

2018 Missouri River – Holter Dam Tailwater Monitoring

Status Report for Northwestern Energy FERC Project 2188

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January 2019

At the November 2017 Missouri River Technical Advisory Committee (MOTAC) meeting, Montana Fish, Wildlife & Parks was awarded \$32,153 from Northwestern Energy for monitoring of the Missouri River and the fishery below Holter Dam as part of FERC license 2188. This report summarizes the results of the 2018 monitoring.

Missouri River trout populations

Two sections of the Missouri River downstream from Holter Dam were electrofished at night using aluminum jet boats. The Craig section is 5.6 miles long and located from river mile (RM) 2.5 to 8.1 (Figure 1). The Cascade section is 4.1 miles long and is located from RM 24.2 to 28.3 (Figure 2). Jet propelled boats were equipped with headlights and fixed boom-type electrofishing systems using stainless steel cable droppers suspended from each boom. Electricity from 240-VAC generators was converted to smooth DC using Coffelt or Smith-Root rectifying units. Brown trout (Salmo trutta) estimates were conducted in each section in spring from the 24th of April to the 10th of May. Two jet boats were used in the Craig section, and one boat was used in the Cascade section with two nights of marking runs and two nights of recapture runs in each section. Rainbow trout (Oncorhynchus mykiss) estimates were conducted in fall from the 1st of October to the 16th of October and two boats were used in each section. Three nights of marking runs and two nights of recapture runs were completed in the Craig section and two nights of marking and two nights of recapture runs were completed in the Cascade section. Data were analyzed using the Montana Fish, Wildlife and Parks (MFWP) FA+ statistical software (MFWP 2004). Population estimates were calculated using the partial Loglikelihood or modified Petersen's methods. The significance level for all estimates was $\alpha < 0.05$.

2018 Missouri River trout population summary

In spring 2018 in the Craig section, the estimate of brown trout 10 inches long and greater was 892 (SD 110.0) per mile (Figure 3). The mean for years when population estimates were calculated based on data since 1982 (n = 34) was 573 per mile (Figure 3). The most abundant size class of brown trout sampled was 12 to 15 inches in 2018. We sampled 57 burbot (*Lota lota*) and 50 walleye (*Sander vitreus*). The burbot sampled ranged from 15.0 to 31.0 inches long and 0.6 to 6.1 lbs. The walleye sampled ranged from 9,130 cfs during marking runs to 12,400 cfs during recapture runs. These flows are higher than most years and resulted in relatively difficult conditions, especially during the recapture runs, with turbid water downstream of Little Prickly Pear Creek until sufficient mixing occurred. These conditions likely contributed to the relatively high error associated with the population estimate compared to some years.

In fall 2018 in the Craig section, the estimate of rainbow trout 10 inches long and greater was 3,792 (SD 73.3) per mile (Figure 3). The estimate of 3,792 fish per mile was the lowest since 2010, but was still greater than the long-term average of 3,405 fish per mile based on annual estimates since 1982 (n = 37). The size structure of rainbow trout 10 inches and larger was dominated by larger fish with 16 to 19 inch fish most common. While reported estimates are fish 10 inches and larger, estimates can be obtained for fish down to 6 inches. Of all rainbow trout 6 inches and larger, 30% were between 6 and 10 inches, which is the greatest proportion of small fish observed since 2010 and the third highest since 1999. We sampled 51 walleye and 76 burbot. The burbot ranged from 6.3 to 26.5 inches and 0.06 to 3.6 lbs. The walleye ranged from 8.8 to 28.1 inches and 0.2 to 8.2 lbs.

A substantial number of rainbow trout were flushed into the Missouri River from Holter Reservoir in 2011. Of the 5,787 rainbow trout handled in 2011 in the Craig section, approximately 19% (1,125) were hatchery fish. The number of hatchery trout declined in each year through 2017 to 71 hatchery rainbows in 2017 (1.3% of rainbows handled). Much higher flows occurred in 2018 than recent years, resulting in a total of 159 hatchery trout handled in 2018 (2.1% of rainbows handled).

In spring 2018 in the Cascade section, the estimate of brown trout 10 inches long and greater was 297 (SD 32.6) per mile (Figure 4). This was 75 percent of the long-term average of 395 per mile and the lowest value observed since 2003. The most abundant size class of brown trout was 16 to 20 inches. We sampled 23 burbot and 7 walleye. The burbot ranged from 13.3 to 25.8 inches and 0.37 to 3.17 lbs. The walleye ranged from 13.6 to 24.5 inches and 0.76 to 6.74 lbs. Flows during spring electrofishing in the Cascade section ranged from approximately 11,500 cfs during marking runs to 16,000 cfs during recapture runs as measured at the gage in Cascade. These flows are higher than most years and resulted in relatively difficult conditions, especially during the recapture runs, with high, fast, and turbid water. These conditions likely contributed to the relatively high error associated with the population estimate compared to some years.

In fall 2018 in the Cascade section, the estimate of rainbow trout 10 inches long and greater was 1,125 (SD 52.9) per mile (Figure 4). This estimate was 70 percent of the long-term average of 1,602 per mile, and represents the lowest estimate since 1994. Similar to rainbow trout in the Craig section, considering rainbow trout that were 6 inches and greater in the Cascade section, 42 percent were between 6 and 10 inches. This was the second highest value observed since 2005, with only 2010 higher when 45 percent of the rainbows were between 6 and 10 inches. We sampled 40 walleye and 50 burbot in the Cascade section. The walleye ranged from 4.6 to 22.8 inches long. Thirty-five of the 40 walleye were less than 10 inches, similar to in 2017. The burbot sampled ranged from 6.0 to 25.5 inches

Water flow

For the 2018 calendar year, the Missouri River below Holter Dam had a mean discharge of 6,923 cfs, which was 130% of the 72-year mean (\bar{x} =5,316 [3,120-8,493]) (Figure 5). This mean discharge ranked in the 86th percentile for the 72-year period of record (62 of 72). The peak discharge in 2018 was 20,000 cfs, which occurred on June 1st (Figures 6 and 7). The 2018 peak flow is 142% of a 73-year mean peak flow (\bar{x} = 14,132 cfs [3,370-34,800]) and is in the 82nd percentile (60 of 73) (Figure 7). In 2017, the daily discharge from 1 May to 30 June was generally higher and peaked earlier than most recent years (Figure 8). However, the 2011 peak discharge was higher than 2018 and it occurred near the end of June compared to the June 1 peak in 2018. The 2011 peak also lasted longer, remaining high through mid-July. The average May through June daily flow for 2018 was 14,761 cfs which is 212% of a 22-year mean (\bar{x} = 6,970 cfs) and the second highest over that time period.

Water temperature

When monitoring water temperature of the Missouri River, regional personnel rely on the information provided from the USGS gauging stations as the 'first line' of notification. When temperature reaches the critical threshold of 70° F, we switch to data monitored by several thermographs located at strategic locations in the Missouri River. These thermographs are used in making management decisions that could include providing recommendations to the regional

Fish, Wildlife & Parks Commissioner to institute time of day angling restrictions of certain fisheries to reduce stress from angling on the trout populations. It is the policy of MFWP that such closure requests may be made when "…daily maximum water temperature reaches or exceeds 73° F (23° C) for at least some period of time during three consecutive days…"

In 2018, the USGS gauging site below Holter Dam recorded a maximum daily temperature of 68.9° F and a maximum daily mean temperature of 66.6° F on August 10th (Figure 6, Table 1). The water temperatures in the Missouri River below Holter were below the threshold required for recommending angling restrictions in 2018.

Missouri River YOY walleye survey

FWP employees conducted 48 seine hauls in 2018 to evaluate young of the year (YOY) walleye abundance at 12 sites in a 47 mile-long reach of the Missouri River between Cascade and Great Falls. The protocol and site descriptions have been described by Grisak and Tribby (2011). Young of the year walleye abundance has been variable at these sites over the past eight years, with reduced values observed in recent years compared to initial surveys. One YOY was collected in 2015, zero were collected in 2016 and 2017, and 11 were collected in 2018 (Figure 9). This is compared to 2009 and 2010, when 213 and 235 YOY were collected across the 12 sampling locations. A general decline in YOY walleye abundance has been observed over the monitoring period with the highest abundance in the first two years of sampling and the lowest abundance in the last four years of sampling.

Individual sites where YOY walleye were most abundant has also varied over the years. In 2011, YOY walleye numbers were highest in the middle sites (site 6-9; with Site 1 the most upstream site near Cascade and Site 12 the most downstream site near Great Falls). In 2012 the highest abundance of YOY walleye occurred at sites 1 through 4. In 2013, YOY walleye were found only at sites 3 and 12. In 2014, YOY walleye were collected from 6 of the 12 sites; however, 51 of the 60 walleye were collected from sites 2, 6, and 9. Walleye were collected at sites 6 and 9 in 2018.

2018 Flooding

Considerable flooding occurred throughout the Great Falls management area in 2018. This was a result of a combination of above average snowpack and heavy rain events. Flows peaked below Holter on June 1st at 20,000 cfs. A combination of high flows in the Missouri River and a sustained heavy rain event along the Rocky Mountain Front that resulted in flooding of the Dearborn and Sun rivers, produced a peak flow of approximately 40,800 cfs in the Missouri River below Morony Dam on June 21st. This includes a peak flow of approximately 10,700 cfs in the Dearborn River on June 19th and 18,600 cfs in the Sun River at Simms on June 20th. The 2018 April through June inflow in the Sun River to Gibson Reservoir was second highest on record (612,670 acre-feet), and second only to 1964 (620,860 acre-feet) when extreme flooding occurred. Despite near record inflows in the Sun River drainage from April through June, flows reached a low of 56 cfs on July 26th at the Simms gage.

The flood flows observed throughout the management area resulted in significant changes to river morphology, including bank erosion and scouring of new channels and habitat. Significant time was spent in the aftermath of the flooding working with local conservation districts and landowners regarding stream permitting requirements. Photos 1 through 13 document the high flows and typical changes to the river channels observed after the 2018 flooding.

REFERENCES

- Grisak, G. and B. Tribby. 2011. 2010 Missouri River Holter Dam tailwater monitoring report. Status report for PPL-Montana FERC Project 2188. Montana Fish, Wildlife & Parks, Great Falls.
- Montana Fish, Wildlife & Parks (MFWP). 2004. Fisheries analysis + program. Version 02152005-VB6-A2K-CR85. Montana Fish, Wildlife & Parks, Bozeman, MT.

Figures



Figure 1. The Craig section of the Missouri River (river mile 2.5 to 8.1) near Craig, Montana. This section is annually electrofished at night for brown trout and rainbow trout population estimates.



Figure 2. The Cascade section of the Missouri River (river mile 24.2 to 28.3) near Cascade, Montana. This section is annually electrofished at night for brown trout and rainbow trout population estimates.







Figure 4. Population estimate of rainbow (*Oncorhynchus mykiss*) and brown (*Salmo trutta*) trout 10 inches and greater per mile in the Missouri River, Montana within the Cascade sampling section from 1981 through 2018. Average number of rainbow (1,602) and brown trout (395) per mile within this sampling section is designated by horizontal lines.



Figure 5. Annual mean discharge (cfs) of the Missouri River below Holter Dam from 1947 through 2018. The annual mean discharge for 2018 utilizes provisional data and was 6,923 cfs.



Missouri River - Below Holter

Figure 6. Missouri River discharge below Holter Dam, Montana from 1 January 2018 to 31 December 2018. Mean daily discharge is indicated in blue, mean daily flow from 1946 to 2018 is in red, and 2018 daily max water temperature (°F) is in black (dashed). Data collected from a USGS gauge (06066500) located below Holter Dam near Wolf Creek, Montana.



Figure 7. Peak annual discharge of the Missouri River below Holter Dam, Montana from 1946 to 2018. Mean peak discharge (14,132 cfs) over the period record is shown by the orange horizontal line. Peak discharge in 2018 was 20,000 cfs.



Figure 8. Daily discharge of the Missouri River below Holter Dam, Montana from 1 May to 30 June 1998 to 2018.



Figure 9. Total abundance of young of the year walleye from seining sites along the Missouri River from Cascade to Great Falls, Montana, from 2009 through 2018.

Tables

Table 1. Mean, min, and max of daily river discharge (cfs) and daily mean temperature (°F) by month recorded at USGS station 06066500 (Missouri River below Holter Dam near Wolf Creek, MT) for the calendar year 2018.

Missouri River		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Mean	34.8	35.1	36.4	40.6	49.7	58.9	64.2	64.9	61.2	53.3	45.0	37.1
Temperature (°F)	Min	34.2	34.0	34.3	38.1	44.2	54.1	60.6	61.3	57.7	49.8	40.1	34.7
	Max	35.8	36.0	39.6	46.4	56.3	62.2	68.4	68.9	63.9	58.3	50.2	40.3
Discharge (cfs)	Mean	4,584	5,241	5,980	8,054	14,587	14,940	7,163	4,397	4,440	4,217	4,587	4,869
	Min	4,320	4,650	5,250	6,470	10,900	11,100	4,830	4,170	4,120	4,030	4,410	4,570
	Max	5,650	5,540	6,620	10,700	19,400	19,700	14,500	4,990	4,710	4,630	4,740	5,090

Photos



Photo 1. Holter Dam, May 30, 2018. Flow ~19,400 cfs (USGS 06066500 below Holter).



Photo 2. Drift boats below Holter Dam on May 30, 2018. Flow ~19,400 cfs (USGS 06066500).



Photo 3. Mid Canon fishing access site on May 30, 2018. Flow ~19,400 cfs (USGS 06066500).



Photo 4. Black Eagle Dam on June 21, 2018. Flow ~40,800 cfs (USGS 06090300 below Morony).



Photo 5. Rainbow Dam on June 22, 2018. Flow ~32,000 cfs (USGS 06090300 below Morony).



Photo 6. Sun River on June 19, 2018. Flow ~12,000 cfs (USGS 06085800 at Simms).



Photo 7. Sun River near Fort Shaw. Example of erosion caused by high flows. July 2018.



Photo 8. Dearborn River between Hwy 200 and 287. Debris and new channel after flooding. July 2018.



Photo 9. Dearborn River between Hwy 200 and 287. Headcut present after flooding. July 2018.



Photo 10. Lyons Creek. Sediment deposition and unstable channel after flooding. July 2018.



Photo 11. Smith River in canyon. Flow ~2,190 cfs (USGS 06077200 below Eagle Creek). May 12, 2018. Peak daily flow was 2,350 cfs on May 11, 2019 (USGS 06077200).



Photo 12. Little Prickly Pear Creek at Sieben during flooding. May 17, 2018.



Photo 13. Little Prickly Pear Creek at Sieben after flooding. Large amount of sediment deposited in former channel and active headcut with overland flow now present. June 14, 2018.