



***Montana Fish,
Wildlife & Parks***

2017 Missouri River – Holter Dam Tailwater Monitoring

Status Report for Northwestern Energy
FERC Project 2188

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In 2017 Montana Fish, Wildlife & Parks received \$29,773 from Northwestern Energy for monitoring the Missouri River and the fishery below Holter Dam as part of FERC license 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 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 16th of May. Two jet boats were used in the Craig section, and one boat was used in the Cascade section. Rainbow trout (*Oncorhynchus mykiss*) estimates were conducted in fall from the 26th of September to the 11th of October and two boats were used in each section. Data were analyzed using the Montana Fish, Wildlife and Parks (MFWP) FA+ statistical software (MFWP 2004). Population estimates were calculated using the partial Log-likelihood or modified Petersen's methods. The significance level for all estimates was $\alpha \leq 0.05$.

2017 Missouri River trout population summary

In spring 2017 in the Craig section, the estimate of brown trout 10 inches long and greater was 576 (SD 16.6) per mile (Figure 3). The mean for years when population estimates were calculated based on data since 1982 (n = 33) was 563 per mile (Figure 3). The most abundant size class of brown trout sampled was 13 to 15 inches in 2017. We sampled 9 burbot (*Lota lota*) and 20 walleye (*Sander vitreus*). The burbot sampled ranged from 15.7 to 27.7 inches long and 1.0 to 3.82 lbs. The walleye sampled ranged from 10.0 to 23.6 inches and 0.32 to 4.98 lbs.

In fall 2017 in the Craig section, the estimate of rainbow trout 10 inches long and greater was 4,936 (SD 145.7) per mile (Figure 3). The size structure of the population was dominated by large fish with 60% of the estimate comprised of fish 17 inches and greater. The estimate of 4,936 fish per mile, was 145% of the long-term average of 3,394 fish per mile based on annual estimates since 1982 (n = 36). We sampled 15 walleye and 37 burbot. The burbot sampled ranged from 13.7 to 26.5 inches and 0.64 to 4.00 lbs. The walleye sampled ranged from 4.8 to 24.4 inches and 0.06 to 6.27 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 percent (1,125) were hatchery fish. The number of hatchery trout has declined in each year since then to 79 hatchery rainbows handled in the Craig section in 2016 (1.5 % of rainbows handled) and 71 hatchery rainbows in 2017 (1.3% of rainbows handled).

In spring 2017 in the Cascade section, the estimate of brown trout 10 inches long and greater was 387 (SD 18.8) per mile (Figure 4). This was 97% of the long-term average of 398 per mile. We sampled 21 burbot and 2 walleye. The burbot ranged from 10.8 to 23.7 inches and 0.24 to 1.87 lbs. The walleye ranged from 16.3 to 20.5 inches and 1.49 to 4.5 lbs.

In fall 2017 in the Cascade section, the estimate of rainbow trout 10 inches long and greater was 1,592 (SD 57.8) per mile (Figure 4). This was 99% of the long-term average of 1,616 per mile. We sampled 37 walleye and 48 burbot in the Cascade section. The walleye ranged

from 5.2 to 22.8 inches long and 0.11 to 5.01 lbs. Thirty of the 37 walleye were less than 9 inches. The burbot sampled ranged from 10.8 to 22.6 inches and 0.27 to 2.32 lbs.

Water flow

For the 2017 calendar year, the Missouri River below Holter Dam had a mean discharge of 5,009 cfs, which was 94.6% of the 71-year mean ($\bar{x}$ =5,293 [3,120-8,493]) (Figure 5). This mean discharge ranked in the 49th percentile for the 71-year period of record (35th of 71). The peak discharge in 2017 was 11,800 cfs, which occurred on June 17th (Figure 6, Table 1). The 2017 peak flow is 84.0% of a 72-year mean peak flow ($\bar{x}$ = 14,051 cfs [3,370-34,800]) and is in the 43rd percentile (31st of 72) (Figure 7). In 2017, the daily discharge from 1 May to 30 June was generally higher than many of the past years (Figure 8). The average May through June daily flow for 2017 was 8,774 cfs which is 133% of a 21-year mean ($\bar{x}$ = 6,599 cfs).

Considerable time was spent in 2017 analyzing past flow regimes as a result of a request to consider managing for flushing flows in the Missouri River below Holter Dam by the Upper Missouri Watershed Alliance (UMOWA) to the Bureau of Reclamation (BOR). The request by UMOWA was due to their concerns of a perceived increase in aquatic vegetation (e.g., aquatic macrophytes and algae) and changes in benthic invertebrate communities over time in the Missouri River. It has been documented that flows of 10,000 cfs and greater downstream of Holter Dam are capable of causing losses of fish from Holter Reservoir to the Missouri River (MFWP 1985) and flows of approximately 15,000 cfs below Holter Dam results in mobilization of fine riverbed materials (Strainer and Grisak 2009). Inflows to the reservoir system were compared to the outflows by comparing the flow at the Missouri River at Toston and Missouri River below Holter USGS gages, respectively. At Toston, inflows were greater than 10,000 cfs in 30 of 36 years (1.2-year interval) compared to in 19 of 36 years (1.9-year interval) below Holter. Flows were greater than 15,000 cfs in 21 of 36 years (1.7-year interval) at Toston and in 11 of 36 years (3.2-year interval) below Holter. While high flows below Holter Dam occur somewhat less frequently than at Toston, the reservoir system also allows for sustaining higher flows during the potentially stressful summer and winter periods than in unregulated reaches of river. Fish densities, growth, and condition of fish in the Missouri River below Holter Dam all indicate a productive and healthy fishery, that meets the increasing demand by the public in terms of increased angler use in recent years. As such, MFWP did not recommend any specific operational changes to BOR for Canyon Ferry Dam. Instead, MFWP will continue to work closely with BOR during spring and fall to minimize flow impacts to the Missouri River and reservoir fisheries.

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 2017, the USGS gauging site below Holter Dam recorded a maximum daily temperature of 68.4°F and a maximum daily mean temperature of 66.6°F on July 29th (Figure 6, Table 1). The water temperatures in the Missouri River below Holter in 2017 were well below the threshold required for recommending angling restrictions.

Missouri River YOY walleye survey

FWP employees conducted 48 seine hauls in 2017 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 seven years, but have been reduced in 2015 through 2017 compared to prior years. One YOY was collected in 2015, while zero were collected in 2016 and 2017 (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 three 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 (1-4). 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.

Missouri River trout spawning

To evaluate trout production in the main stem Missouri River, trout redds are counted when flows conditions are suitable for viewing and counting redds by helicopter, and when personnel and funding is available. In 2010, 2013, 2015, and 2016, redd counts were completed. The protocol follows that described by Grisak et al. (2012) and the survey area spans from Holter Dam to the Pelican Point FAS (26.2 miles). In 2010, 1,644 rainbow trout redds were counted in this reach of river, 3,113 rainbow trout redds were counted in 2013, 2,793 rainbow trout redds were counted in 2015, and 1,557 rainbow trout redds were counted in 2016 (Figure 10, Table 2). Rainbow trout redd counts were not completed in 2017.

Rainbow trout population estimates spiked in 2011 (6,034 rainbow trout 10 inches and greater per mile) and 2012 (7,312 rainbow trout 10 inches and greater per mile) in the Craig section of the Missouri River (Figure 3). A corresponding spike in rainbow trout redds was observed in spring 2013 (n=3,113), followed by a decrease in redds in subsequent years as population estimates decreased back toward the mean (Figures 3 and 10). While this decreasing trend of population estimates and redd counts from 2012 may initially be perceived as significant decreases in reproduction, the 2016 trout redd count (n=1,557) is similar to the 2010 count (n=1,644) prior to the large population peak in 2011 and 2012.

Rainbow trout redds counts were not conducted in the major spawning tributaries in 2016 or 2017. In 2015, tributary spawning (except Dearborn River) was estimated to account for 57% of the total spawning with 43% of the spawning occurring in the mainstem of the Missouri River. In 2010, tributary spawning was 62% of total spawning with 38% occurring within the Missouri River, which is similar to that observed in 2015, especially if the Dearborn River been surveyed.

Brown trout redd counts in the same stretch of the Missouri River were not completed in 2016 or 2017. In 2015, brown trout redd counts were conducted on major tributaries to the Missouri River but not the mainstem Missouri (Figure 11). The 2015 brown trout redd counts in Little Prickly Pear Creek, Wolf Creek, Lyons Creek, and Sheep Creek were approximately 11 to 84% less than previous brown trout redd counts conducted in 2007 through 2009 (Table 3).

REFERENCES

- Grisak, G., B. Tribby and A. Strainer. 2012. An Evaluation of walleye in the Missouri River between Holter Dam and Great Falls, Montana. PPL-Montana MOTAC projects 771-09, 771-10, 759-11, 771-11 and Fisheries Bureau Federal Aid Job Progress Report Federal Aid Project Number F-113-R9, R10, R11, R12. Montana Statewide Fisheries Management. Great Falls.
- 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.
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- Strainer, A. C., and G. G. Grisak. 2009. An evaluation of trout spawning substrate composition and substrate changes following spring run-off in the Missouri River below Holter Dam. Final report for PPL-Montana FERC Project 2188. Montana Fish, Wildlife & Parks, Great Falls.

Figures

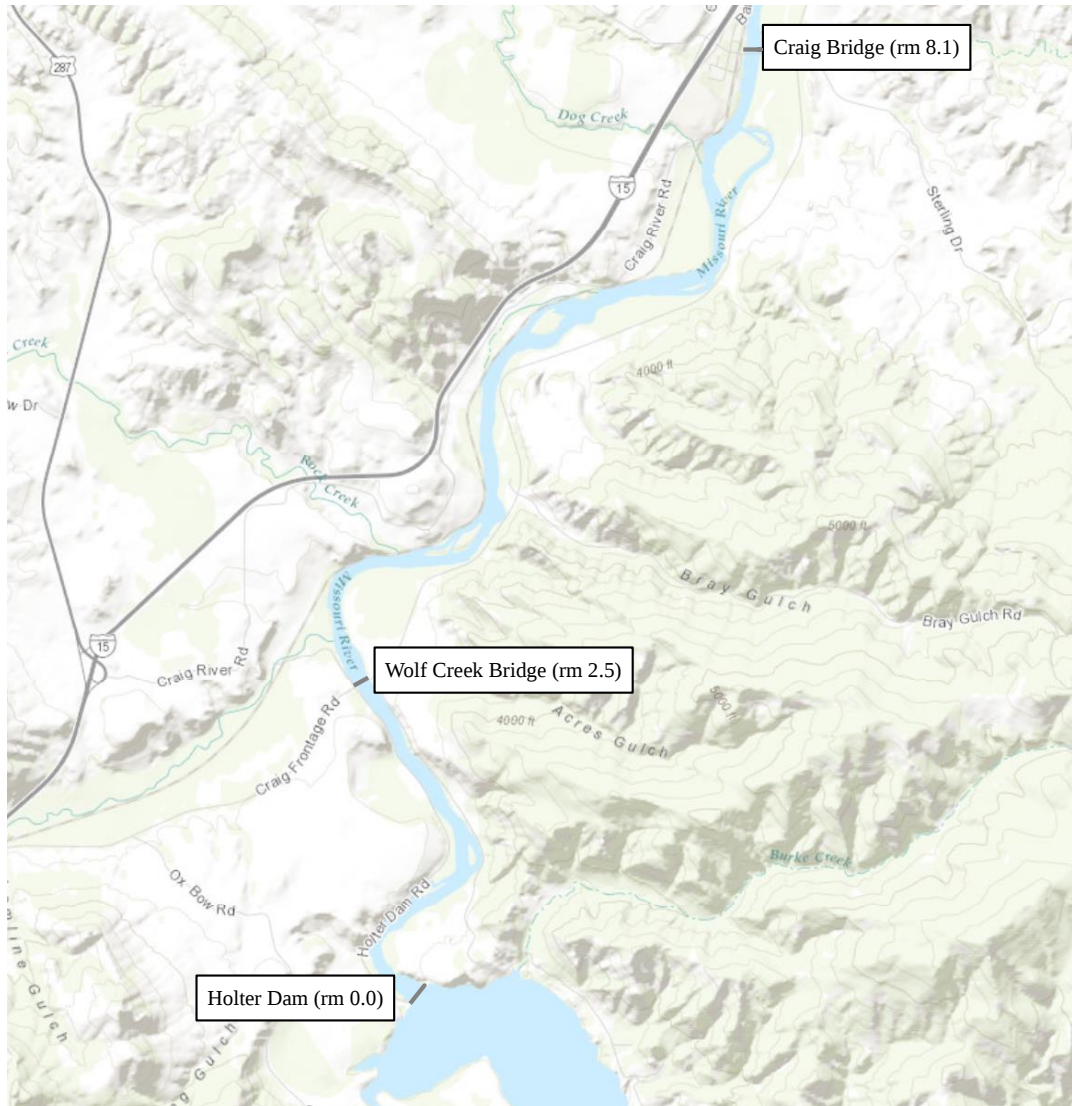


Figure 1. The Craig section of the Missouri River (river mile 2.5 to 8.1) near Craig, Montana. This section is annually electrofished at night for brown trout and rainbow trout population estimates.

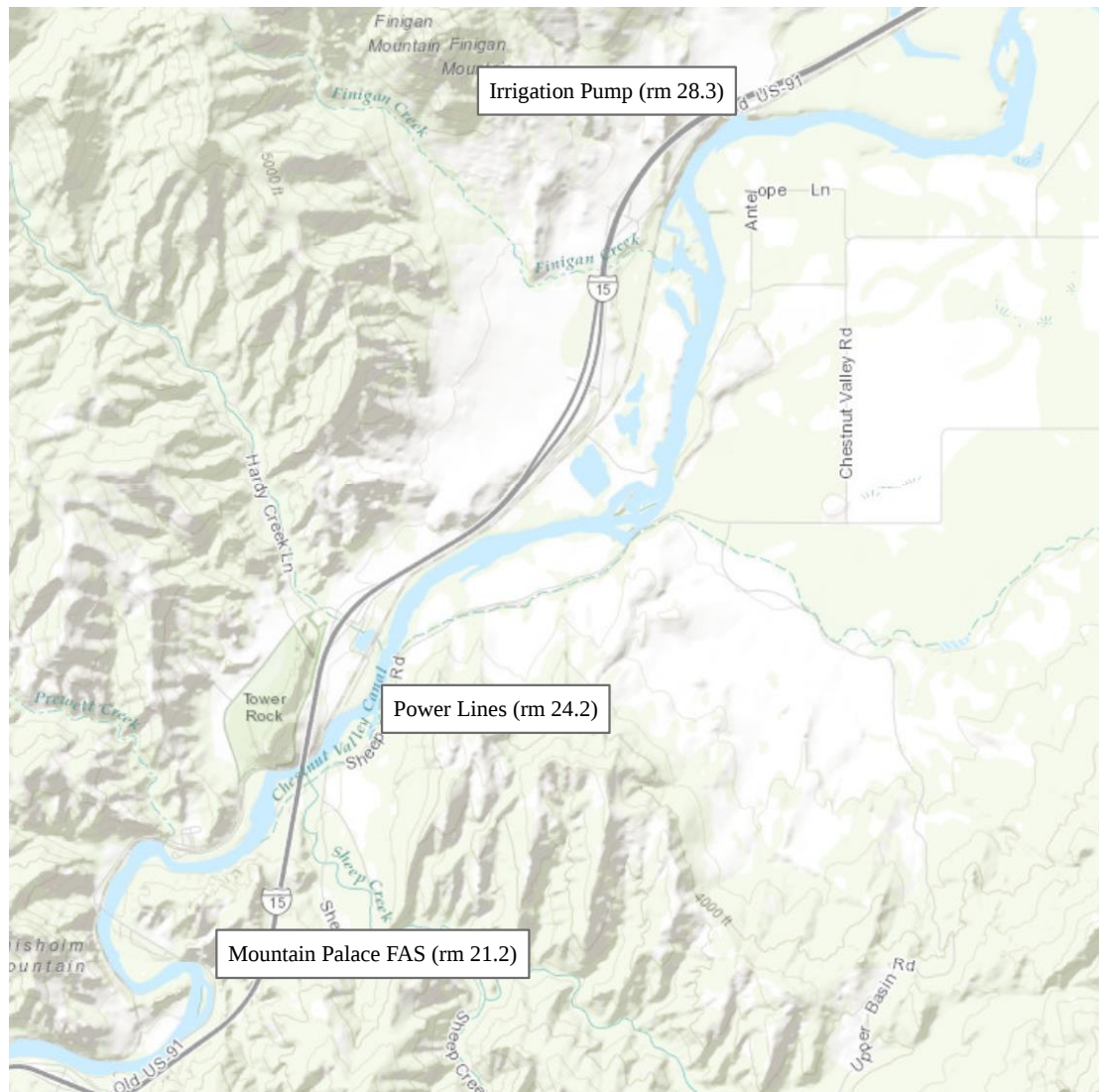


Figure 2. The Cascade section of the Missouri River (river mile 24.2 to 28.3) near Cascade, Montana. This section is annually electrofished at night for brown trout and rainbow trout population estimates.

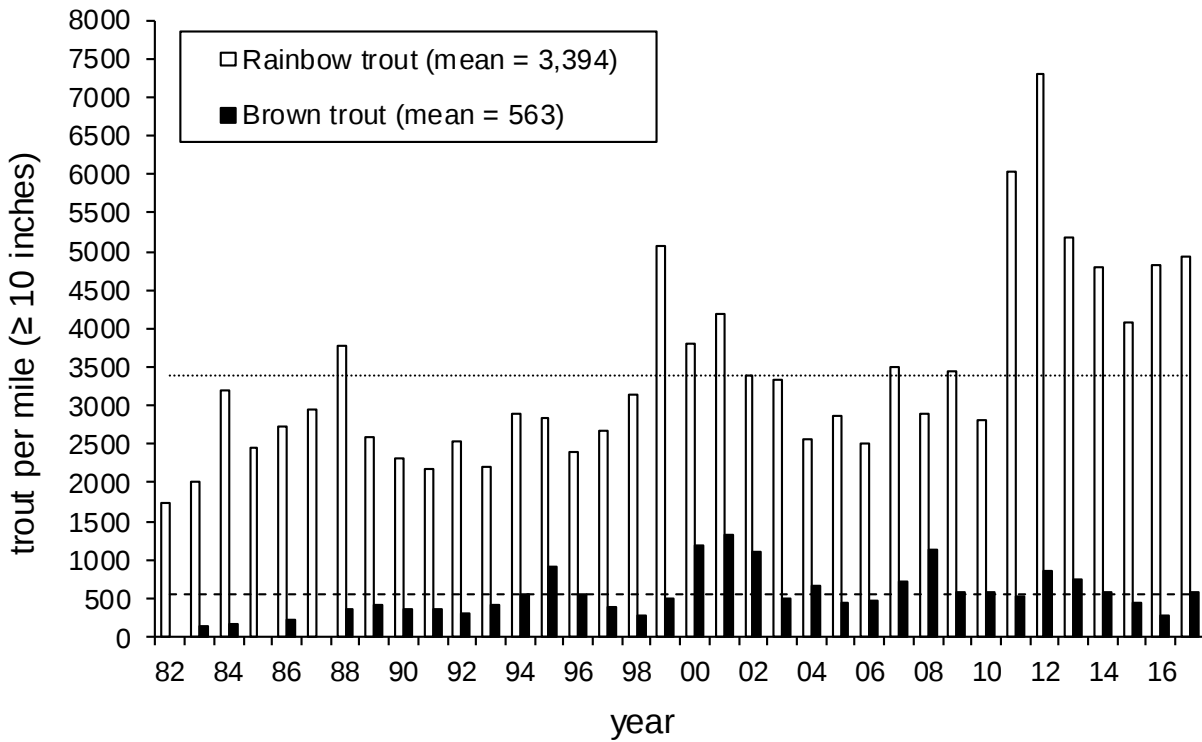


Figure 3. Population estimate of rainbow (*Oncorhynchus mykiss*) and brown (*Salmo trutta*) trout greater than 10 inches per mile in the Missouri River, Montana within the Craig sampling section from 1982 through 2017. Average number of rainbow (3,394) and brown trout (563) per mile within this sampling section is designated by horizontal lines.

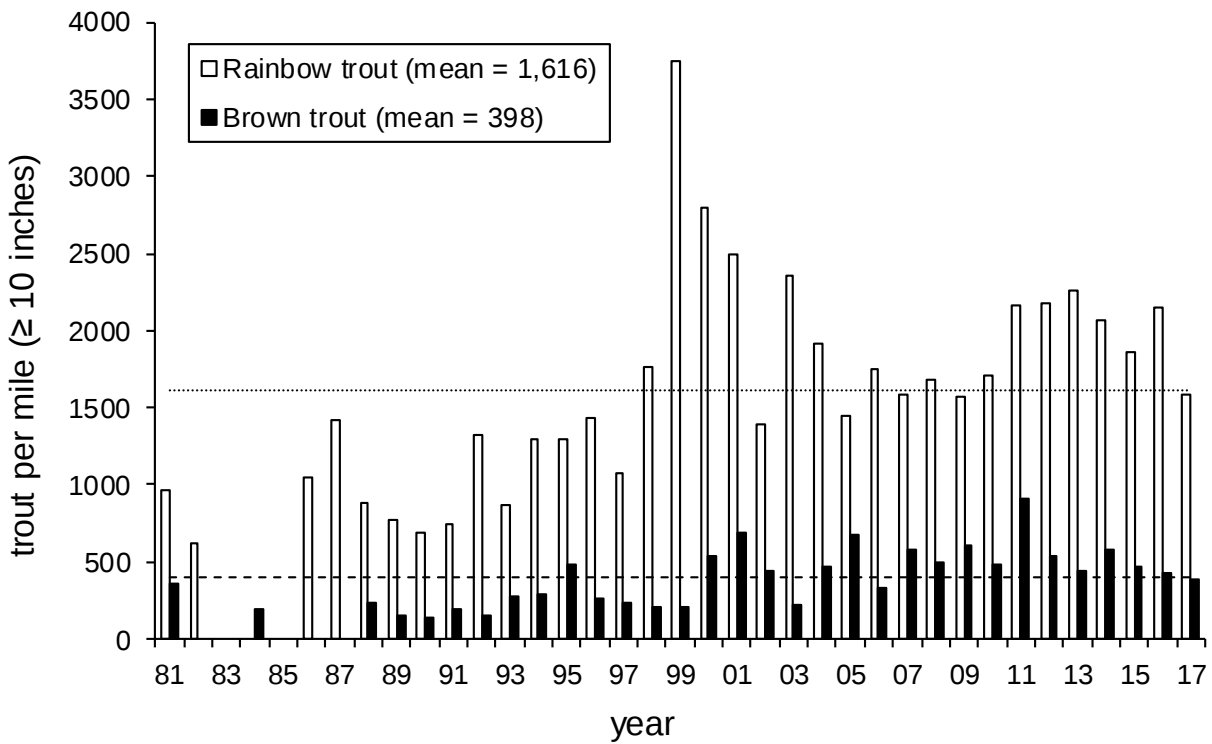


Figure 4. Population estimate of rainbow (*Oncorhynchus mykiss*) and brown (*Salmo trutta*) trout greater than 10 inches per mile in the Missouri River, Montana within the Cascade sampling section from 1981 through 2017. Average number of rainbow (1,616) and brown trout (398) per mile within this sampling section is designated by horizontal lines.

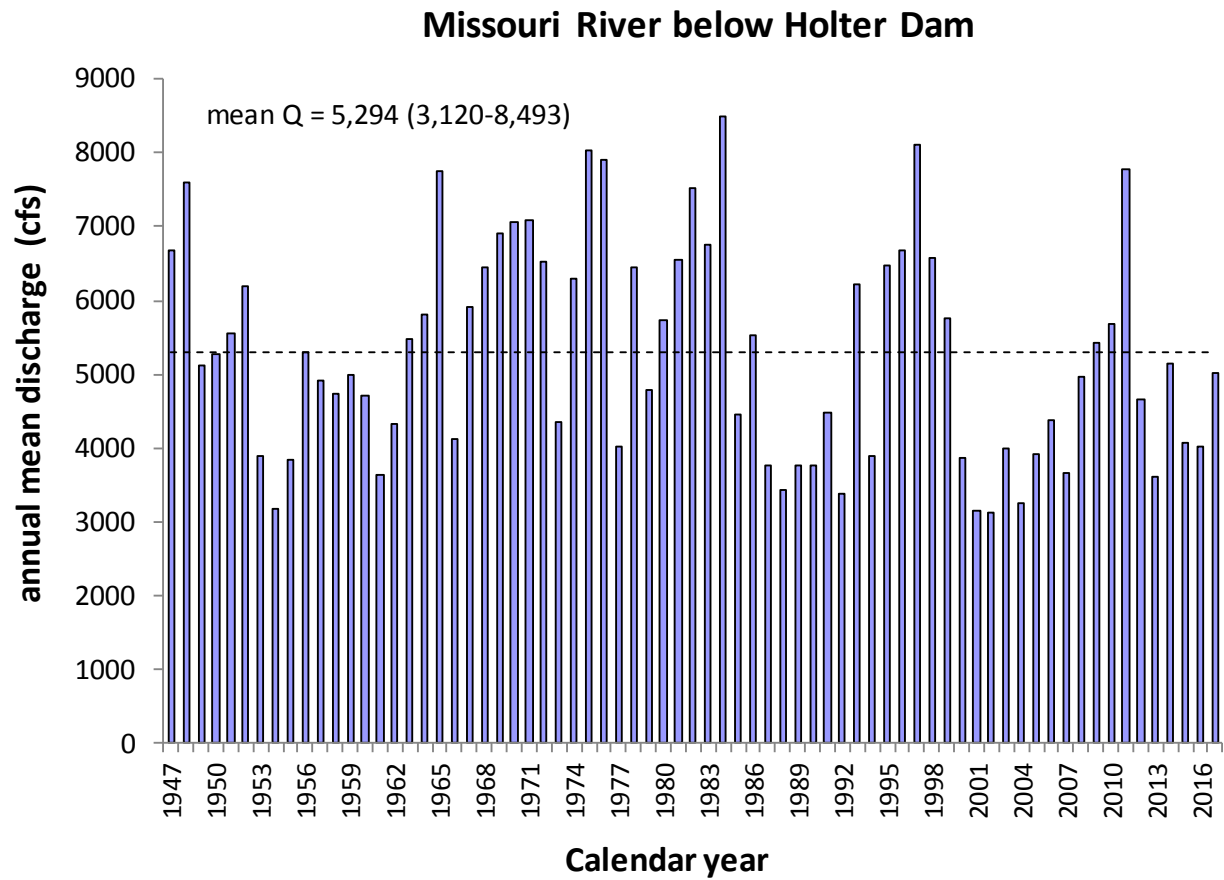


Figure 5. Annual mean discharge (cfs) of the Missouri River below Holter Dam from 1947 to 2017. The annual mean discharge for 2017 was 5,009 cfs.

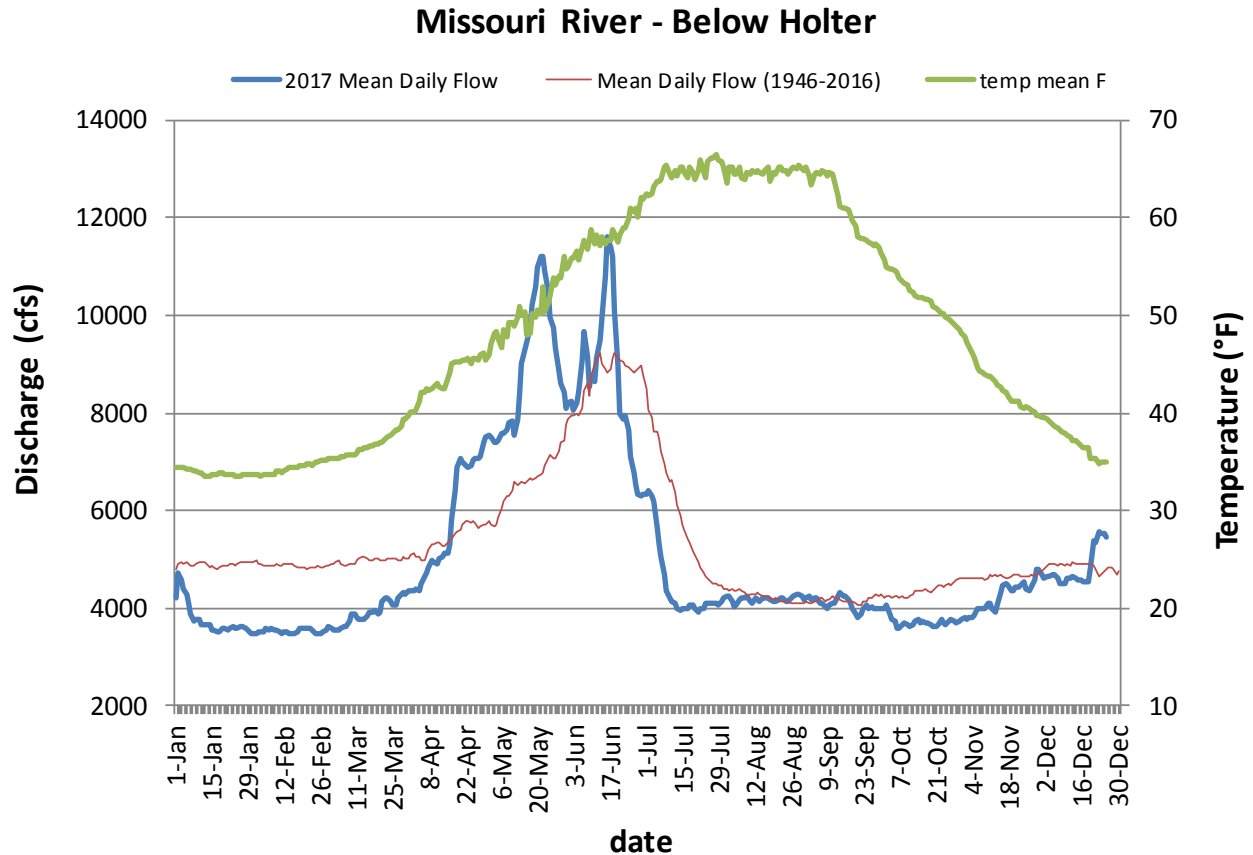


Figure 6. Missouri River discharge below Holter Dam, Montana from 1 January 2017 to 28 December 2017. Mean daily discharge is indicated in blue, mean daily flow from 1946 to 2016 is in red, and 2017 daily max water temperature (°F) is in green. Data collected from a USGS gauge (06066500) located below Holter Dam near Wolf Creek, Montana.

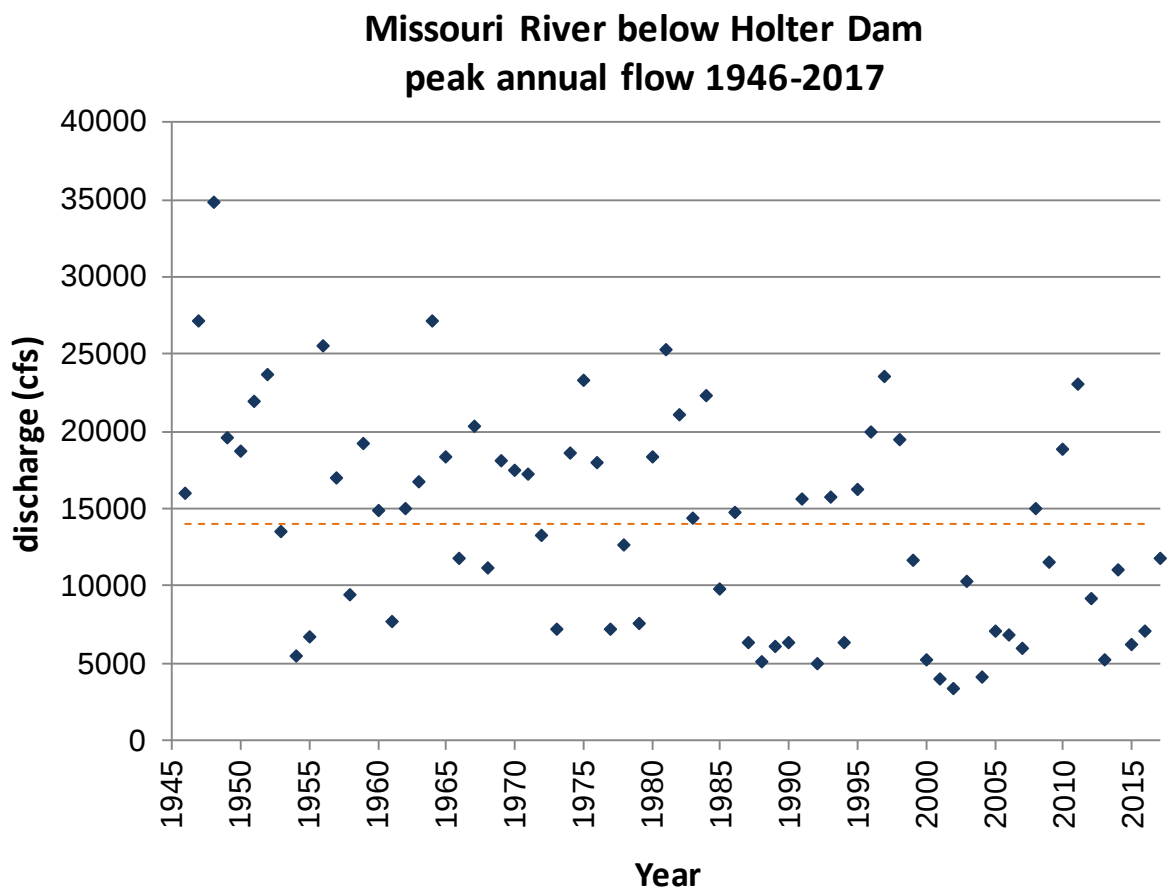


Figure 7. Peak annual discharge of the Missouri River below Holter Dam, Montana from 1946 to 2017. Mean peak discharge (14,051 cfs) over the period record is shown by the orange horizontal line.

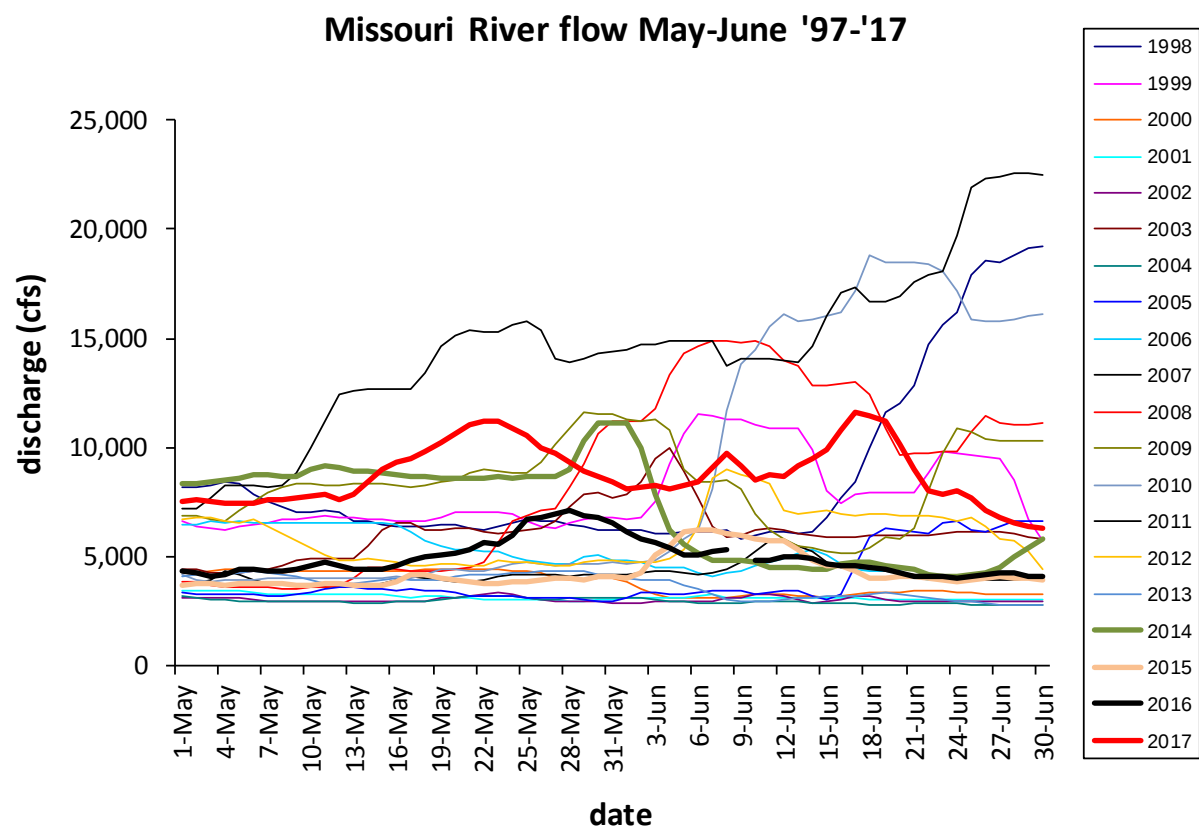


Figure 8. Daily discharge of the Missouri River below Holter Dam, Montana from 1 May to 30 June 1998 to 2017.

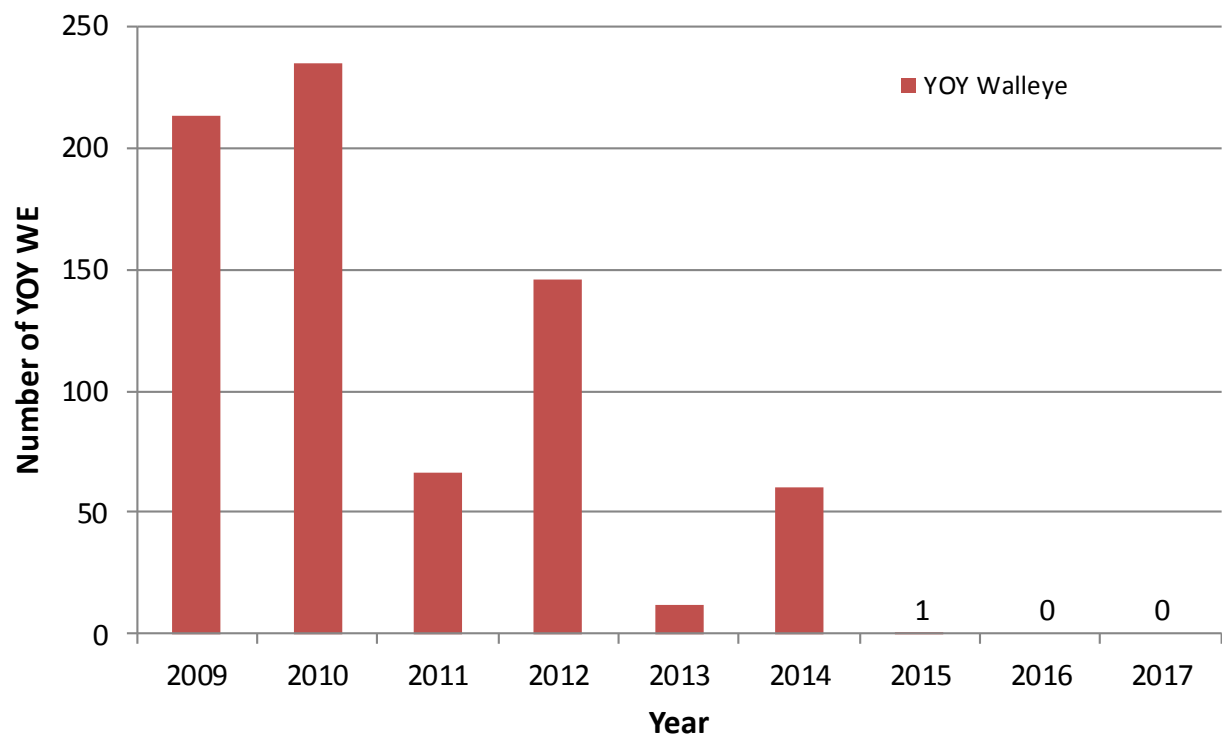


Figure 9. Total abundance of young of the year walleye from seining sites along the Missouri River from Cascade to Great Falls, Montana.

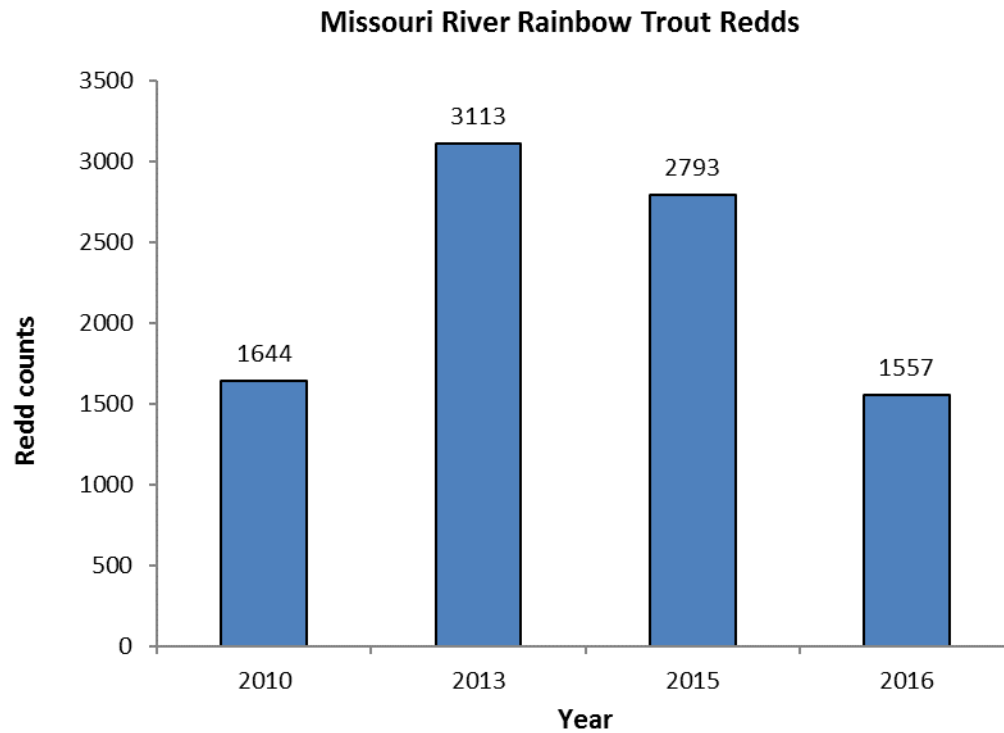


Figure 10. Mainstem Missouri River rainbow trout redd counts from 2010 to 2016. Redd counts were not conducted in 2011, 2012, 2014, and 2017.

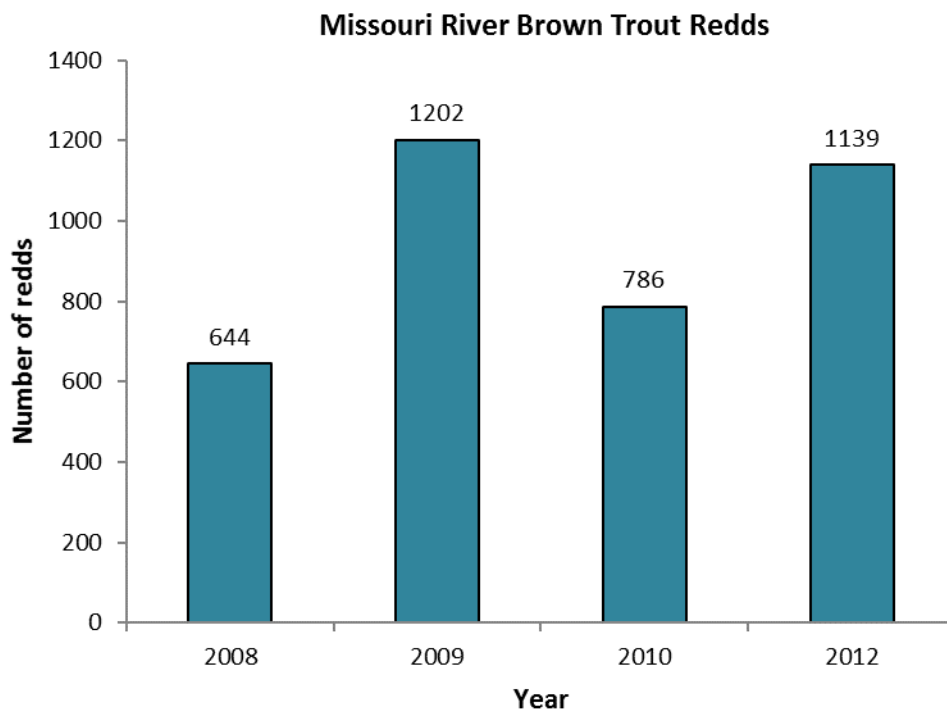


Figure 11. Mainstem Missouri River brown trout redd counts from 2008 to 2012. Redd counts were not conducted in 2011 or from 2013 to 2017.

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 2017.

Missouri River		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°F)	Mean	33.8	34.2	36.7	43.5	50.0	58.0	64.5	64.7	61.4	52.0	43.1	37.3
	Min	33.4	33.4	35.2	39.7	45.5	54.7	61.9	63.5	57.0	48.6	39.7	34.7
	Max	34.3	35.1	39.4	46.2	56.1	62.1	66.6	65.3	65.1	56.5	48.2	39.7
Discharge (cfs)	Mean	3758	3526	3893	5684	8872	8673	4569	4182	4083	3726	4192	4804
	Min	3470	3470	3560	4360	7390	6290	3930	4020	3790	3580	3750	4510
	Max	4710	3600	4310	7380	11200	11600	6400	4290	4330	4050	4780	5560

Table 2. Rainbow trout redd counts from 2007-2017 in the Missouri River and tributaries.

Stream	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Missouri River	---	---	---	1644	---	---	3113	---	2793	1557	---
Dearborn River	---	---	---	632	---	---	---	---	---	---	---
Little Prickly Pear Creek	2125	1461	---	---	---	---	---	---	1466	---	---
Lyons Creek	847	897	---	386	---	---	---	---	373	---	---
Wolf Creek	1289	678	---	1451	---	---	---	---	1655	---	---
Sheep Creek	282	286	---	234	---	---	---	---	271	---	---

Table 3. Brown trout redd counts 2007-2017 in the Missouri River and tributaries.

Stream	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Missouri River	---	644	1202	786	---	1139	---	---	---	---	---
Dearborn River	---	137	169	---	---	---	---	---	---	---	---
Little Prickly Pear Creek	1111	973	990	---	---	---	---	---	399	---	---
Lyons Creek	81	249	---	---	---	---	---	---	39	---	---
Wolf Creek	390	269	362	---	---	---	---	---	221	---	---
Sheep Creek	114	129	---	---	---	---	---	---	101	---	---