Fisheries Division

Federal Aid Job Progress Report

<u>Montana Statewide Fisheries Management</u>

Federal Aid Project Number: F-113

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Project Title: Montana Statewide Fisheries Management

Job Title: Southeastern Montana Warm-water Streams Investigation

Abstract: The Tongue River is a major tributary to the Yellowstone River. Anthropogenic activities, particularly the construction of dams, in the Tongue River watershed has affected the fish assemblage. A monitoring program was initiated in 2003 to monitor relative abundance, size distribution, and body condition of fish populations through time. Annual trend sampling consists of electrofishing at six locations. Seining was part of annual trend sampling from 2003 to 2009. In 2007 a bypass channel (Muggli Bypass) was constructed to provide fish passage around T&Y Diversion Dam. Modified fyke nets and electrofishing gears were used to assess the success of the fish passage structure. Passage was evaluated from 2008 to 2012. Twenty fish species have been documented using the Muggli Bypass since its construction. Fish passage for most species was deemed successful based on similar trends in abundances between the bypass channel and the river reach downstream of the diversion dam. However, Shovelnose Sturgeon, a species found in the reach of river below T&Y Diversion Dam, have not been documented passing through the bypass channel. Alterations to the Muggli Bypass may be necessary to provide Shovelnose Sturgeon passage.

INTRODUCTION

The Tongue River is a major tributary to the Yellowstone River in Eastern Montana. It supports a rich assemblage of native warm-water fish and provides spawning habitat and fish production that contributes to Yellowstone River fish populations. Few long-term studies have focused on the status of the Tongue River fish assemblage despite a long history of human activity in the drainage. Although game fishes are present in the river, sport fishing is limited by access and flow conditions. The primary human activities in the Tongue River watershed are agriculture and the development of coal resources.

Agriculture is the primary land use practice in the Tongue River watershed. Water from the Tongue River is used to irrigate tens-of-thousands of acres of farmland in the Tongue River drainage. Irrigation projects have had and still have a substantial impact on the Tongue River fish assemblage. Water withdrawal is so extensive that reaches of the Tongue River, particularly downstream of T&Y Dam, are nearly dewatered during low water years (e.g. May 1992, 1993, 2005, 2013 and July 2002, August 2001, and September 2006). Irrigation diversion dams' function as barriers to fish movement and have fragmented fish populations. Fish are also lost from the Tongue River fishery through entrainment into irrigation canals. Historical development of coal resources has been another major industry in the watershed since the 1970s. Construction of a Tongue River Railroad has been proposed to facilitate increased coal extraction and transport. The proposed railroad would be constructed along the banks of the Tongue River for much of its course. Numerous sites in the Tongue River watershed have been permitted for the development of coal bed methane extraction. The extraction of coal bed methane involves pumping methane and groundwater from coal seams. Water with high salinity and conductivity is a byproduct in the process that is discharged into the Tongue River above Tongue River Reservoir. In recent years, the expansion of natural gas from oil production and development of alternative energy sources (wind turbines) has dramatically reduced market demands for coal. Coal industries in the Tongue River Basin continue to decline most recently evidenced by the closure of the Decker Mines. Market forces and environmental policy may have a long-term impact on this industry and subsequently on mining activity in the Tongue River Basin for years to come.

Although many of the changes occurring in the Tongue River drainage have the potential to negatively affect the fish assemblage, there are ongoing projects intended to improve and protect the fishery. These projects have focused primarily on reducing entrainment and improving or creating fish passage at three major irrigation diversion dams on the Tongue River. Since its construction in 1886, the Tongue & Yellowstone (T&Y) Diversion Dam has prevented the upstream movement of fishes beyond the dam and fragmented a once connected system. In 1999, the T&Y canal head gate and louver structure was replaced to reduce fish entrainment into the irrigation canal. In August 2007, a fish passage structure, the Muggli Bypass, was constructed around T&Y Diversion Dam. In October 2008 SH Diversion Dam upstream of T&Y was removed. In 2005 water withdrawals from the Mobley Diversion Dam were transferred to pumps. The dam is no longer maintained and damage from ice scour and high flow has created some fish passage opportunity. However, Mobley Diversion Dam may impede fish movement during low water periods and a more complete removal of Mobley Diversion Dam would likely further improve fish passage. The completion of the Muggli Bypass and removal of SH Dam has provided a means for fish to move upstream to the Tongue River Dam within certain flow ranges.

Collection of baseline data before possible expansion of energy development and assessment of fish passage opportunities prompted the implementation of a monitoring program in the Tongue River. The monitoring program began in 2003 to assess the status of the Tongue River fish assemblage and evaluate fish population trends.

Goals and Objectives

The purpose of this project is to monitor fish population trends in the Tongue River. Specifically, the objectives are to:

(1) assess the current relative abundance, size structure, and body condition of fish populations in the Tongue River,

(2) evaluate changes in relative abundance, size structure, and body condition through time, and

(3) maintain the fish passage around T&Y Diversion Dam.

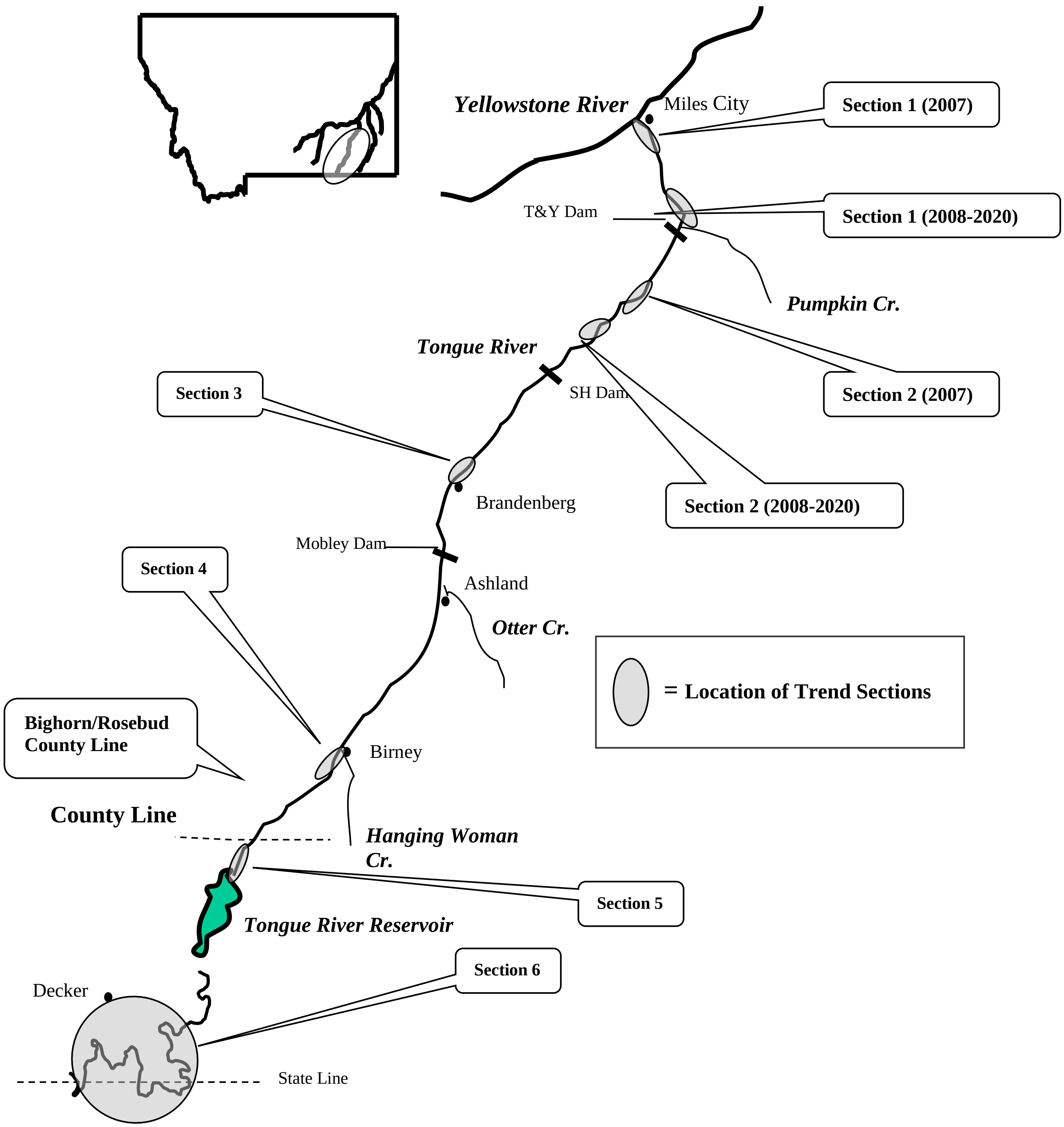
Through carrying out these objectives, Montana Fish, Wildlife & Parks will be able to identify concerns or benefits that activity in the Tongue River watershed may have and make more informed management decisions.

STUDY AREA

The Tongue River originates on the eastern side of the Big Horn Mountains in north-central Wyoming. The Tongue River has a drainage area of 5,379 square miles (13,932 km^2), approximately 70% occurring in Montana. The total length of river in Montana is 209 miles (337 km), stretching from the Wyoming state line to its confluence with the Yellowstone River, near Miles City (Figure 1). The Fort Union Coal Formation underlies the Tongue River watershed (Elser et al. 1977).

The Tongue River in Montana has been divided into five segments separated by four dams (Figure 1). There are three irrigation diversion dams: (1) Tongue and Yellowstone (T&Y) Diversion Dam at river mile 20 (km 32), (2) SH Diversion Dam at river mile 51(km 82) which no longer exists, and (3) Mobley Diversion Dam at river mile 105 (km 169), and one flood control dam, Tongue River Dam at river mile 189 (km 304). There is a thermally unique sixth river segment created by cold-water releases from the hypolimnion zone of Tongue River Reservoir. This segment is approximately ten river miles long and ends downstream of the dam near the Rosebud/Big Horn County line.

Figure 1. Tongue River, tributaries, diversion dams and trend sections.



Average annual discharge of the Tongue River at Miles City from 1940 to 2020 was 410 cubic feet per second (Figure 2). Drought conditions from 2000 to 2006 resulted in below average flows in the Tongue River. During this period, drought and irrigation demand nearly dewatered the river during summer months. Flows were above average in 2007, 2008, 2010, 2011, 2014, 2017, 2018 and 2019. Flows were near average in 2009 and 2015. Flows were below average in 2012, 2013, 2016, and 2020 (USGS 2020). The recent court settlement (2017) of the Water Compact between Montana and Wyoming is changing how spring discharge is managed at Tongue River Reservoir. Spring water releases from the reservoir will likely evolve as water managers try to maximize reservoir storage capacity while meeting other obligations of the Water Compact settlement.

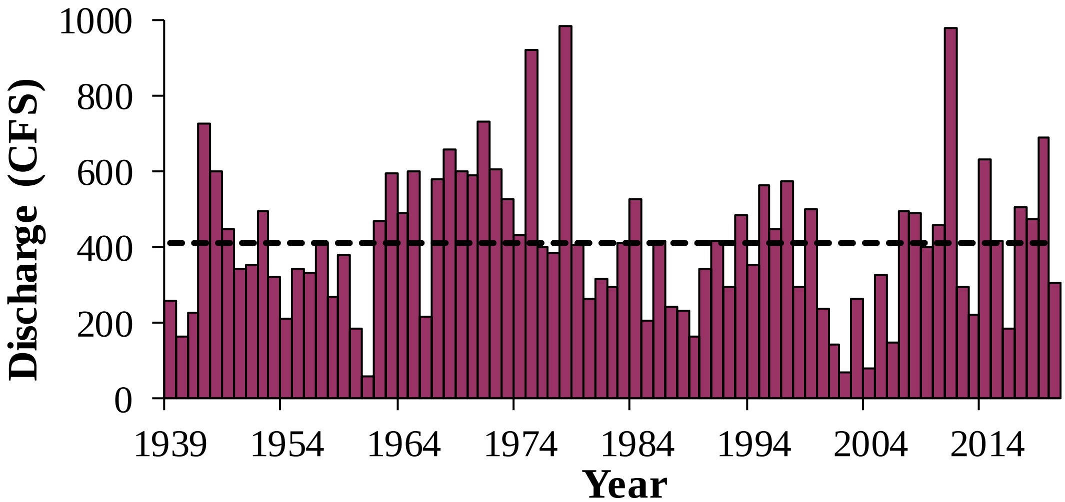


Figure 2. Mean annual discharge in cubic feet per second (CFS) of the Tongue River at Miles City, period of record 1939-2020. Dashed line represents overall mean annual discharge for the period of record.

METHODS

Annual trend sampling

Six trend sections were established to represent the six segments of river (Figure 1). Annual electrofishing of the Tongue River began in 2003. Electrofishing gear included a 14-foot flat bottom boat, 3500-watt generator, Coffelt VVP-15, single boom anode, ½ inch-mesh dip net and a single netter. In 2012 the Coffelt VVP-15 was replaced with the Smith-Root VVP-15B model. In 2014 the Smith-Root VVP-15B model was replaced with the Smith-Root GPP 5.0 model. One riverbank was continuously sampled in each section to reduce sampling bias and to include all habitat types. Seines were incorporated into annual trend sampling from 2003 to 2009. Trend sections were sampled in one-mile increments and for a total distance of five miles for Hirsch trend area, nine miles for the

State Line trend area, and six miles for each of the other four trend areas. Differences in the total length of trend sections is a result of the available locations for launching and retrieving a boat.

Catch per unit effort (C/f) (Fabrizio and Richards 1996; Hubert 1996; Ney 1996) was calculated as the number of fish caught per hour of electrofishing and used to describe the relative abundance of each fish species. Calculations of C/f were made for each species in each trend section, and C/f was compared between trend sections and across years.

Proportional size distribution (PSD) (Anderson and Neumann 1996; Guy et al. 2006 and 2007) was used to describe the length structure of fish species sampled. Calculations of PSD values were made for: Brown Trout (Milewski and Brown 1994), Channel Catfish, Sauger, Smallmouth Bass, Walleye, Northern Pike (Gablehouse 1984), Rainbow Trout (Anderson and Neumann 1996), River Carpsucker, Shorthead Redhorse Sucker, and White Sucker (Bister et al. 2000). Calculations of PSD values for Brown Trout and Rainbow Trout were made using data from trend section five. Calculations of PSD values for the other species were made using pooled data from all trend sections. Comparisons of PSD values were made between years.

Body condition of fish species sampled was calculated using relative weight (W_r) (Wege and Anderson 1978; Anderson and Neumann 1996; Blackwood et al. 2002). Relative weight was calculated for Brown Trout (Milewski and Brown 1994), Channel Catfish (Brown et al. 1995), Northern Pike (Anderson and Neumann 1996), Rainbow Trout, Sauger (Anderson and Neumann 1996), River Carpsucker, White Sucker, Shorthead Redhorse Sucker (Bister et al. 2000), Smallmouth Bass (Kolander et al. 1993), and Walleye (Murphy et al 1990). Calculations of mean W_r values for Brown Trout and Rainbow Trout were made using data from trend section five. Calculations of mean W_r for the other species were made using pooled data from all trend sections. Comparisons of mean W_r values were made between years.

Water chemistry

Water chemistry and river flows were recorded on days that electrofishing occurred. A handheld water meter (YSI pro 1030) was used to collect water temperature, dissolved oxygen, specific conductivity, and salinity data. A Secchi tube was used to quantify water clarity. River discharge was obtained from the United States Geological Survey web page (USGS 2020).

Fish passage

The head gate that regulates flow entering the Muggli Bypass channel was inspected and cleaned in the spring and summer of 2020. Inspecting and cleaning of debris at the head gate and entire length of bypass channel needs to be a biennial effort (summer & fall) conducted by fisheries staff. This and other needs and responsibilities at T&Y Dam by FWP and the irrigation district are included in an operations plan. The operation plan and a written agreement was provided by FWP to the T&Y Irrigation Board in 2020. The district supports the agreement but to date have not signed the document. FWP staff also assisted the T&Y District in 2020 by building and replacing the access ladder into the canal that is used by the district to clean debris from the fish louvers.

RESULTS

Annual trend sampling

All six trend sections were sampled using electrofishing gear in 2020. The locations of the trend sections have been the same since 2009 (Figure 1). Section locations, lengths and sampling dates are provided in Appendix 1, Table 1. Electrofishing catch rates by trend section for 2020 are summarized in Appendix 1, Table 2.

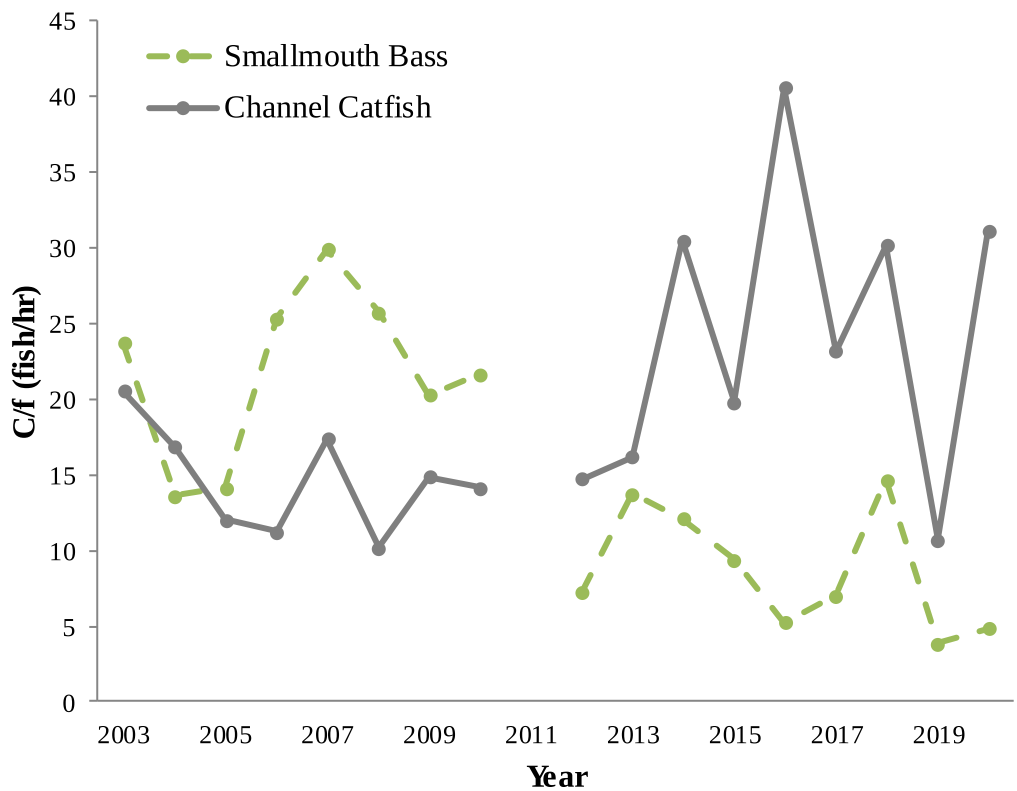


Figure 3. Relative abundance of Smallmouth Bass and Channel Catfish (y-axis) measured in C/f (fish/hour) as a function of year (x-axis) for the Tongue River 2003-2020.

Twenty-one species were collected in the 2020 trend survey of the Tongue River. Shorthead Redhorse Suckers were the most abundant species sampled overall. Channel Catfish and Smallmouth Bass were the most abundant game fish collected in the Tongue River. Catch rates suggest a decline in the number of Smallmouth Bass collected in recent years, possibly a function of a return to higher average discharges which are less favorable for bass than the drought conditions of the 2000's (Figure 3).

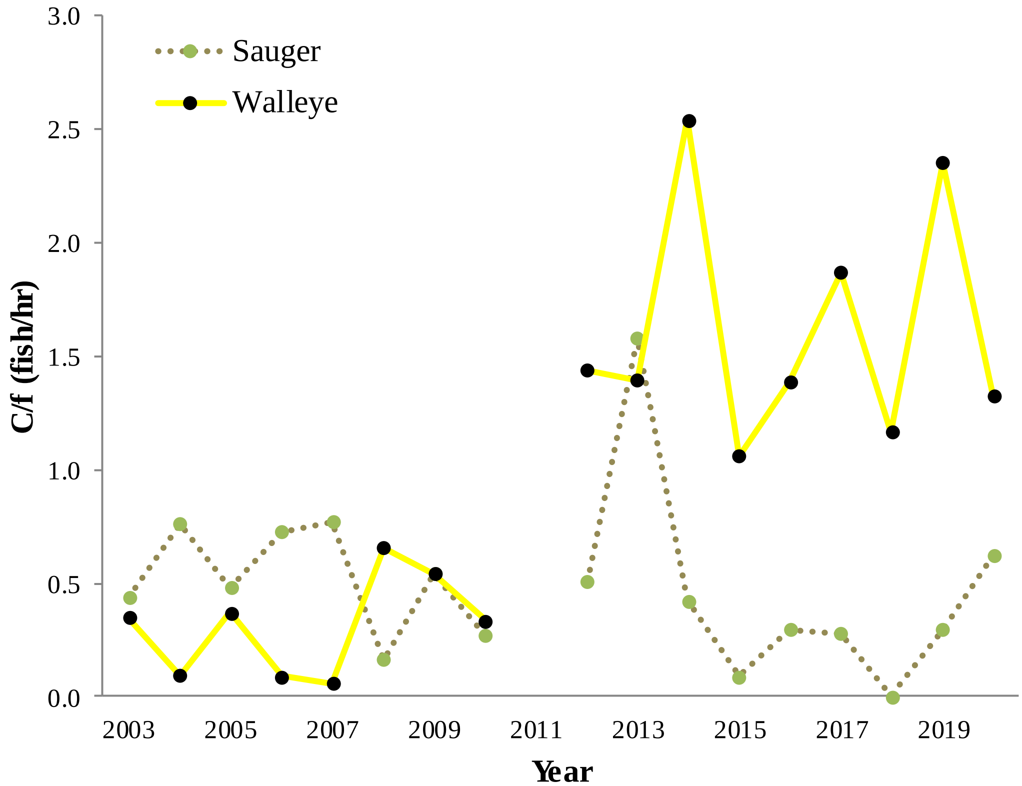


Figure 4. Relative abundance of Sauger and Walleye (y-axis) measured in C/f (fish/hour) as a function of year (x-axis) for the Tongue River 2003-2020.

Catch rates for Sauger and Walleye are both consistently low and somewhat variable. Sauger are generally only collected in the State Line and Miles City sections with collections from the middle sections rare and infrequent. Walleye are also not regularly sampled in all sections. Prior to completion of the Muggli Bypass in 2007 Walleye were only consistently found in the State Line section. Since completion of the passage projects that have restored connectivity between the Yellowstone River and the middle sections of the Tongue River as well as some relief from dewatering in the Miles City reach, Walleye have been consistently found in the State Line, Tongue River Dam, Brandenburg, and Miles City sections. In 2020, most Walleye were found in the Tongue River Dam, Miles City, and Stateline sections with one found in the Birney section as well (section 4). The overall abundance of Walleye throughout the river has been higher in recent years (Figure 4). Like Walleye, Freshwater Drum are a species that offers angling opportunity that has re-established its historical presence in the reach of the Tongue River between T&Y Diversion Dam and the Tongue River Dam. Freshwater Drum have been observed in electrofishing surveys in this reach nine of the twelve years since completion of the Muggli Bypass.

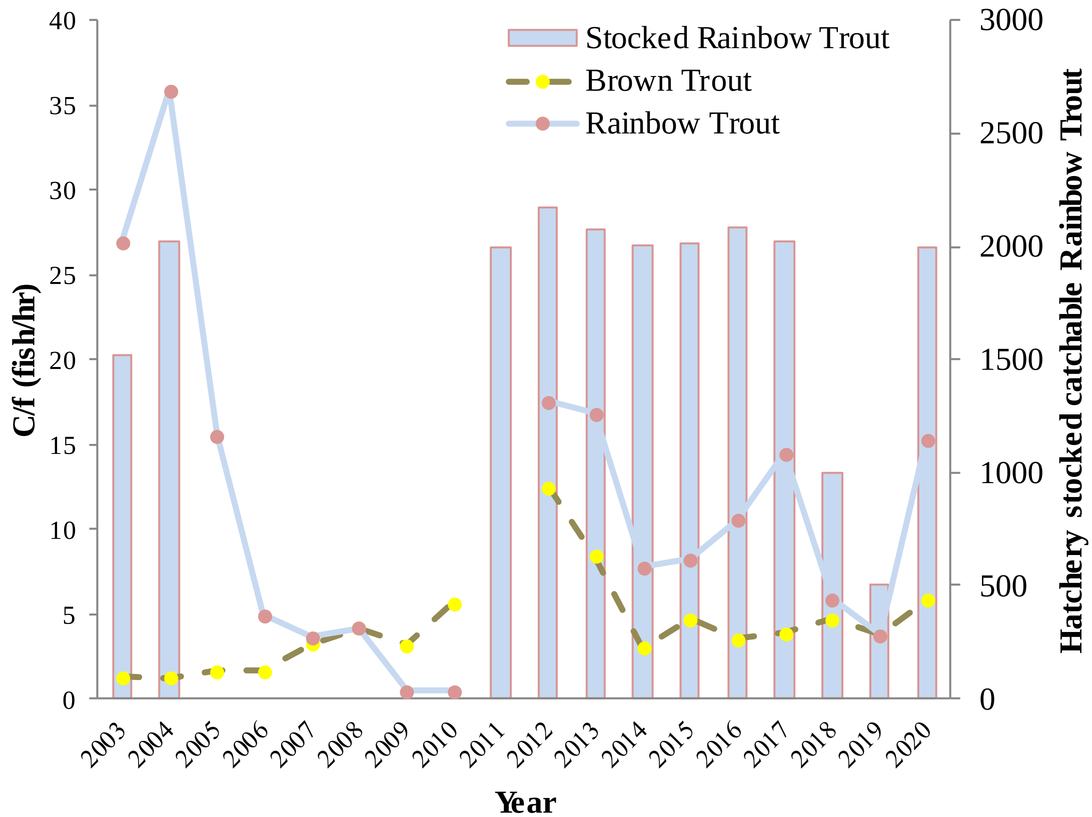


Figure 5. Relative abundance of Rainbow Trout and Brown Trout (primary y-axis) measured in C/f and number of catchable Rainbow Trout stocked as a function of year (x-axis) for the Tongue River Dam Tailrace 2003-2020.

Catch rates in the Tongue River Dam tailrace are providing a quality trout fishery. Catch rates averaged 12.5 trout per hour with a standard error of 1.8 from 2012 to 2017 after hatchery stocking resumed in 2011 (Figure 5). Reduced stocking rates in 2018 and 2019 due to a budget driven statewide reduction in catchable trout stockings returned lower catch rates averaging 4.8 trout per hour with a standard error of one. The 2019 legislature restored the lost fisheries budget and a stocking rate of 2000 catchable Rainbow Trout was resumed in 2020. The effect on catch rates was immediate and the 2020 catch rate was 15.3 trout per hour. Size structure measured by PSD suggests Rainbow Trout up to preferred size and Brown Trout up to trophy size were available to anglers in 2020 (Appendix 2 table 2). Body condition measured by W_r suggest trout in the Tongue River Dam tailrace fishery are of above average condition for their size (Appendix 2 table 2).

Size structure (PSD) and body condition (W_r) have been consistent throughout the study period (2003-2020) for most species. Trout, Sauger, and Walleye have demonstrated the most variability among game fishes (Appendix 2 tables 2 and 3). Data indicates Sauger catch rates and relative weights have been particularly low in recent years. Data for this fisheries Rainbow and Brown Trout continue to suggest size structure and relative weights are higher than average. Smallmouth Bass and Channel Catfish have had consistent results with the size structure of bass skewed heavily towards stock and quality size fish (Appendix 2 table 1). Channel Catfish size structure has been more evenly distributed across size classes at times but in recent years the catch has been skewed toward quality size fish (Appendix 2 table 1). Results of size structure and body condition indexes have been less variable for non-game fishes (Shorthead Redhorse Sucker, and White Sucker). Size structure is generally more evenly distributed across size classes and relative weights are consistently high (Appendix 2 table 4). Sample size is likely a strong factor influencing variability of index results. Goldeye are a non-game fish species that like Shorthead Redhorse Sucker and White Sucker are very abundant in the Yellowstone River. The fish passage improvements in the Tongue River have resulted in this species recolonizing the reach between T&Y Diversion Dam and Tongue River Dam. Since completion of the Muggli Bypass in 2008 Goldeye have been observed in electrofishing surveys in this reach every year.

Fish passage

The Muggli Bypass was not sampled in 2020. Passage was evaluated from 2008 to 2012. Twenty fish species have been documented using the Muggli Bypass since its construction. Fish passage for most species was deemed successful based on similar trends in abundances between the bypass channel and the river downstream of the bypass (McKoy 2012). However, Shovelnose Sturgeon, which are found in the Tongue River below T&Y Diversion Dam, have not been documented passing through the bypass. Two small experiments were conducted in 2009 and 2010 to evaluate shovelnose sturgeon passage by releasing tagged fish into various segments of the bypass channel. See Appendix 4 and 5 in Bollman (2019) for a detailed report for both experiments. When inspected in the fall of 2018, the head gate that regulates flow in the Muggli Bypass channel was plugged full of silt and debris and it is likely that fish passage was unavailable for most of 2018. Debris was cleaned out in the fall of 2018 and Spring of 2019, restoring the passage route. The head gate was inspected and cleaned in the spring and summer of 2020 to ensure fish passage opportunity.

The T&Y Canal louver fish screens installed in 1999 had a thin coating on them that has since been worn away by flow and suspended sediment and the exposed metal has been rusting. A private donation by Theresa Anderson and matching funds from a Future Fisheries Grant was secured to have the louvers removed, shipped, cleaned, galvanized, and re-installed. Whether the louvers were worth restoring or if the money would be better invested toward building new louvers came into question so in January 2018 one of the steel louvers was sent off as a test. It was removed before the irrigation season and shipped to Northwest Paint and Sandblasting in Spokane, Washington where it was cleaned and then galvanized by Spokane Galvanizing. The louver was re-installed in June 2018. Inspection of the galvanized louver after the 2019 and 2020 irrigation season demonstrates the quality and integrity of the sandblasting and galvanizing was successful thus far. Just as there is still some room for improvement with fish passage at T&Y (i.e. in regard to Shovelnose Sturgeon), entrainment protection could also be improved. McKoy (2013) summarized entrainment monitoring efforts at T&Y Diversion Dam pre (i.e. 1997) and post louvre and fish return system construction (i.e. 2004, 2005, and 2013). While post fish louvre sampling demonstrates the louvre and fish return system is returning fish to the Tongue River, two out of three post louvre study years the number of fish being entrained down the canal exceeded the number returning to the Tongue River through the fish return system.

Fish passage and entrainment protection efforts at T&Y Diversion Dam have been wildly successful and are impressive considering the lack of Endangered Species Act funding that is typically associated with passage and entrainment projects. The spirit of cooperation and good working relationship between the T&Y Irrigation District and FWP that resulted in these improvements still exists and provides potential for future improvements for fish passage, entrainment protection, and irrigation water delivery. A written operations plan that will ensure continued mutually beneficial operation of existing infrastructure and some vision for future improvements is expected to be signed in 2021.

DISCUSSION

Changes to Tongue River fish populations attributable to coal bed natural gas production have not been documented but may exist as they are difficult to quantify. Coal bed methane extraction is currently at a low level of development because of market prices. Continued monitoring will be important to detect impacts to fisheries if activity expands in the future. Low sample sizes of small bodied fishes preclude use for trend analysis. Mini-fyke nets could be added to the sampling regime in the future to provide a more robust sample design for small bodied fishes. Mini-fyke nets were efficient and effective for detecting composition of the small bodied fish assemblage of the Yellowstone River (Duncan et al. 2012). Addition of this gear is planned for 2021.

Results of this study must be viewed with some caution. The use of data combined from all trend sections and the variation inherent to prairie stream sampling will make detection of changes in fish populations difficult. Large sample sizes are needed to overcome the inherent variation in field data. Continued and increased monitoring is recommended because of the potential for further expansion of irrigation and mining activity.

Despite the success of the Muggli Bypass, improvements are needed to increase its effectiveness. Shovelnose Sturgeon is the only species observed in abundance below the dam that has not been documented successfully navigating the bypass. The bypass was designed specifically to pass Shovelnose Sturgeon. Water velocity and turbulence between boulders in the lower third of the channel are hypothesized to prevent sturgeon from using the constructed bypass channel. Water velocities in the lower third of the bypass were rarely below 7 ft/s during periods of high flow. Recommended water velocity for Shovelnose Sturgeon passage is between 3 and 4 ft/s (White and Medford 2002). The high-water velocities in the bypass can be attributed to a steeper than designed gradient in the lower third of the constructed channel that compensates for a flatter than designed slope in the upper third of the constructed channel. Spacing of the boulders in the channel may also be a problem. Many of the boulders were placed with a gap of 8 to 10 inches; attempting to offset the steeper slope of the channel. The narrow gap may be a barrier to the passage of large fish. The recommended boulder spacing was intended to be 24 inches (White and Medford 2002). In 2008 & 2009, when river discharge exceeded 800 cfs attraction velocities of 2 ft/s maintained from the bypass channel to the thalweg of the river were masked by turbulent water flowing over T&Y Diversion Dam. During periods of high discharge fish may have difficulty finding the bypass channel entrance due to this back-eddy effect. To address velocity issues in the lower third of the bypass and the masking of attraction flows the channel was re-sloped and moved downstream 1.5 channel widths in the fall of 2009. This modification reduced the magnitude of decreased attraction flows, but sampling results indicates problems still exist, particularly water velocities in the lower third of the channel. Increasing the spacing between boulders, using different boulder placement patterns, and modifying the slope of the entire bypass channel to design specifications should be considered as future adaptive management options.

Pallid Sturgeon recovery efforts continue to occur in the Lower Yellowstone River and during 2020 a telemetered wild adult Pallid Sturgeon as well as a hatchery origin Pallid Sturgeon were documented in the Tongue River. The wild male Pallid Sturgeon with telemetry tag code 227 on frequency 149.760 was first observed in the Tongue River on June 5th at river mile 1, was observed furthest upstream on June 8th at river mile 13 and was observed exiting the Tongue River on June 15th. The hatchery origin Pallid Sturgeon of unknown sex with telemetry tag code 177 on frequency 149.620 was first observed in the Tongue River on June 5th at river mile 5, was observed furthest upstream on June 8th at river mile 11 and observed exiting the Tongue River on June 13th. This hatchery origin Pallid Sturgeon was netted and assessed while in the Tongue River and was of a size that would be expected to still be sexually immature. As a result of Pallid Sturgeon presence in the Tongue River larval sampling was conducted from June 12-22 and 233 acipensiform larvae were collected and have been sent to Ed Heist at Southern Illinois University for species identification. It is expected that they will likely come back as Shovelnose Sturgeon. Shovelnose Sturgeon aggregate in high densities in the reach below T&Y Diversion Dam. Past tagging studies have demonstrated these to be Yellowstone River migrants. This reach has been used on many occasions to successfully collect pre-spawn Shovelnose Sturgeon that have been transported to Garrison Dam for production to supplement the species in the Bighorn River in Wyoming upstream of Yellowtail Reservoir. Pallid Sturgeon which are a federally endangered species whose failure to naturally recruit since the construction of the Missouri River Dams (Fort Peck, and Garrison) is believed to be a function of lack of adequate drift distance between their current spawning grounds (i.e. river mile 4-8 of the Yellowstone River) and the dead zone in the headwaters of Lake Sakakawea. While some passage into upstream reaches by wild adult Pallid Sturgeon has been documented since 2014 it is believed that too few adults may be making it into these upstream reaches and the odds of them finding each other in suitable spawning habitat far enough upstream may explain why no recruitment has been documented in spite of observed spawning. However, hope remains for the next generation of Pallid Sturgeon (i.e. hatchery origin) that exist in much higher numbers and whose earlier year classes are beginning to reach sexual maturity. The documented use of the Tongue River in 2020, anticipated improved passage beyond Intake Diversion Dam as a result of bypass channel completion by Spring of 2022, and the maturation of the hatchery origin generation of Pallid Sturgeon provide justification for FWP and the irrigation district to plan for future improvement of the Muggli bypass that would facilitate sturgeon passage and potentially increase the habitat available for migrating sturgeon by over 150 river miles.

Keywords: Fish Passage, T&Y Diversion Dam, Coal Bed Methane, Tongue River Railroad, Tongue River Reservoir, Shovelnose Sturgeon, Sauger

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Appendix 1

Table 1. Summary of Tongue River sections and water quality, 2020.

	Section Number and Name					
	1 Miles City	**2 Hirsch**	**3 Brandenberg**	**4 Birney**	**5 TR Dam**	**6 State Line**
Date Sampled	6/11/2020	6/18/2020	6/17/2020	6/16/2020	6/15/2020	6/12/2020
Latitude Start	46.24981	46.04757	45.31975	45.30101	45.13745	44.99658
Longitude Start	-105.75264	-105.9397	-106.51936	-106.56555	-106.76632	-106.88007
Latitude Stop	46.31088	46.07417	45.82478	45.32097	45.17194	45.0112
Longitude Stop	-105.76489	-105.92361	-106.23136	-106.52156	-106.7288	-106.8218
River Mile Start/Stop	20 - 15	51 - 46	90 - 85	165 - 160	189 - 184	209 - 199
Water Temperature (Fahrenheit)	68.5	62.6	64.2	64.6	67.8	68.7
Specific Conductivity (mS/cm)	799	813	724.0	654	533	355
Dissolved Oxygen (mg/L)	8.4	9.1	8.6	8.2	11.6	8.5
Salinity (ppt)	0.4	0.4	0.4	0.3	0.3	0.2
Turbidity (cm)	6		29	78	85	
River Flow (cfs)	859	813	501	471	510	697

Appendix 1.

Table 2. Results of Tongue River electrofishing by section, 2020.

Species	N	Catch/ Hour	Percent of Catch	Length Mean (mm)	Length Range (mm)	Weight Mean (gm)	Weight Range (gm)
Section 1 Miles City (T&Y Dam - Yellowstone R.) - 119 minutes; 6 river miles							
Channel Catfish	30	15.1	8.5	474	280 - 704	1215	240 - 3530
Common Carp	5	2.5	1.4	449	347 - 667	1468	580 - 3860
Flathead Chub	20	10.1	5.6	159	117 - 205	45	20 - 100
Freshwater Drum	4	2.0	1.1	346	313 - 384	525	340 - 680
Goldeye	57	28.7	16.1	330	274 - 359	301	180 - 370
Burbot	1	0.5	0.3	195	-	20	-
Longnose Sucker	1	0.5	0.3	437	-	920	-
River Carpsucker	194	97.8	54.8	394	290 - 517	870	280 - 2020
Sauger	3	1.5	0.8	405	314 - 545	693	220 - 1500
Stonecat	2	1.0	0.6	145	125 - 165	20	-
Shorthead Redhorse Sucker	22	11.1	6.2	225	126 - 395	161	10 - 520
Shovelnose Sturgeon	2	1.0	0.6	739	652 - 825	1945	1330 - 2560
Smallmouth Bass	4	2.0	1.1	263	175 - 386	350	60 - 920
Walleye	3	1.5	0.8	445	289 - 550	977	220 - 1580
Western Silvery/Plains Minnow	6	3.0	1.7	108	100 - 117	12	10 - 20
	354	178	100				
Section 2 (Hirsch) - 82 minutes; 5 river miles							
Channel Catfish	11	8.0	14.9	410	244 - 635	772	120 - 2450
Common Carp	3	2.2	4.1	449	411 - 510	1187	960 - 1660
Flathead Chub	12	8.8	16.2	168	117 - 206	57	20 - 100
Goldeye	5	3.7	6.8	340	309 - 370	346	240 - 380
River Carpsucker	4	2.9	5.4	353	346 - 358	605	600 - 640
Sauger	1	0.7	1.4	328	-	300	-
Shorthead Redhorse Sucker	35	25.6	47.3	291	159 - 389	305	60 - 640
Smallmouth Bass	1	0.7	1.4	174	-	60	-
White Sucker	1	0.7	1.4	185	-	60	-
Western Silvery/Plains Minnow	1	0.7	1.4	118	-	20	-
	74	54	100				

Appendix 1.

Table 2. Results of Tongue River Electrofishing by Section, 2020 (continued).

Species	N	Catch/ Hour	Percent of Catch	Length Mean (mm)	Length Range (mm)	Weight Mean (gm)	Weight Range (gm)
Section 3 (Brandenberg) - 102 minutes; 6 river miles							
Channel Catfish	21	12.4	10.7	503	370 - 680	1222	420 - 3320
Common Carp	9	5.3	4.6	482	364 - 595	1729	780 - 3300
Flathead Chub	2	1.2	1.0	146	127 - 165	30	20 - 40
Goldeye	12	7.1	6.1	328	311 - 350	309	250 - 400
Rock Bass	9	5.3	4.6	357	140 - 638	898	60 - 2980
River Carpsucker	40	23.5	20.3	384	308 - 475	792	400 - 1400
Stonecat	1	0.6	0.5	145	-	20	-
Shorthead Redhorse Sucker	67	39.4	34.0	296	82 - 400	349	40 - 700
Smallmouth Bass	23	13.5	11.7	233	126 - 422	250	20 - 1020
White Sucker	12	7.1	6.1	305	192 - 402	415	80 - 760
Western Silvery/Plains Minnow	1	0.6	0.5	135	-	20	-
	197	116	100				
Section 4 (Birney) - 103 minutes; 6 river miles							
Channel Catfish	108	62.9	32.8	552	350 - 622	1892	260 - 3200
Common Carp	9	5.2	2.7	556	515 - 606	2195	1520 - 2760
Goldeye	13	7.6	4.0	353	303 - 396	425	280 - 660
Longnose Sucker	1	0.6	0.3	437	-	1020	-
River Carpsucker	61	35.5	18.5	408	336 - 474	938	540 - 1420
Shorthead Redhorse Sucker	103	60.0	31.3	396	288 - 475	680	280 - 1040
Stonecat	1	0.6	0.3	142	-	40	-
Smallmouth Bass	7	4.1	2.1	230	163 - 330	200	60 - 490
White Sucker	24	14.0	7.3	317	225 - 468	491	120 - 1140
Walleye	1	0.6	0.3	518	-	1300	-
Yellow Perch	1	0.6	0.3	143	-	20	-
	329	192	100				

Appendix 1.

Table 2. Results of Tongue River Electrofishing by Section, 2020 (continued).

Species	N	Catch/ Hour	Percent of Catch	Length Mean (mm)	Length Range (mm)	Weight Mean (gm)	Weight Range (gm)
Section 5 (Tongue River Dam) - 115 minutes; 6 river miles							
Brown Trout	11	5.7	2.7	385	228 - 679	1035	160 - 3940
Channel Catfish	178	92.9	43.0	562	350 - 708	1947	700 - 4140
Common Carp	10	5.2	2.4	565	509 - 650	2850	2100 - 4200
Goldeye	1	0.5	0.2	406	-	480	-
Longnose Sucker	1	0.5	0.2	157	-	40	-
Rainbow Trout	29	15.1	7.0	438	217 - 590	1463	220 - 2800
River Carpsucker	24	12.5	5.8	426	383 - 468	1140	1800 - 1660
Shorthead Redhorse Sucker	138	72.0	33.3	423	332 - 520	919	420 - 1680
Smallmouth Bass	4	2.1	1.0	285	177 - 339	355	100 - 520
Stonecat	3	1.6	0.7	160	148 - 174	43	30 - 60
Walleye	8	4.2	1.9	521	254 - 729	1909	120 - 4990
White Sucker	7	3.7	1.7	355	257 - 470	663	180 - 1380
	414	216	100				
Section 6 (Stateline) - 155 minutes; 10 river miles							
Channel Catfish	3	1.2	1.8	801	753 - 840	7166	4200 - 8500
Common Carp	10	3.9	5.9	606	455 - 700	3340	2160 - 4600
Longnose Sucker	3	1.2	1.8	198	172 - 247	90	60 - 150
Rock Bass	2	0.8	1.2	151	136 - 165	80	60 - 100
Sauger	3	1.2	1.8	521	372 - 620	1273	400 - 1940
Shorhead Redhorse Sucker	80	31.0	47.3	396	160 - 510	754	50 - 1300
Smallmouth Bass	16	6.2	9.5	229	90 - 432	310	40 - 1220
Spottail Shiner	15	5.8	8.9	106	96 - 122	11	10 - 20
Walleye	3	1.2	1.8	467	333 - 550	1267	300 - 2000
White Sucker	34	13.2	20.1	328	132 - 480	605	40 - 1380
	169	65	100				

Appendix 2

Table 1. Size distribution and body condition of abundant game fishes of the Tongue River

Smallmouth Bass

		PSD					Wr				
Year	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
2003	149	81	15	4	-	-	104	89	79	-	-
2004	143	83	14	3	-	-	91	96	74	-	-
2005	264	87	11	2	1	<1	87	80	105	67	93
2006	277	88	8	3	1	-	92	85	93	11	-
2007	112	42	49	9	-	-	89	97	102	-	-
2008	304	87	11	2	1	-	94	87	53	86	-
2009	262	85	10	2	3	-	93	92	82	92	-
2010	321	82	13	4	1	-	92	90	79	87	-
2012	81	73	20	8	-	-	105	91	85	-	-
2013	148	84	5	9	2	-	91	89	76	85	-
2014	83	82	8	8	1	-	89	94	80	87	-
2015	69	80	10	10	-	-	88	93	90	-	-
2016	46	72	22	7	-	-	88	95	89	-	-
2017	53	72	21	4	4	-	96	93	87	87	-
2018	37	65	22	11	3	-	110	95	87	94	-
2019	12	67	8	25	-	-	93	88	76	-	-
2020	38	63	21	11	5	-	99	95	95	97	-

Channel Catfish

		PSD					Wr				
Year	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
2003	215	29	50	19	3	<1	96	95	88	126	96
2004	177	24	61	1	13	-	89	108	93	103	-
2005	341	42	54	4	-	-	94	101	89	-	-
2006	118	16	79	5	-	-	95	106	96	-	-
2007	472	29	35	29	7	-	92	96	100	102	-
2008	124	39	48	11	3	-	96	114	99	96	-
2009	191	41	48	10	1	-	95	110	110	99	-
2010	210	37	55	6	2	-	102	120	110	95	-
2012	197	16	63	20	1	-	104	104	106	105	-
2013	174	25	66	8	1	-	96	104	101	83	-
2014	348	14	74	7	5	-	93	104	97	101	-
2015	220	11	76	9	4	-	93	110	102	103	-
2016	405	16	77	6	1	-	92	107	103	113	-
2017	244	9	81	7	3	-	88	109	101	124	-
2018	178	11	80	6	3	-	104	115	101	129	-
2019	73	4	90	4	1	-	87	114	108	112	-
2020	348	7	78	14	1	-	98	105	101	120	-

Appendix 2 continued

Table 2. Size distribution and body condition of Tongue River Dam tailrace trout

Brown Trout

		PSD					Wr				
Year	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
2003	2	-	50	-	50	-	-	112	-	97	-
2004	0	-	-	-	-	-	-	-	-	-	-
2005	3	67	33	-	-	-	105	119	-	-	-
2006	10	50	20	30	-	-	97	91	128	-	-
2007	3	67	-	-	33	-	81	-	-	52	-
2008	10	-	22	11	56	11	-	82	176	129	123
2009	7	-	67	14	17	-	-	129	127	189	-
2010	14	-	77	8	15	-	-	107	117	116	-
2012	31	23	10	39	16	13	113	112	120	127	129
2013	17	17	-	17	28	38	77	-	115	87	97
2014	7	14	14	-	14	57	132	94	-	106	100
2015	8	-	-	-	13	88	-	-	-	114	95
2016	7	-	43	-	14	43	-	101	-	119	88
2017	7	29	14	-	14	43	107	122	-	117	108
2018	8	25	38	-	38	-	109	117	-	117	-
2019	6	-	17	-	-	83	-	80	-	-	105
2020	11	9	45	-	9	36	124	127	-	126	107

Rainbow Trout

		PSD					Wr				
Year	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
2003	43	71	24	5	-	-	133	113	106	-	-
2004	58	83	17	-	-	-	123	106	-	-	-
2005	29	41	59	-	-	-	109	108	-	-	-
2006	9	89	11	-	-	-	113	96	-	-	-
2007	0	-	-	-	-	-	-	-	-	-	-
2008	8	-	50	50	-	-	-	81	94	-	-
2009	2	-	100	-	-	-	-	104	-	-	-
2010	1	-	-	100	-	-	-	-	98	-	-
2012	42	92	8	-	-	-	136	139	-	-	-
2013	27	36	55	9	-	-	146	119	108	-	-
2014	13	8	85	8	-	-	125	111	100	-	-
2015	14	-	64	36	-	-	-	126	110	-	-
2016	21	57	24	19	-	-	138	127	116	-	-
2017	24	17	54	29	-	-	149	123	94	-	-
2018	10	50	20	30	-	-	125	118	109	-	-
2019	6	-	33	67	-	-	-	135	124	-	-
2020	27	26	22	52	-	-	145	142	126	-	-

Appendix 2 continued

Table 3. Size distribution and body condition of Sauger and Walleye of the Tongue River

Sauger

		PSD					Wr				
Year	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
2003	5	20	40	40	-	-	97	88	91	-	-
2004	8	13	-	38	50	-	46	-	86	101	-
2005	9	13	50	25	13	-	63	82	79	67	-
2006	8	-	25	75	-	-	-	83	88	-	-
2007	58	29	43	26	2	-	84	86	83	98	-
2008	2	-	-	100	-	-	-	-	99	-	-
2009	8	-	29	57	14	-	-	71	86	94	-
2010	4	-	50	50	-	-	-	87	90	-	-
2012	8	80	-	-	-	20	96	-	-	-	128
2013	18	12	88	-	-	-	87	88	-	-	-
2014	5	-	20	60	20	-	-	56	86	92	-
2015	1	-	-	100	-	-	-	-	96	-	-
2016	3	-	-	100	-	-	-	-	85	-	-
2017	3	-	-	67	33	-	-	-	69	90	-
2018	0	-	-	-	-	-	-	-	-	-	-
2019	2	-	50	50	-	-	-	79	71	-	-
2020	7	-	57	-	43	-	-	82	-	80	-

Walleye

		PSD					Wr				
Year	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
2003	4	-	50	25	25	-	-	99	112	100	-
2004	1	-	-	-	-	-	-	-	-	-	-
2005	7	17	50	33	-	-	82	85	91	-	-
2006	1	-	-	-	-	-	-	-	-	-	-
2007	55	15	67	17	-	-	92	91	96	-	-
2008	8	43	29	14	14	-	87	148	94	80	-
2009	7	83	17	-	-	-	91	88	-	-	-
2010	5	33	67	-	-	-	84	98	-	-	-
2012	23	33	40	20	7	-	93	97	94	100	-
2013	15	87	13	-	-	-	92	101	-	-	-
2014	30	23	40	30	7	-	86	90	95	90	-
2015	12	8	67	17	8	-	93	109	104	95	-
2016	12	-	75	17	8	-	-	92	91	83	-
2017	20	5	60	35	-	-	91	90	94	-	-
2018	7	-	29	57	14	-	-	97	85	96	-
2019	12	25	33	25	17	-	84	86	91	100	-
2020	15	27	13	40	20	-	83	87	95	94	-

Appendix 2 continued

Table 4. Size distribution and body condition of abundant non-game fishes of the Tongue River

Shorthead Redhorse Sucker

		PSD					Wr				
Year	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
2003	249	16	61	23	-	-	85	81	78	-	-
2004	877	8	24	31	37	1	75	88	89	93	76
2005	1080	16	9	40	34	<1	84	85	87	89	80
2006	431	27	8	30	34	<1	94	86	95	94	94
2007	644	19	17	33	6	<1	103	90	94	99	56
2008	932	38	24	13	26	<1	81	88	93	97	100
2009	798	32	23	15	30	1	89	85	97	97	94
2010	1063	22	29	16	32	<1	79	70	76	79	82
2012	895	9	33	17	40	2	84	75	75	83	79
2013	1065	11	30	25	33	1	80	73	73	78	81
2014	227	16	26	29	26	2	90	86	85	95	100
2015	226	15	25	36	22	1	89	86	87	87	91
2016	197	6	27	41	25	1	82	83	87	93	94
2017	228	12	28	32	27	<1	90	85	86	95	98
2018	120	8	17	37	37	2	99	96	94	98	103
2019	169	14	30	27	28	1	86	94	91	81	110
2020	211	12	23	35	29	1	97	98	95	98	92

River Carpsucker

		PSD					Wr				
Year	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
2003	154	5	24	57	6	-	88	81	93	93	-
2004	120	3	43	51	4	-	182	87	97	88	-
2005	174	8	19	61	12	-	86	83	93	87	-
2006	39	19	30	51	-	-	96	92	98	-	-
2007	1602	6	20	61	13	1	92	93	98	98	83
2008	144	30	33	35	1	-	84	89	95	85	-
2009	144	16	30	52	3	-	85	85	93	94	-
2010	133	15	33	46	5	-	89	91	93	87	-
2012	168	1	49	45	5	-	99	96	97	99	-
2013	105	1	35	61	3	-	99	96	95	94	-
2014	134	4	34	59	3	-	86	95	93	115	-
2015	114	2	27	68	4	-	94	96	92	100	-
2016	143	3	26	66	4	-	96	95	94	93	-
2017	139	1	30	68	1	-	81	87	94	79	-
2018	34	-	47	47	6	-	-	90	101	87	-
2019	45	4	22	62	11	-	96	101	94	87	-
2020	137	-	12	81	7	-	-	98	99	104	-

Appendix 2 continued

Table 4 continued. Size distribution and body condition of abundant non-game fishes of the Tongue River

White Sucker

		PSD					Wr				
Year	N	S-Q	Q-P	P-M	M-T	T	S-Q	Q-P	P-M	M-T	T
2003	258	39	35	23	3	-	94	89	98	84	-
2004	354	37	12	36	14	-	99	97	99	103	-
2005	127	26	12	38	25	-	84	84	96	97	-
2006	127	46	34	20	-	-	87	102	99	-	-
2007	231	38	47	13	6	-	98	88	85	91	-
2008	243	25	31	26	17	1	94	93	99	101	27
2009	253	21	29	30	22	-	109	87	97	102	-
2010	414	19	31	35	15	-	89	90	95	97	-
2012	361	18	31	27	25	-	100	97	97	100	-
2013	401	15	25	40	20	-	91	92	92	93	-
2014	137	12	22	42	25	-	84	91	97	98	-
2015	63	8	24	56	13	-	83	93	94	95	-
2016	71	13	15	49	23	-	85	92	96	97	-
2017	62	16	8	39	37	-	95	85	96	99	-
2018	34	35	15	24	26	-	100	98	97	101	-
2019	28	29	29	11	32	-	83	99	94	100	-
2020	77	23	27	27	22	-	101	105	104	108	-