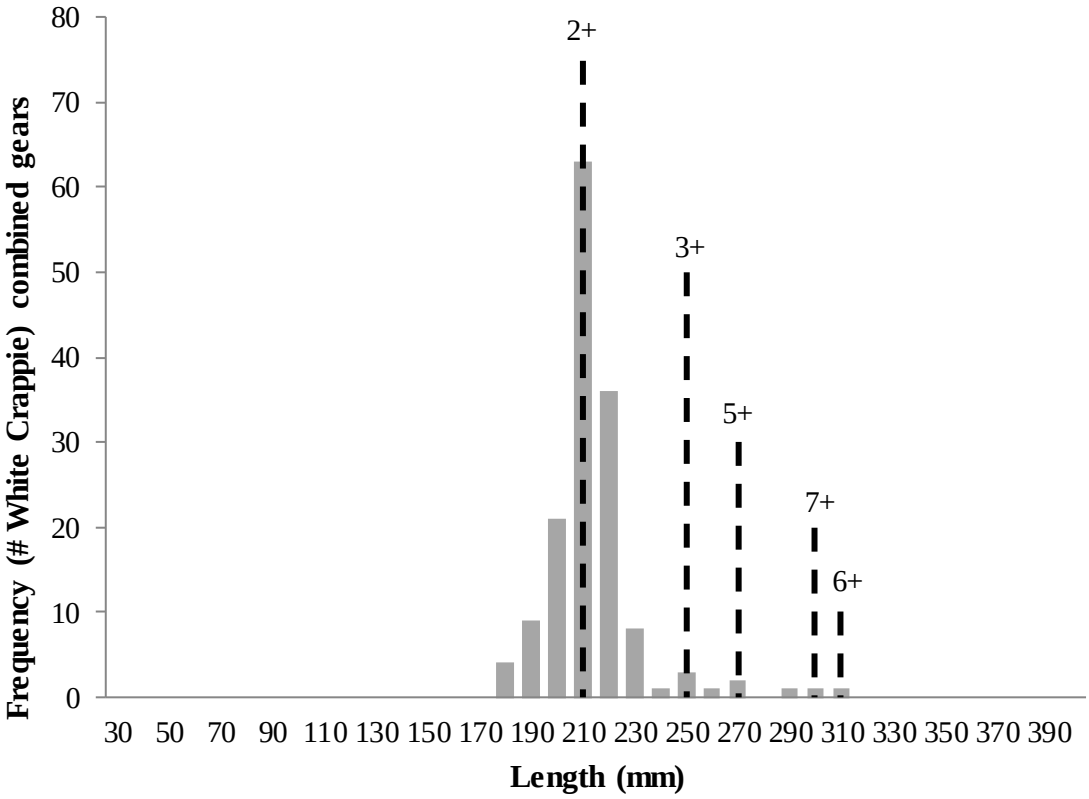

Figure 18. Length frequency histogram of White Crappie (#) sampled in August 2013 with mean length at age markers from subsample of otolith aged crappie. Gill-net, trap-net, and electrofishing catches combined.

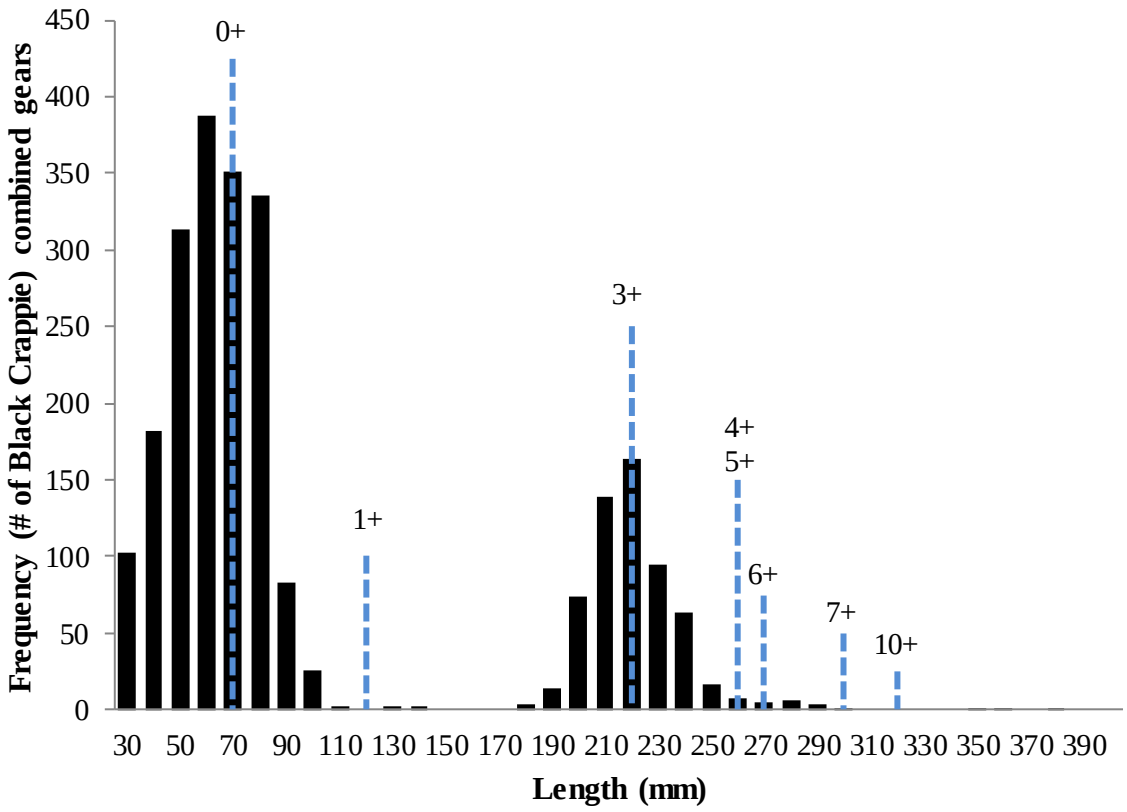

Figure 19. Length frequency histogram of Black Crappie (#) sampled in August and October 2014 with mean length at age markers from subsample of otolith aged crappie. Gill-net, trap-net, seine, and electrofishing catches combined.

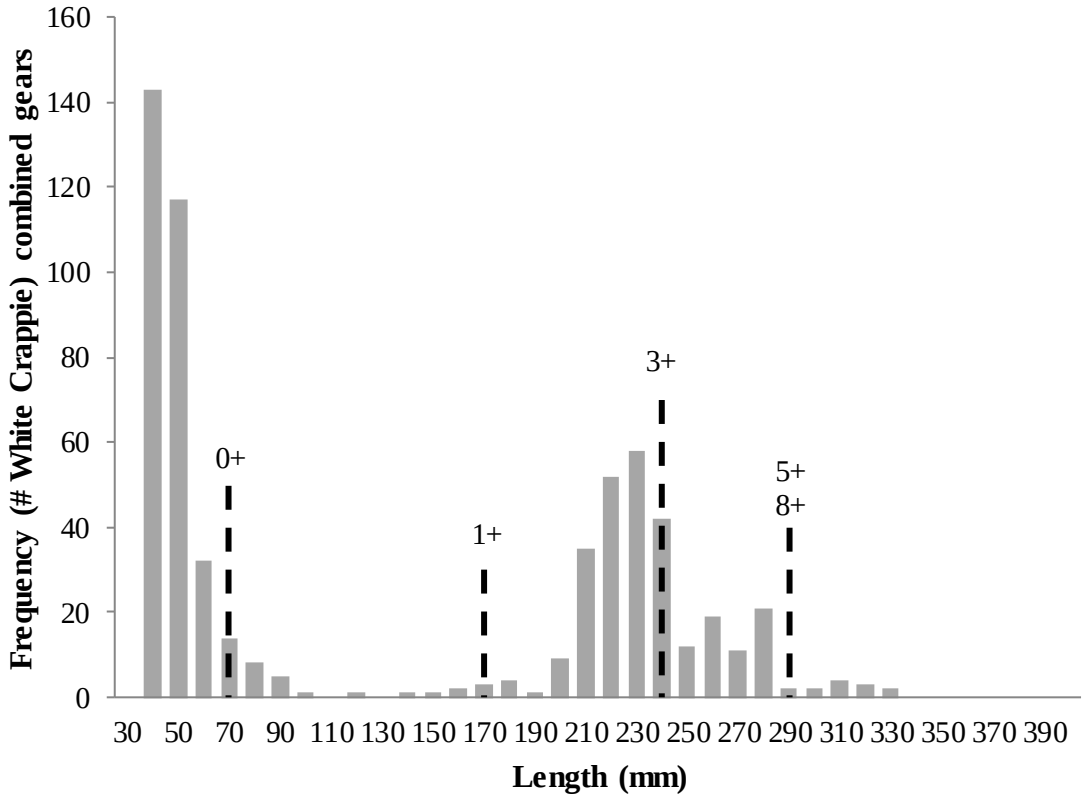

Figure 20. Length frequency histogram of White Crappie (#) sampled in August and October 2014 with mean length at age markers from subsample of otolith aged crappie. Gill-net, trap-net, seine, and electrofishing catches combined.

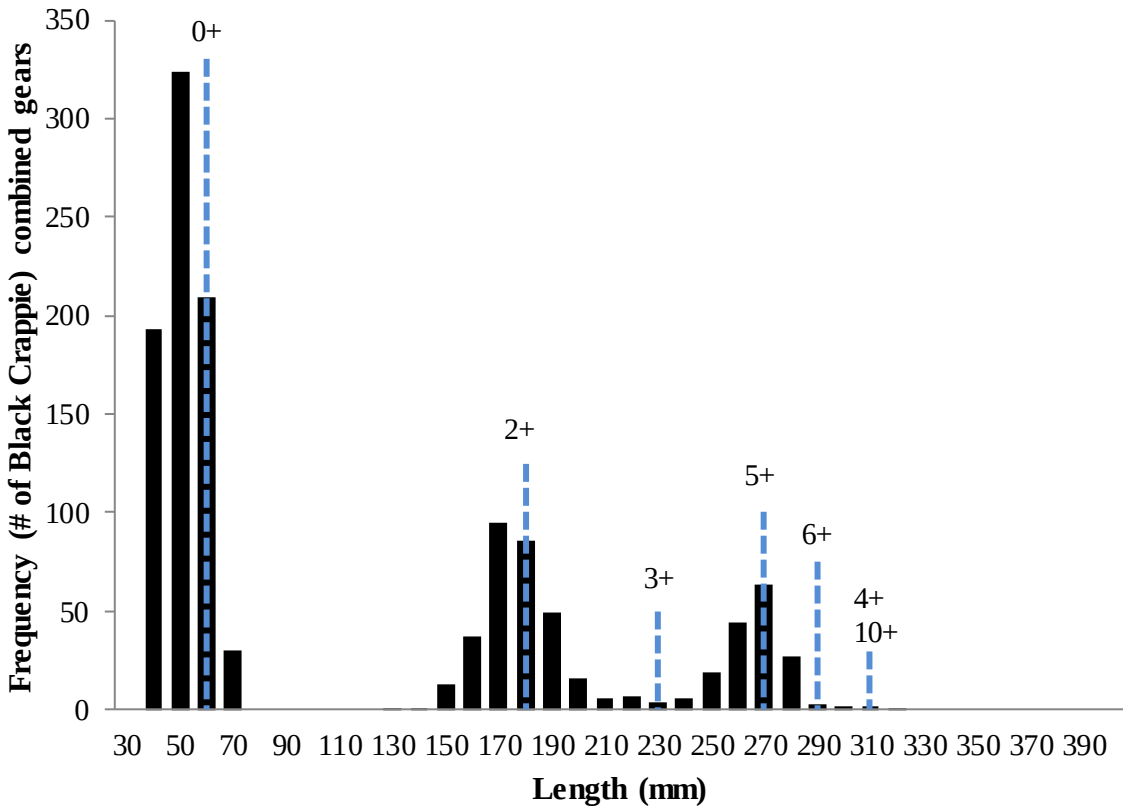

Figure 21. Length frequency histogram of Black Crappie (#) sampled in August 2017 with mean length at age markers from subsample of otolith aged crappie. Gill-net, trap-net, seine, and electrofishing catches combined.

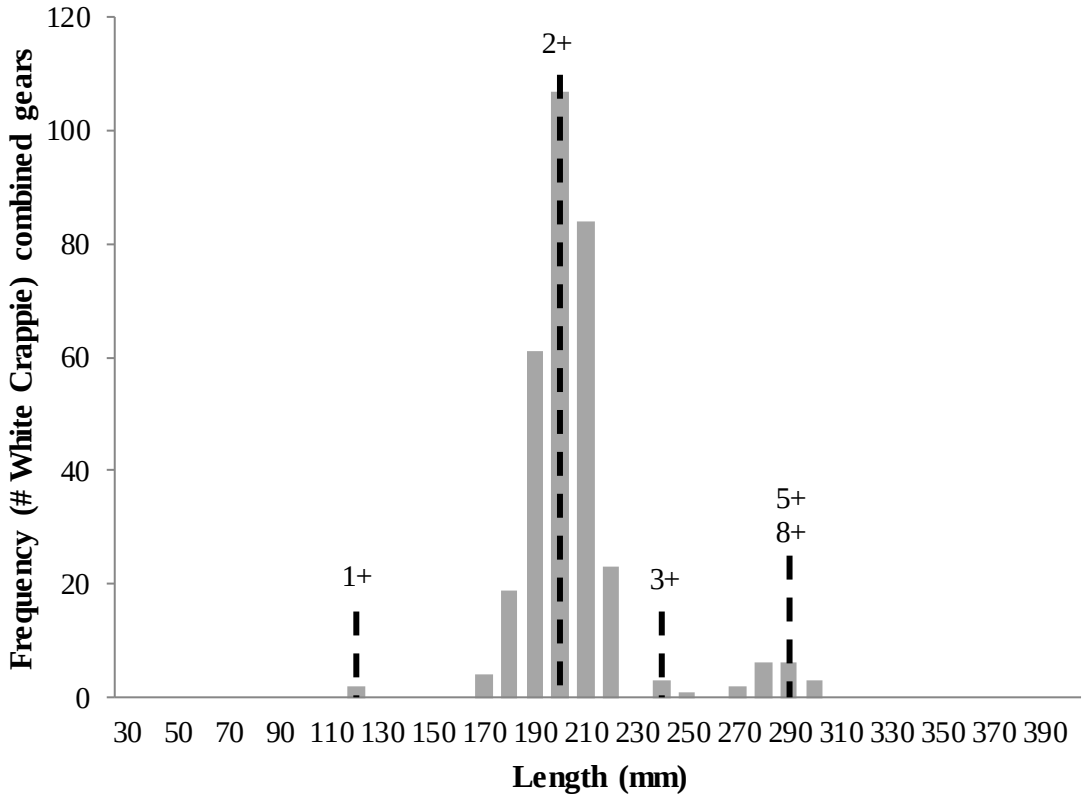

Figure 22. Length frequency histogram of White Crappie (#) sampled in August 2017 with mean length at age markers from subsample of otolith aged crappie. Gill-net, trap-net, seine, and electrofishing catches combined.

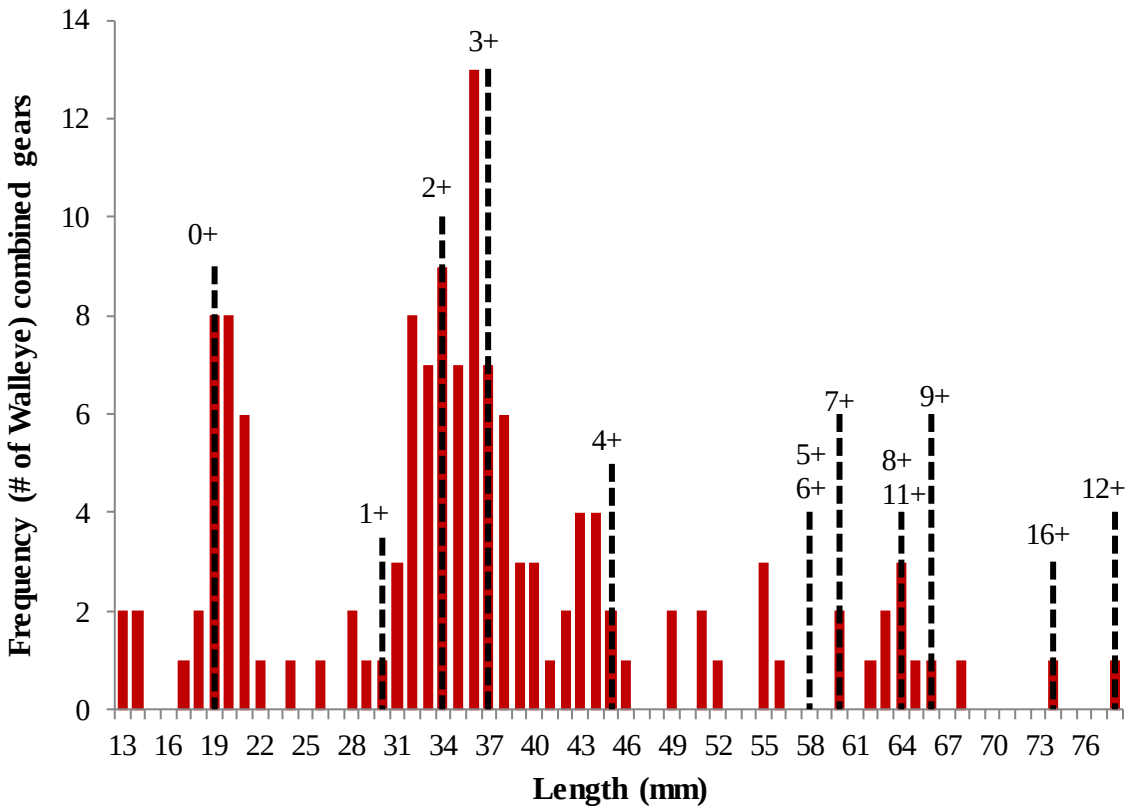

Figure 23. Length frequency histogram of all Walleye (#) sampled in August 2014 with mean length at age markers from subsample of leading dorsal spine aged Walleye. Gill-net, trap-net, and electrofishing catches combined.

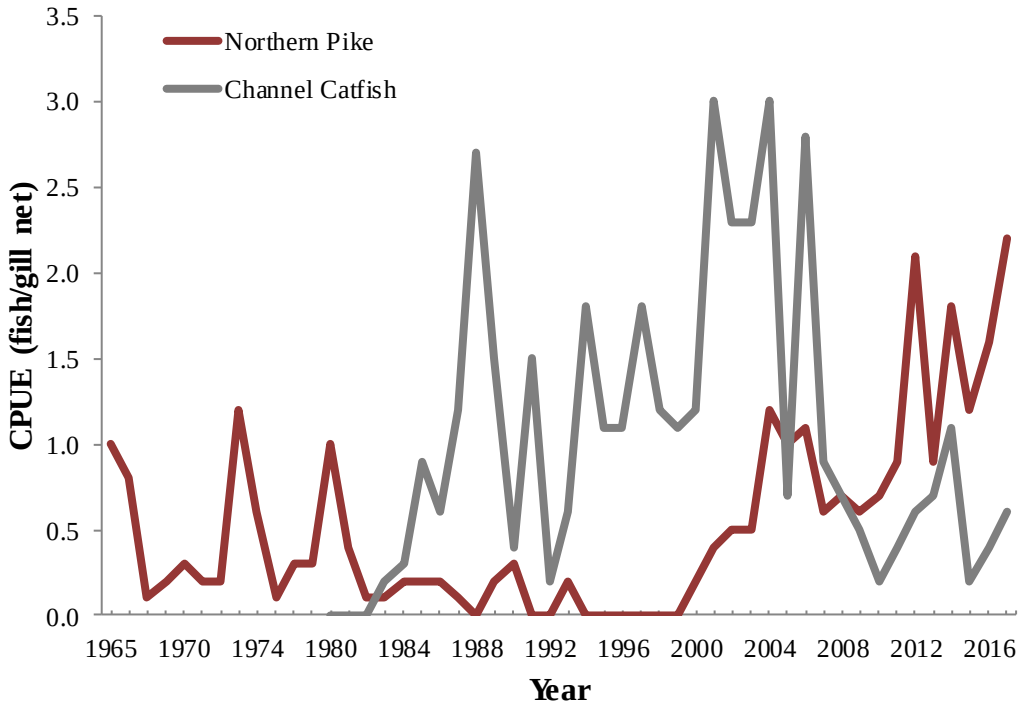

Figure 24. Relative abundance of Channel Catfish and Northern Pike (Y-axis) measured in CPUE (fish/gill net) as a function of year (X-axis) in Tongue River Reservoir 1965-2017.

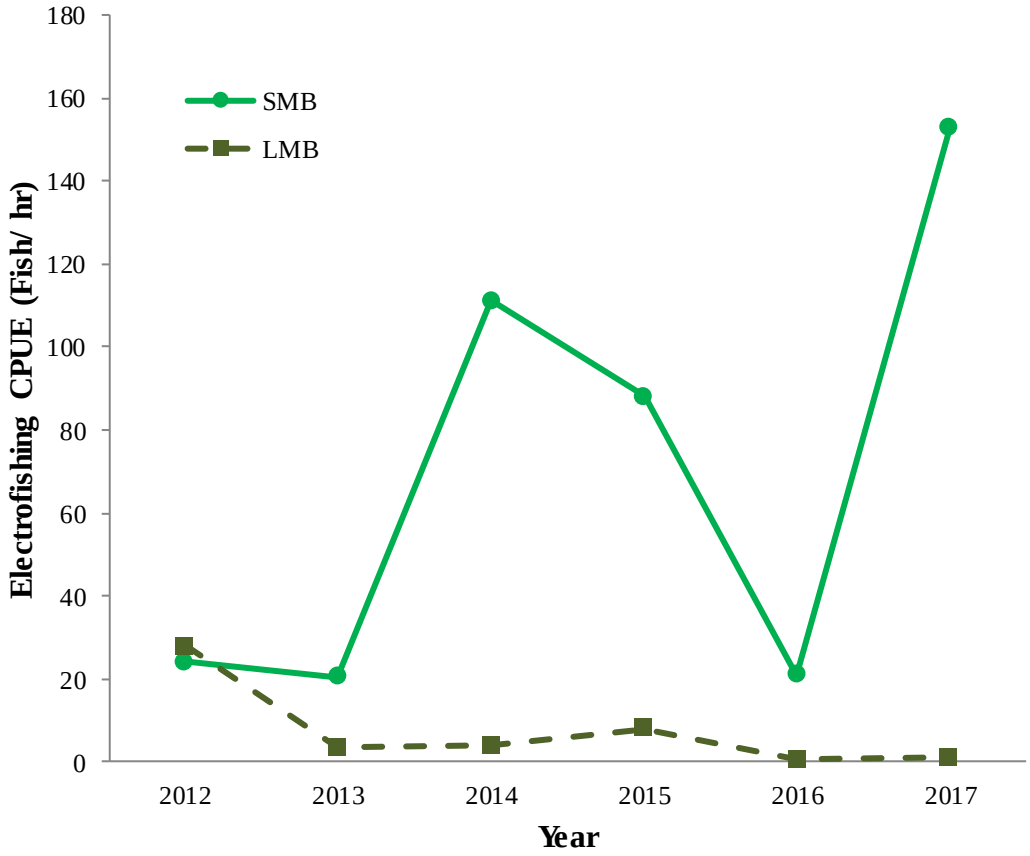

Figure 25. Relative abundance of Largemouth Bass and Smallmouth Bass (Y-axis) measured in CPUE (fish/hr) as a function of year (X-axis) from Tongue River Reservoir electrofishing 2012-2017.

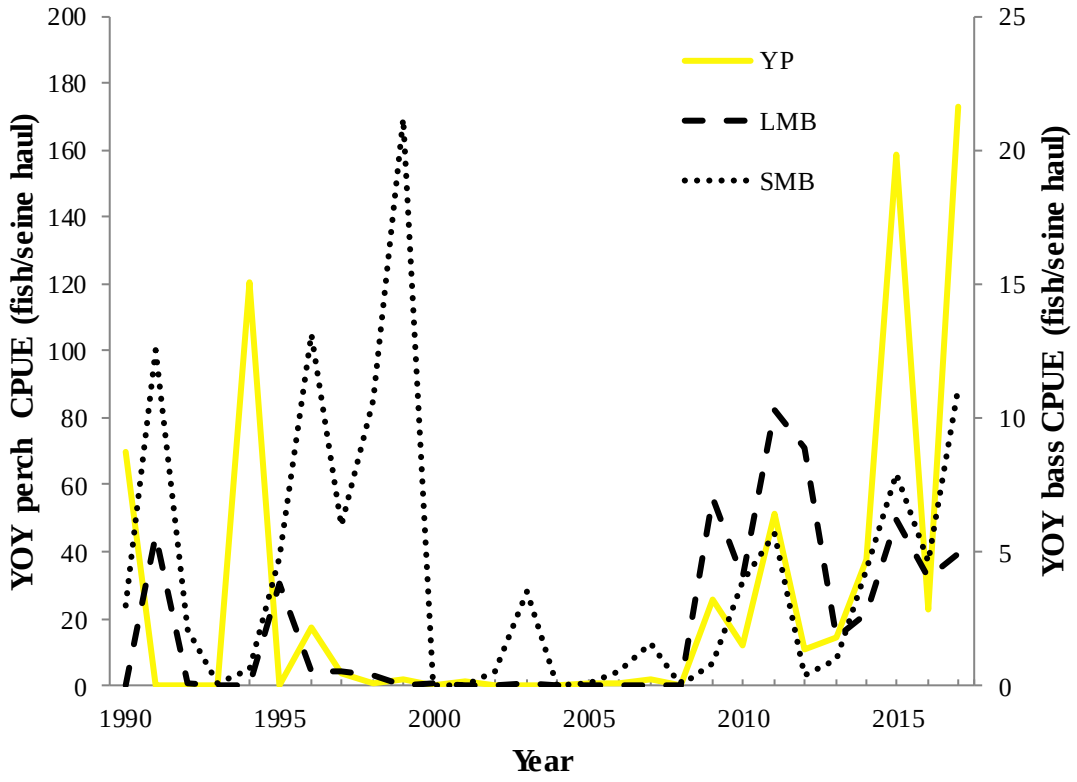

Figure 26. Relative abundance of young-of-the-year (YOY) Yellow Perch (primary Y-axis), Largemouth Bass, and Smallmouth Bass (secondary Y-axis) measured in CPUE (fish/seine haul) as a function of year (X-axis) from Tongue River Reservoir seines, 1984-2017.

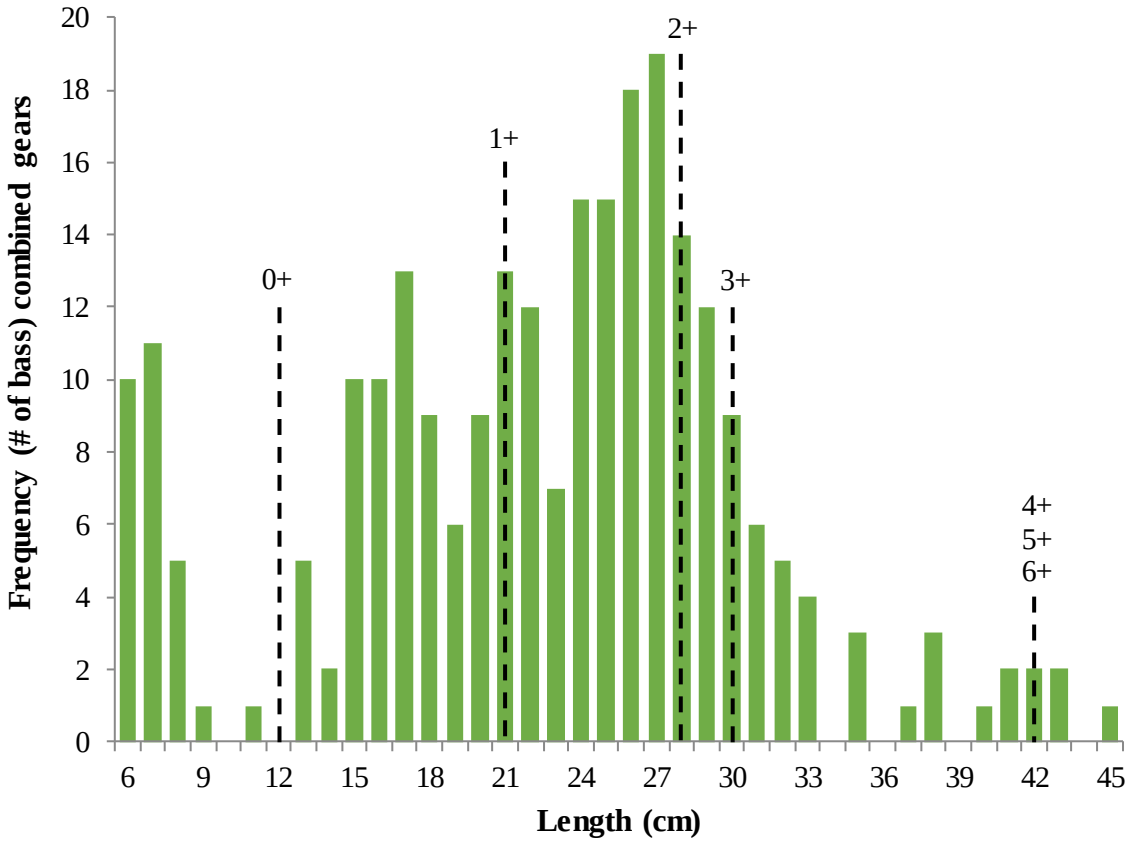

Figure 27. Length frequency histogram of all Smallmouth Bass (#) sampled in August 2014 with mean length at age markers from subsample of leading dorsal spine aged Smallmouth Bass. Gill-net, trap-net, seine, and electrofishing catches combined.

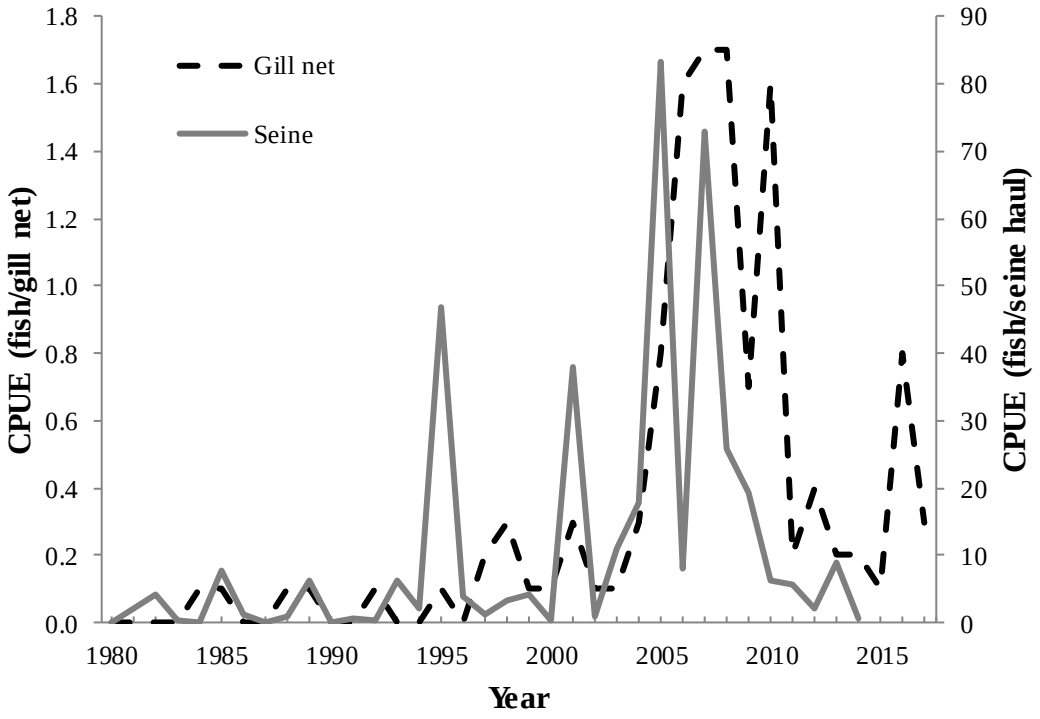

Figure 28. Relative abundance of all Pumpkinseed Sunfish caught in gill nets (primary Y-axis) and seine hauls (secondary Y-axis) measured in CPUE as a function of year (X-axis) in Tongue River Reservoir 1989-2017.

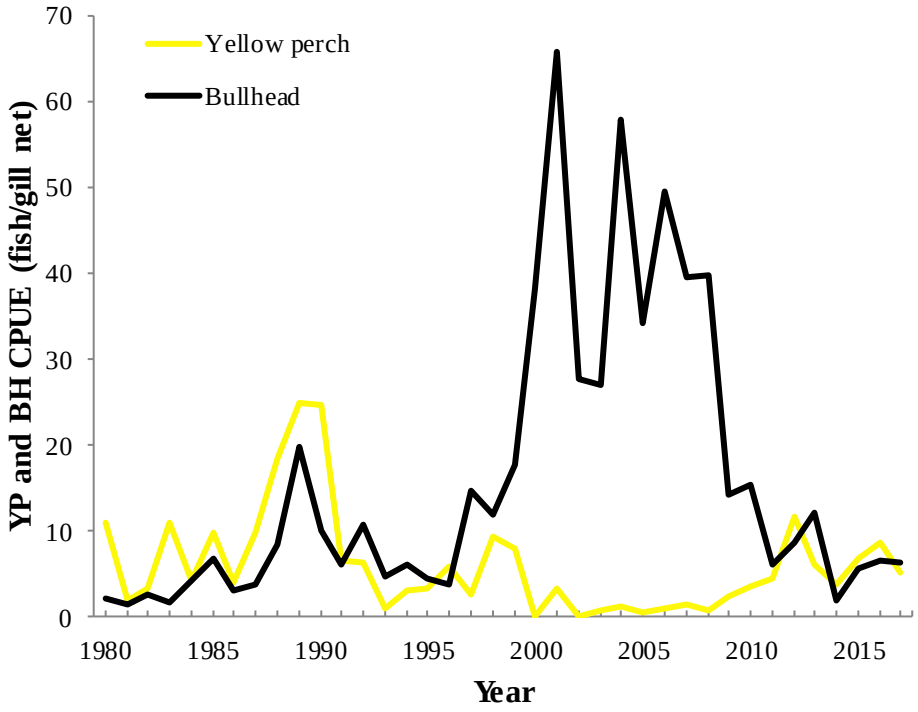

Figure 29. Relative abundance of Yellow Perch and bullheads caught in gill nets (primary Y-axis) measured in CPUE as a function of year (X-axis) in Tongue River Reservoir 1980-2017.

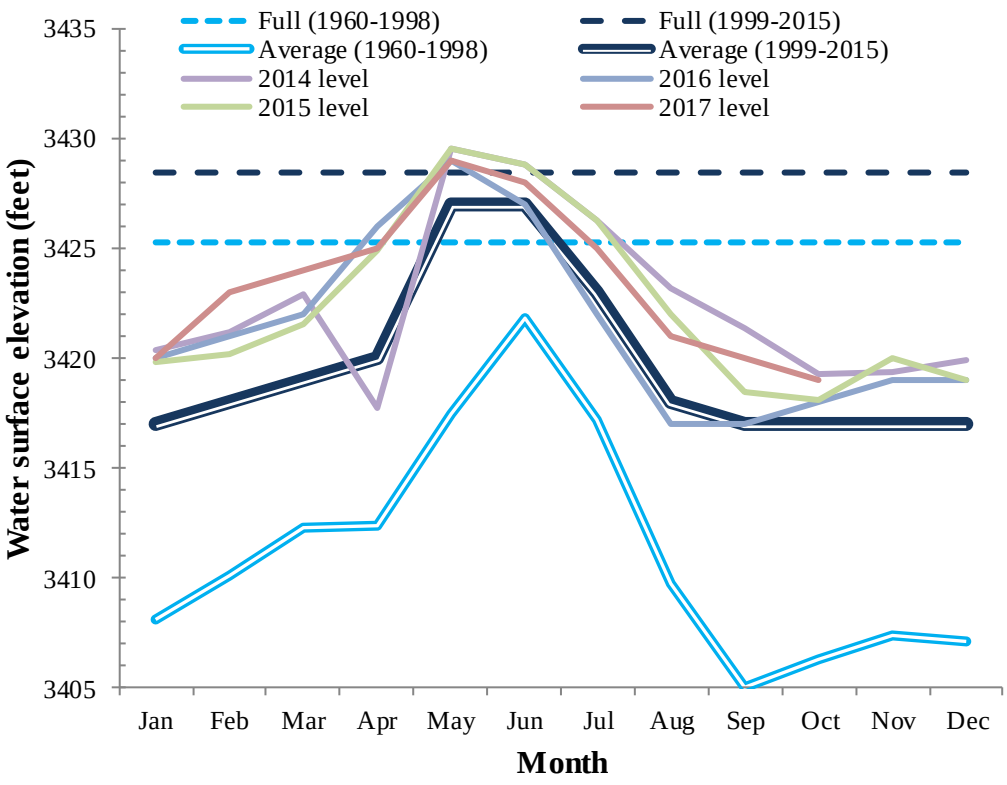

Figure 30. Tongue River Reservoir 2014, 2015, 2016, and 2017 water surface elevation in feet by month with full pool reference lines and historical mean storage level pre (1960-1998) and post (1999-2017) dam reconstruction, data provided by DNRC website.

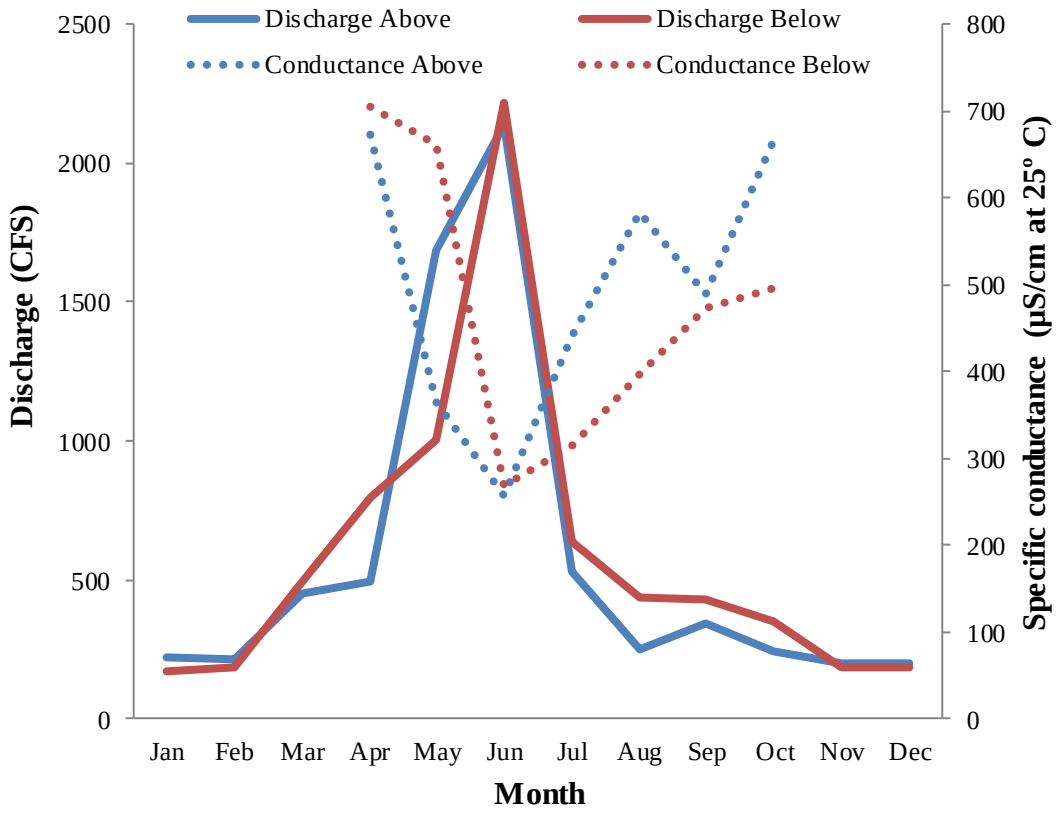

Figure 31. 2014 Monthly mean discharge measured in cubic feet per second (primary Y-axis) and specific conductance measured in microseimens per cm at 25º C (secondary Y-axis) by month (X-axis) from USGS gauging stations 06306300 Tongue River at state line (Above) and 06307500 Tongue River at Tongue River Dam (Below), Decker MT.

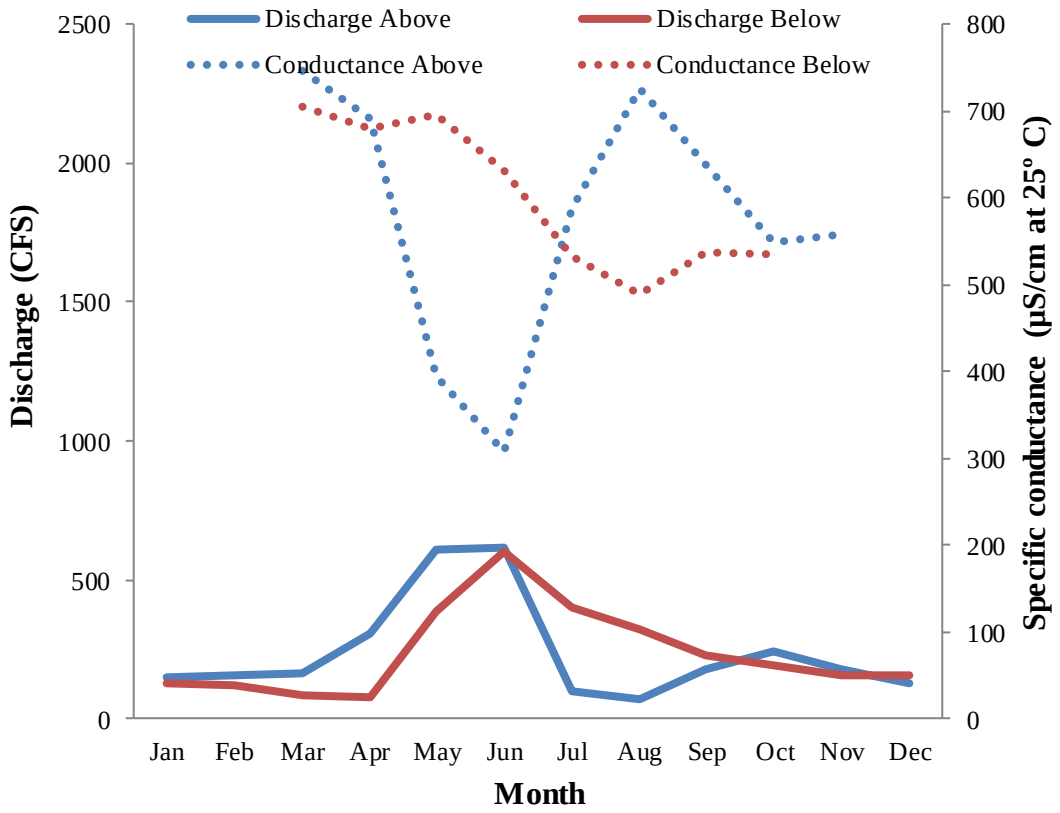

Figure 32. 2016 Monthly mean discharge measured in cubic feet per second (primary Y-axis) and specific conductance measured in microseimens per cm at 25º C (secondary Y-axis) by month (X-axis) from USGS gauging stations 06306300 Tongue River at state line (Above) and 06307500 Tongue River at Tongue River Dam (Below), Decker MT.

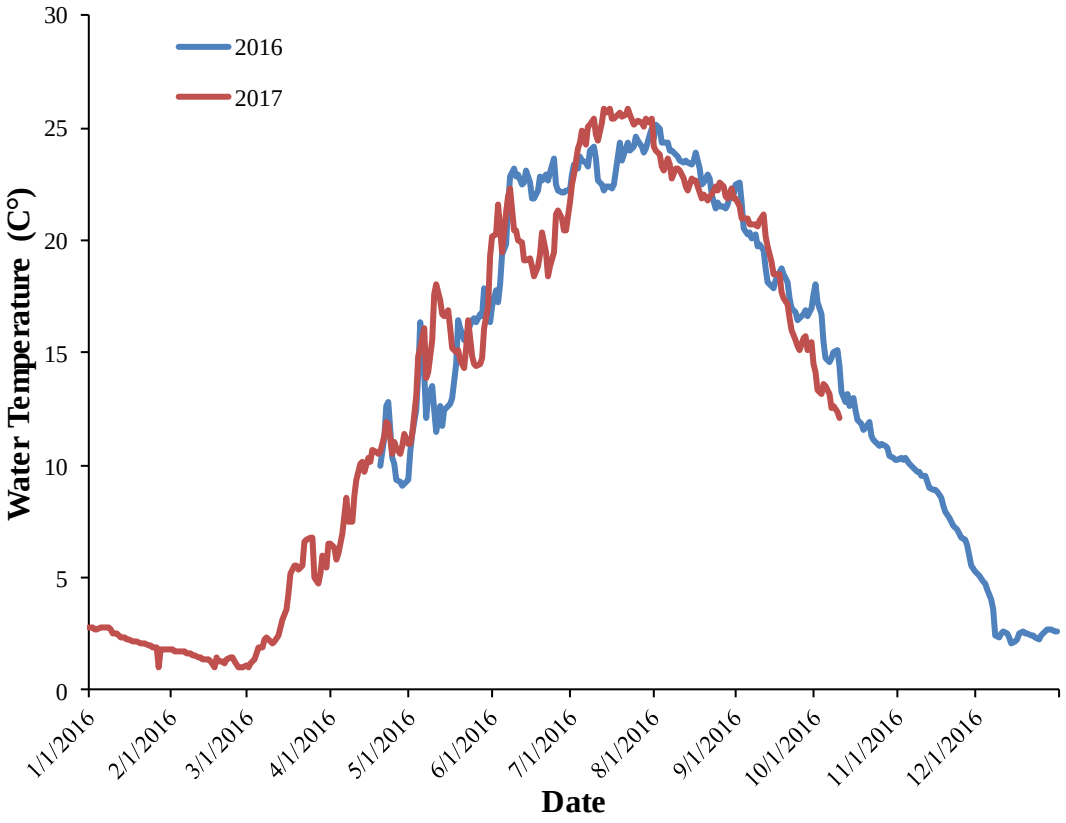

Figure 33. Daily mean water temperature measured in degrees Celsius (C°) on the Y-axis by date on the X-axis for 2016 and 2017 at Tongue River Reservoir, Decker, MT.

Appendix 1. Age study summary of reader agreement

			Reader Agreement		
Year	Species	Readers	Agreed	Within 1 Year	Within 2 Years
2013	Crappie	University of Idaho, FWP (Caleb Bollman)	96%	100%	-
2014	Crappie	FWP (Caleb Bollman), FWP (Drew Wallace)	89%	99%	-
2014	Walleye	University of Idaho, FWP (Caleb Bollman)	83%	97%	-
2014	Northern Pike	University of Idaho	47%	76%	93%
2014	Smallmouth Bass	FWP (Caleb Bollman), FWP (Drew Wallace, Niall Clancy)	63%	91%	98%
2017	Crappie	FWP (Caleb Bollman), FWP (Drew Wallace)	95%	100%	-

Appendix 2. Age-length Keys

2013 Black Crappie Age-Length Key

*Corresponding year class designation ->			2011	2010	2009	2008	2007	2006	2005	2004	2003
Length	Number	Number (age)	Sample allocation per age-group								
Group (cm)	in sample	in subsample	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+	Age 8+	Age 9+	Age 10+
15	1	1(2)	1								
16	6	1(2)	6								
17	57	13(2)	57								
18	138	11(2)	138								
19	222	7(2)	222								
20	203	8(2)	203								
21	106	6(2)	106								
22	34	4(2), 1(3)	27	7							
23	10	6(3), 1(4)		9	1						
24	2										
25	9	1(3), 3(4), 1(6)		2	5	2					
26	6	1(5), 2(6), 1(7), 1(9)				1	3	1		1	
27											
28	1	1(8)							1		
29											
30	1	1(10)									1
31	1	1(6)					1				
32	1	1(9)								1	
33	2										
34	1										
35	1	1(10)									1
All	802		760	18	6	3	4	1	1	2	2

2013 White Crappie Age-Length Key

*Corresponding year class designation ->			2011	2010	2009	2008	2007	2006
Length	Number	Number (age)	Sample allocation per age-group					
Group (cm)	in sample	in subsample	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+
18	4	1(2)	4					
19	9	3(2)	9					
20	21	4(2)	21					
21	63	4(2)	63					
22	36	6(2)	36					
23	8	2(2)	8					
24	1	1(3)		1				
25	3	2(3)		3				
26	1							
27	2	2(5)				2		
28								
29	1	1(7)						1
30	1	1(7)						1
31	1	1(6)					1	
All	151		141	4		2	1	2

2014 Black Crappie Age-Length Key

*Corresponding year class designation ->			2014	2013	2011	2010	2009	2008	2007	2004
Length	Number	Number (age)	Sample allocation per age-group							
Group (cm)	in sample	in subsample	Age 0+	Age 1+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+	Age 10+
3	103	4(0)	103							
4	182	5(0)	182							
5	314	6(0)	314							
6	387	5(0)	387							
7	351	5(0)	351							
8	336	5(0)	336							
9	83	5(0)	83							
10	25	3(0), 2(1)	15	10						
11	2	2(1)		2						
12										
13	2	2(1)		2						
14	2	1(1)		2						
15										
16										
17										
18	3				3					
19	14	4(3)			14					
20	74	9(3)			74					
21	139	10(3)			139					
22	164	10(3)			164					
23	95	11(3)			95					
24	63	8(3), 1(5)			56		7			
25	16	1(3), 1(4), 1(5), 1(6)			4	4	4	4		
26	7	3(3), 2(5), 1(6)			4		2	1		
27	5	1(4), 1(5), 1(6)			2		2	2		
28	6	2(6), 2(10)						3		3
29	3							1	1	1
30	1	1(7)							1	
31										
32										
33										
34										
35	1	1(10)								1
36	1	1(10)								1
37										
38	1									1
All	2380		1771	16	555	4	15	11	2	7

2014 White Crappie Age-Length Key

*Corresponding year class designation ->			2014	2013	2011	2010	2009	2008
Length	Number	Number (age)	Sample allocation per age-group					
Group (cm)	in sample	in subsample	Age 0+	Age 1+	Age 3+	Age 4+	Age 5+	Age 6+
4	143	4(0)	143					
5	117	2(0)	117					
6	32	5(0)	32					
7	14	5(0)	14					
8	8	5(0)	8					
9	5	5(0)	5					
10	1		1					
11	0							
12	1		1					
13	0							
14	1			1				
15	1	1(1)		1				
16	2	1(1)		2				
17	3	3(1)		3				
18	4	4(1)		4				
19	1	1(1)		1				
20	9	3(3)			9			
21	35	2(3)			35			
22	52	4(3)			52			
23	58	10(3)			58			
24	42	10(3)			42			
25	12	4(3), 1(4)			10	2		
26	19	8(3)			19			
27	11	3(3)			11			
28	21	2(3)			21			
29	2	1(5), 1(6)					1	1
30	2						1	1
31	4	1(5)					4	
32	3				1		1	1
33	2	1(3), 1(6)			1			1
All	605		321	12	259	2	7	4

2017 Black Crappie Age-Length Key

*Corresponding year class designation ->			2017	2015	2014	2013	2012	2011	2008
Length	Number	Number (age)	Sample allocation per age-group						
Group (cm)	in sample	in subsample	Age 0+	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 9+
4	193		193						
5	324	1(0)	324						
6	209	4(0)	209						
7	30	2(0)	30						
8									
9									
10									
11									
12									
13	1	1(2)		1					
14	1	1(2)		1					
15	13	12(2)		13					
16	37	8(2)		37					
17	95	19(2)		95					
18	86	14 (2)		86					
19	49	11(2)		49					
20	16	11(2), 1(3)		15	1				
21	6	2(2), 2(3)		3	3				
22	7	1(2), 5(3)		1	6				
23	4	3(3), 1(5)			3		1		
24	6	3(3), 1(5)			5		2		
25	19	1(3), 10(5)			2		17		
26	44	9(5), 1(6)					40	4	
27	63	7(5)					63		
28	27	11(5), 2(6)					23	4	
29	3	1(6)						3	
30	2	1(3), 1(9)			1				1
31	2	1(4), 1(5)				1	1		
32	1	1(6)						1	
All	1238		756	301	20	1	146	13	1

2017 White Crappie Age-Length Key

*Corresponding year class designation ->			2016	2015	2014	2012	2009
Length	Number	Number (age)	Sample allocation per age-group				
Group (cm)	in sample	in subsample	Age 1+	Age 2+	Age 3+	Age 5+	Age 8+
12	2	2(1)	2				
13							
14							
15							
16							
17	4	1(2)		4			
18	19	9(2)		19			
19	61	22(2)		61			
20	107	19(2)		107			
21	84	15(2)		84			
22	23	19(2)		23			
23							
24	3	1(2), 2(3)		1	2		
25	1	1(3)			1		
26							
27	2	2(5)				2	
28	6	5(5), 1(8)				5	1
29	6	5(5)				6	
30	3	3(5)				3	
All	321		2	299	3	16	1

2014 Walleye Age-Length Key

*Corresponding year class designation --->			2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2003	2002	1998
Length	Number	Number (age)	Sample allocation per age-group												
Group (cm)	in sample	in subsample	Age 0+	Age 1+	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+	Age 8+	Age 9+	Age 11+	Age 12+	Age 16+
13	2	2(0)	2												
14 - 17	2	1(0)	2												
	1	1(0)	1												
18	2	2(0)	2												
19	8	7(0)	8												
20	8	7(0)	8												
21	6	4(0)	6												
22 - 24	1	1(0)	1												
	1	1(0)	1												
25															
26 - 28	1	1(2)			1										
	2	1(1), 1(2)		1	1										
29	1														
30	1														
31	3	3(2)			3										
32	8	1(1), 6(3)		1		7									
33	7	3(2), 3(3)			4	4									
34	9	5(3), 1 (4)				8	1								
35	7	6(3)				7									
36	13	1(2), 7(3)				5	8								
37	7	2(3)				7									
38	6	6(3)				6									
39	3	1(2), 1(3)			2	2									

2014 Walleye Age-Length Key…continued

*Corresponding year class designation --->			2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2003	2002	1998
Length Group	Number	Number (age)	Sample allocation per age-group												
(cm)	in sample	in subsample	Age 0+	Age 1+	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+	Age 7+	Age 8+	Age 9+	Age 11+	Age 12+	Age 16+
40	3	3(3)				3									
41	1	1(3)				1									
42	2	2(3)				2									
43	4	3(3), 1(4)				3	1								
44	4	4(3)				4									
45	2	2(3)				2									
46 - 49	2	1(2), 1(4)			1		1								
51	2	1(7)								2					
52 - 55	3	2(5), 1(6)						2	1						
56 - 60	2	1(5), 1(8)						1			1				
62	1	1(6)							1						
63	2	2(5)						2							
64	3	1(6), 1(7), 1(11)							1	1			1		
65	1	1(7)								1					
66 - 68	1	1(9)										1			
68 - 74	1	1(8)									1				
74 - 78	1	1(16)													1
78	1	1(12)												1	
All	138		31	2	11	60	12	6	4	4	2	1	1	1	1

2014 Smallmouth Bass Age-Length Key

*Corresponding year class designation ->			2014	2013	2012	2011	2010	2009	2008
Length	Number	Number (age)	Sample allocation per age-group						
Group (cm)	in sample	in subsample	Age 0+	Age 1+	Age 2+	Age 3+	Age 4+	Age 5+	Age 6+
6	10	1(0)	10						
7	11	5(0)	11						
8	5	4(0)	5						
9	1	1(0)	1						
10									
11	1								
12									
13	5								
14	2								
15	10	5(1)		10					
16	10	2(0), 2(1)	5	5					
17	13	4(0), 6(1)	5	8					
18	9	3(0), 5(1)	3	6					
19	6	5(1)		6					
20	9	5(1), 1(2)		8	1				
21	13	4(1), 2(2)		9	4				
22	12	6(1), 2(2), 2(3)		8	2	2			
23	7	2(1), 2(2)		4	4				
24	15	4(1), 6(2), 1(3)		6	8	1			
25	15	5(1), 6(2), 1(3)		6	8	1			
26	18	6(1), 10(2)		7	11				
27	19	1(1), 12(2), 2(3)		1	15	3			
28	14	2(1), 5(2), 3(3)		3	7	4			
29	12	9(2), 3(3)			9	3			
30	9	8(2), 1(3)			8	1			
31	6	5(2), 1(3)			5	1			
32	5	4(3)				5			
33	4	3(2), 1(3)			3	1			
34									
35	3	1(2), 1(3)			2	2			
36									
37	1	1(3)				1			
38	3	1(2), 1(6)			1				1
39									
40	1	1(4)					1		
41	2	1(4), 1(6)					1		1
42	2	1(4), 1(5)					1	1	
43	2	1(3), 1(4)				1	1		
44									
45	1	1(4)					1		
All	256		40	87	88	26	5	1	2