

2011-2012 Missouri River – Holter Dam Tailwater Monitoring

Status Report for PPL-Montana FERC Project 2188

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In 2011 and 2012 Montana Fish, Wildlife & Parks received \$20,133 and 20,237, respectively from PPL-Montana for monitoring the Missouri River and the fishery below Holter Dam as part of FERC project 2188.

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 and 8.1. The Cascade section is 4.1 miles long and is located from Rm 24.2 to 28.3. 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 estimates were conducted in each section during the first and third weeks of May each year and two jet boats were used in the Craig section, but only one boat was used in the Cascade section. Rainbow trout estimates were conducted in October and two boats were used in each section. Data are analyzed using the MFWP FA+ statistical software (Montana Fish, Wildlife & Parks (MFWP), 2004). Population estimates are calculated using the partial Log-liklihood or modified Petersen's methods. The significance level for all estimates was $\alpha \le 0.05$.

2011 Missouri River Trout Population Summary

In May 2011 in the Craig section, the estimate of brown trout ≥ 10 inches long was 537 (SD17) per mile (Figure 1). The 30 year mean is 560 per mile. We sampled 41 walleye and 13 burbot. The largest burbot was 26.0 inches long and weighed 7.5 pounds. The largest walleye was 21.9 inches long and weighed 2.58 pounds.

In October 2011 in the Craig section, the estimate of rainbow trout ≥ 10 inches long was 6,034 (SD 194) per mile (Figure 1). This was the highest estimate on record and was 198% of the long term average estimate. During the estimate, fishery workers observed a very high number of 10-12 inch hatchery fish in the Craig section this year, which was an artifact of the high water flows during the spring flushing fish from Holter Lake. Hatchery fish made up 20.2% of the fish we sampled (1130/5583). For the first time ever, we were able to calculate an estimate of hatchery fish which was 1,605 (SD 240) per mile. The estimate of wild trout was 4,429 fish per mile which was 145% of the long term average and would be the second highest on record. In the previous few years we observed higher numbers of 8 and 9 inch rainbow trout suggesting a possible future increase in the adult population. The results of 2011 confirm these fish successfully recruited into the adult population. We sampled 169 walleye and 120 burbot in the Craig section this year.

In May 2011 in the Cascade section, the estimate of ≥ 10 inch fish was 909 (SD 83) per mile (Figure 2). This was 241% of the long term average. We sampled 2 walleye and 14 burbot. The largest walleye was 19.4 inches long and weighed 3.23 pounds. The largest burbot was 22.3 inches long and weighed 2.37 pounds.



Figure 1. Estimated number of rainbow and brown trout greater than 10 inches per mile in the Craig section of the Missouri River 1982-2012.



Figure 2. Estimated number of rainbow and brown trout greater than 10 inches per mile in the Cascade section of the Missouri River 1981-2012.

In October 2011 in the Cascade section, the estimate of ≥ 10 inch fish was 2,161 (SD 82) per mile (Figure 2). This was 141% of the long term average. We sampled 37 walleye and 33 burbot in the Cascade section. The largest walleye was 32.5 inches long and 13.95 pounds. The largest burbot was 25.0 inches long and weighed 2.84 pounds. Fishery workers observed higher than normal numbers of hatchery rainbow trout in the Cascade section, but the numbers were far less than in the Craig section.

2012 Missouri River Trout Population Summary

In May 2012 in the Craig section the estimate of brown trout ≥ 10 inches long was 850 per mile (\pm 25) (Figure 1). The 28 year mean is 570 per mile. In the spring we sampled 13 burbot and 54 walleye. The largest burbot was 20.8 inches long and 1.62 pounds and the largest walleye was 30 inches long and weighed 11.2 pounds.

In October 2012 in the Craig section the estimate of rainbow trout ≥ 10 inches long is 7,312 (±149) per mile (Figure 1). The 30 year mean is 3,036. This is the highest estimate on record and surpasses the previous record of 6,034 per mile from last year. There continues to be a substantially higher than normal number of hatchery fish in this section and for the second time ever we were able to calculate an estimate of 700 (±184) per mile. Wild fish = 6,612 per mile, Hatchery fish = 700 per mile. We handled 6,922 fish, which is the highest number we've ever handled during this estimate. We sampled 68 walleye and 73 burbot. The largest walleye was 28.0 inches long and weighed 9.6 pounds and the largest burbot was 21.8 inches long and 3.45 pounds. After looking at the length frequency distribution of hatchery fish from 2011 and 2012, there was a positive shift in growth and abundance, suggesting the hatchery fish from this year are likely those that entered the river from Holter Lake last year.

In May 2012 in the Cascade section the estimate of brown trout ≥ 10 inches long was 545 per mile (\pm 26) (Figure 2). The 27 year mean is 384 per mile. In the spring we sampled 21 burbot and 3 walleye. The largest burbot was 20.2 inches long and weighed 2.24 pounds. The largest walleye was 22.5 inches long and weighed 4.65 pounds.

In October 2012 in the Cascade section the estimate of rainbow trout ≥ 10 inches long was 2,182 (±66) per mile (Figure 2). The 28 year mean is 1,506. We sampled 12 walleye and 5 burbot. The largest burbot was 22.5 inches long and weighed 2.51 pounds. The largest walleye was 21.6 inches long and weighed 4.28 pounds..

Something that was a bit uncommon but consistent in both sections in 2012 was crews sampled more fish in the recapture runs than in the marking runs. For Craig the number sampled during the recapture run was 14% higher than the marking run and for Cascade, the number was 30% higher.

The proportions of rainbow trout to brown trout in the Craig section increased by 9% in 2011 (92:08) and remained similar in 2012 (90:10). During both years, the proportions of rainbow trout remained slightly higher than the long term average (85:15) for this section. In the Cascade

section there was a slight decrease in the proportion of rainbows to browns (70:30) in 2011, but the proportions increased in 2012 (80:20), which is consistent with the long term average.

Angling regulations

In March 2011, the Fish, Wildlife & Parks Commission instituted changes in the walleye harvest limits from Holter Dam to Great Falls. The changes included no harvest or possession limit for walleye from Holter Dam to the Cascade Bridge and 20 fish daily and 40 in possession from Cascade Bridge to Great Falls.

In 2012 the Commission instituted changes to the trout limits from Holter Dam to Cascade Bridge that that standardized the trout limit to 3 daily and in possession, only 1 over 18 and only 1 may be a brown trout.

Angling pressure estimates

Montana Fish, Wildlife & Parks calculates statewide angler pressure estimates every two years. These data provide a reasonable good measure of the importance of this fishery to recreation and the economy of the state. In 2011 the Missouri River section 9 received an estimated 105, 989 angler days. This section was the number one fishery in the region and ranked number two statewide (Table 1). Average angler days for this section of river over the past 18 years are 98,810 angler days.

Year	Angler days	State rank	Reg rank	No. 1 fishery	Angler days
1995	75,201	2	1	Canyon Ferry Res.	94,731
1997	88,576	4	1	Fort Peck Res.	108,562
1999	111,203	3	1	Canyon Ferry Res.	119,886
2001	123,427	1	1		
2003	106,447	2	1	Madison R. (S2)	115,342
2005	93,229	2	1	Madison R. (S2)	116,345
2007	78,468	4	2	Madison R. (S2)	106,330
2009	106,746	4	2	Canyon Ferry Res.	133,220
2011	105,989	2	1	Bighorn R. (S3)	126,200

Table 1. Estimated angler days and statewide rank for the Missouri River section 9, Montana, 1995-2011.

Economic statistics

Economic statistics are compiled by Montana Fish, Wildlife & Parks Strategic Planning and Data Services Unit to determine the contribution of statewide fisheries on the economy of Montana.

The methodology for determining the economic value of angling to the state's economy has been described by Grisak et al. (2012). The value of both resident and non-resident angler days increased by 5% from 2009 to 2011. In 2011 section 9 of the Missouri River generated an estimated \$14 million in revenue (Table 2). There was a 10% decrease in resident angler days and 10% increase in non-resident angler days compared to the 2009 estimates.

Water flow

For the 2011 calendar year the Missouri River below Holter Dam had a mean discharge of 7,744

cfs, which was 144% of the 65 year mean (\bar{x} =5374 [3120-8493]) (Figure 3). The maximum discharge in 2011 was 23,000 cfs, which occurred on July 2 (Figure 4, Table 3). This flow year ranked in the 91st percentile for the 65 year period of record and was the 7th highest recorded at the Holter gage. There were 101 consecutive days in 2011 (from April 19 to July 28) where the river discharge was sustained above 6000 cfs.

	Resident	Non-res	Total	Resident	Non-resident	total
	value (\$)	value (\$)	Angler days	Angler days	Angler days	
1995	32.34	168.78	75,201	56,613	18,588	\$4,968,147.06
1997	33.23	173.44	88,576	66,179	22,397	\$6,083,663.85
1999	34.57	180.42	111,203	87,768	23,435	\$7,262,282.46
2001	36.8	192.06	123,472	84,860	38,612	\$10,538,668.72
2003	38.13	199.04	106,447	64,854	41,593	\$10,751,553.74
2005	40.43	211.03	93,229	59,762	33,467	\$9,478,718.67
2007	43.04	224.65	78,468	53,604	24,864	\$7,892,813.76
2009	44.55	232.53	106,746	67,266	39,480	\$12,176,984.70
2011	46.83	244.44	105,989	57,825	48,164	\$14,481,152.91
Average			98,815	66,526	32,289	\$9,292,665.10

Table 2. Estimated angler days by residency and economic contribution for the Missouri River section 9, Montana, 1995-2011.

For the 2012 calendar year the Missouri River below Holter Dam had a mean discharge of 5,325 cfs, which was 99% of the 66 year mean (\bar{x} =5374 [3120-8493]) (Figure 3). The maximum discharge in 2012 was 8,950 cfs, which occurred on June 8 (Figure 4, Table 4). This flow year ranked in the 30st percentile for the 65 year period of record. There were 43days in 2012 (April 19-May 8 and June 6-26) where the river discharge was sustained above 6000 cfs.



Figure 3. Mean annual flow for Missouri River below Holter Dam, 1947-2012.



Figure 4. Maximum annual flow for the Missouri River below Holter Dam, 1946-2012.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Missouri temp 2011	mean	34.1	34.7	35.7	41.0	47.6	54.3	63.0	65.7	63.0	57.2	45.3	36.4
	min	34.0	34.5	35.5	40.6	47.0	53.8	62.1	64.6	62.6	57.0	45.1	36.3
	max	34.2	34.9	36.1	41.5	48.2	54.8	63.8	66.8	63.6	57.5	45.6	36.6
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Missouri flow 2011	mean	5629	5657	5245	5985	12116	17030	14842	5821	5130	4734	5453	5424
	min	5480	5400	4920	5220	7170	13700	5670	5680	4150	4020	5040	5020
	max	5730	5790	5560	7130	15800	22600	23000	6200	5690	5300	5860	5880

Table 3. River flow (cfs) and temperature (°F) recorded at USGS station 06066500 (Missouri River below Holter Dam near Wolf Creek, Montana) for the calendar year 2011.

Table 4. River flow (cfs) and temperature (°F) recorded at USGS station 06066500 (Missouri River below Holter Dam near Wolf Creek, Montana) for the calendar year 2012.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Missouri flow 2012	mean	5287	5269	5178	5997	5236	6592	4258	3942	3602	3481	3420	3655
	min	5070	5070	4750	5310	4530	4430	4040	3700	3500	3340	3320	3530
	max	5550	5420	5440	7070	6740	8950	4580	4120	3720	3700	3610	3840
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Missouri temp 2012	mean	34.6	34.6	36.7	437	50.7	55.9	64 3	64 4	61 9	543	454	38.0
				00.7	10.7	50.7	55.7	01.5	01.1	01.7	54.5	12.1	50.0
	min	33.8	34.2	35.1	39.9	47.3	52.3	61.0	62.4	60.1	50.0	41.9	34.7
	min max	33.8 35.4	34.2 35.1	35.1 39.9	39.9 48.6	47.3 54.1	52.3 61.7	61.0 66.2	62.4 65.7	60.1 65.7	50.0 60.3	41.9 49.5	34.7 38.0

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 each the Missouri, Smith, Sun and Dearborn rivers. 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 to request such closures when "...daily maximum water temperature reaches or exceeds 73° F (23° C) for at least some period of time during three consecutive days..."

In 2011 the USGS Wolf Creek Bridge site below Holter Dam recorded a maximum daily temperature of 67.1°F for 5 days in July and August (Table 3). In 2012 the maximum daily water temperature was 66.2 °F which occurred on July 28. Fortunately, the relatively mild water temperatures during both years did not warrant recommending angling restrictions on this valuable fishery.

Similar to 2010, in fall 2011 regional MFWP staff received numerous reports of dead brown trout in the Missouri River and its tributaries with "white cotton-like" growth. Filed examinations observed several dead brown trout in Little Prickly Pear Creek and Sheep Creek, but biologists did not characterize this as unusually high. An analysis of the water temperature data showed water temperature was elevated 3.73°F higher than the 10-year mean between October 2 and November 2 (Figure 5). On this basis, it was clear that *Saprolegnia* fungus, a commonly occurring fungus in the Missouri River, was expressed at higher than normal levels due to prolonged higher than normal water temperatures observed during the brown trout spawning season.



Figure 5. Maximum daily water temperature of the Missouri River below Holter Dam from October 1 through November 31, 2001-2011.

Missouri River YOY walleye survey

We conducted 43 seine hauls each year in 2011 and 2012 to evaluate 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 four years. Overall abundance of YOY in 2011 and 2012 was less than the previous two years. (Figure 6). In 2009 and 2010, YOY abundance was highest in the upper sites (1-4). In 2011 there was a change in abundance where YOY walleye numbers were highest in the middle sites (6-9). In 2012 the highest abundance of YOY walleye occurred at sites (1-4).



Figure 6. Walleye YOY seine survey sites and results, Missouri River, Montana.

Missouri River brown trout spawning

In an effort to evaluate brown trout production in the main stem Missouri River, we've counted brown trout redds in four of the past five years. The protocol follows that described by Grisak et al. (2012) and the study area spans from Holter Dam to the Pelican Point FAS (26.2 miles). Brown trout redd counts are usually conducted during the first week of December. In 2012 we counted 1,139 redds in this reach of river, which is the second highest on record and is 121% of the annual average (Figure 7).



Figure 7. Brown trout redds counts from the Missouri River near Craig, Montana 2008-12.

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