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Lewistown Area Fisheries Management

2013 Annual Report

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ABSTRACT

Twenty-three reservoirs were sampled with gill nets in the Lewistown Management Area in 2013. Ackley Lake rainbow trout *Oncorhynchus mykiss* numbers were down in 2013, falling below the 25-year average. Rainbow trout had improved length, however white sucker *catostomus commersoni* numbers remain above average and interspecific competition is evident. The trout fishery at Bair Reservoir appears to have improved greatly over the past six years, with high catch per unit effort (CPUE) and above average length. East Fork Reservoir appears to have recovered from the drawdown and dam repairs in 2012, with northern pike *Esox lucius* and yellow perch *Perca flavescens* CPUE and lengths near average. Martinsdale Reservoir rainbow trout catch rates were below average in 2013, however the mean length remains above the long-term average. Catch rates of yellow perch were the highest on record in Petrolia Reservoir. Walleye *Sander vitreus* catch rates were down in Petrolia, however the mean length remained above average. Yellow Water Reservoir white sucker and common carp *Cyprinus carpio* catch rates were similar to the records highs seen in 2011 when they were first observed following a prolonged absence. Rainbow trout catch rates and average length were the lowest on record, suggesting that the influx of carp and white suckers are limiting the trout fishery or a winterkill event occurred during the winter of 2012/2013.

The yellow perch and sauger *Sander canadense* combination appears to work well in Jakes Reservoir; however as stocked sauger age out, there has been a decline in yellow perch average length-at-age and condition. A wild fish transfer of 83 sauger were moved from the Missouri River to Jakes Reservoir to supplement the aging sauger population.

In the Missouri River Breaks area, Box Elder Creek Reservoir rainbow trout are being negatively impacted by an illegal introduction of yellow perch. Largemouth bass *Micropterus salmoides* in Bubs Reservoir were in good condition with fish up to 1.3 pounds sampled. Drag Creek Reservoir bluegill *Lepomis macrochirus* are stunted and stocked largemouth bass were not present in 2013 sampling. An alternative top-down control may be required to benefit the fishery in Drag Creek. Fyke netting Dry Blood Reservoir found largemouth bass in excellent condition. The attempted wild fish transfer of black crappie *Pomoxis nigromaculatus* evidently failed in Dry Blood, as no fish have been sampled since the transfer in 2010. The rainbow trout fishery in Manuel Reservoir #2 is doing very well, with fish larger than 2.0 pounds sampled. The fishery in Payola Reservoir is doing well, with largemouth bass and yellow perch found in good numbers and condition. The largemouth bass in South Fork Blood Reservoir weren't large, but were in good condition. Whisker Reservoir appears to have recovered from the winterkill in 2010-11, with largemouth bass and black crappie in excellent condition.

In the Lewistown/Denton/Winifred area, Upper and Lower Carter Pond were sampled with fyke nets. The illegal introduction of bluegill and yellow perch has expanded significantly. The bluegill population is showing signs of stunting. Rainbow trout are still present; however negative impacts of the illegal introductions are evident, with decreasing trends in condition and size. The stocked rainbow fishery in Hansen Reservoir is doing well, with fish in excess of 2.0 pounds sampled. Upper and Lower Hassler Reservoir were sampled in 2013, with rainbow trout found in both. The fishery in Upper Hassler appears to be doing well, however rainbow trout in Lower Hassler are not performing and alternative stocking will be attempted in 2014. Slivka Reservoir #2 experienced a fishkill in the spring of 2013 and no stocked largemouth bass were

sampled during summer monitoring. Monitoring of Urs Reservoir found large rainbow trout, however sampling was compromised due to issues with the gill net set.

Two small reservoirs were sampled in Meagher County. Bonanza Reservoir was found to be a high-quality fishery, with large brook trout *Salvelinus fontinalis* and rainbow trout present and in excellent condition. Rostad Reservoir was found to hold a few rainbow trout and many white suckers. Stocking of Rostad will likely be suspended in the future as it does not appear to be a quality fishery.

Population estimates were performed on the Burleigh, Machler, and Carroll Trail sections of Big Spring Creek. Trends of total trout ≥ 10 inches were slightly down from the recent peak in 2009-10, however estimates are near the long-term averages. Species composition continues to shift drastically, with the proportion of rainbow trout the lowest on record at each section. Additionally, estimates of rainbow trout 6-10 inches were the lowest on record at each section for the second consecutive year.

In the Judith River drainage, Ross Fork Creek and Little Trout Creek were sampled. Numerous cyprinid, catostomid, and salmonid species were present. Sampling on Ross Fork near the confluence with the Judith River found very high numbers of trout at abnormal densities, suggesting that the Ross Fork may provide important habitat and thermal refugia from the warm temperatures of the Judith. Westslope cutthroat trout *Oncorhynchus clarki lewisi* were monitored in Dry Wolf Creek and West Fork Cottonwood Creek. The brook trout/westslope cutthroat trout fishery in Dry Wolf is maintaining balance, with similar numbers of each trout species per 1,000 feet. Twenty-five genetic samples were collected from westslope cutthroat trout in West Fork Cottonwood Creek.

In the Musselshell River drainage, Careless Creek and Willow Creek were sampled, however no fish were captured. Genetic samples and a depletion estimate were performed on the westslope cutthroat trout population in Half Moon Creek. The population appears to be very robust with numbers up drastically from 2011 estimates. Thriving trout fisheries were found in McCartney Creek and North Fork Flatwillow Creek, with brown trout *Salmo trutta*, brook trout, and rainbow trout present. Sampling within a grazing exclosure on South Fork Flatwillow Creek found a healthy brook trout population, with the total catch and average length improved over recent monitoring. Autumn sampling took place on South Fork Musselshell River and Cottonwood Creek to assess fall spawning use, with high numbers of large brown trout present at both sites.

Brown trout redd surveys were performed at six fishing access sites on Big Spring Creek in December, with counts being above average at all sites. Flow measurements were taken at three gaging stations on Big Spring Creek. Base flows were at or above average at all stations.

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OBJECTIVES

The purpose of this project is to implement the fisheries program in the Lewistown management area in Central Montana. Major watersheds include the Judith and Musselshell. The mission of the Fisheries Bureau of Montana Fish, Wildlife and Parks (FWP) is to preserve and enhance aquatic species and their ecosystems to meet public demand for recreational opportunities while assuring stewardship of aquatic life. The fisheries program is described in detail in Tews and Horn (2006).

STUDY AREA AND PROCEDURES

The study area is in central Montana on the eastern edge of Region 4 (Figure 1). It does not include the Missouri River on its northern boundary. The southern boundary is the Petroleum, Fergus, and Judith Basin County lines, including the headwaters of the Musselshell River in Meagher County. The eastern boundary is the Musselshell River. The western boundary is the headwaters of the Musselshell, Judith and Arrow Creek drainages. It includes all of Fergus and Petroleum counties and parts of Meagher, Judith Basin and Chouteau counties.

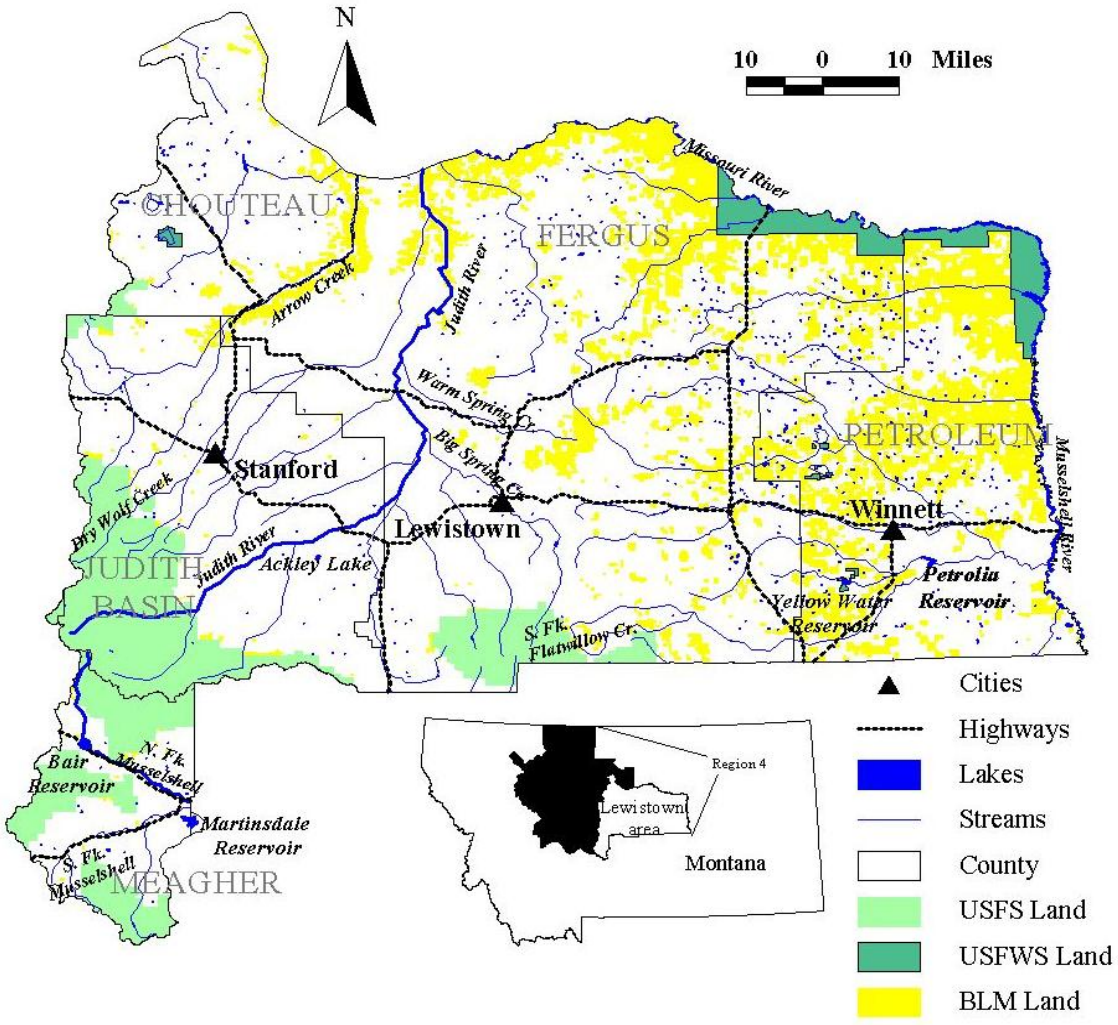

Figure 1. Map of Lewistown fisheries management area.

In still water, fish populations were sampled using 125 x 6 ft experimental multifilament nylon gill nets with 25 ft sections of 0.75, 1.0, 1.25, 1.5 and 2.0 inch square mesh, 2 x 3 ft frame traps (0.25 inch mesh), and 4 x 6 ft frame trap nets (1.0 inch square mesh). Gill nets were fished either sinking or floating. Trout populations on Big Spring Creek were surveyed using a fiberglass drift boat equipped with a mobile electrode or a plastic scanoe equipped with a mobile electrode and a Smith-Root VVP15 (or similar) to rectify AC to DC. Power was obtained from a 240-volt generator. Fish populations in small streams were sampled with a Smith-Root Model 12-B battery powered backpack electrofishing unit. Fish total length was measured to the nearest 0.1-inch or 1 mm and weighed to the nearest 0.01 lb or 1 gram. All game fish were measured. The first 50 fish of other species were measured from each net or sampling event. Big Spring Creek mark-recapture estimates from 2012-2013 were analyzed with the FIS program (MFWP 2011). Mark-recapture estimates from 2004 – 2011 were analyzed with the FA+ program (MFWP 2004). Older estimates utilized the MR-4 program (MFWP 1994) or the FA+ program. Most estimates were completed using partial log-likelihood statistics. Modified Peterson estimates were used when data sets did not fit the partial log-likelihood model. Anal or dorsal spines from yellow perch *Perca flavescens*, walleye *Sander vitreus*, largemouth bass *Micropterus salmoides*, and bluegill *Lepomis macrochirus* were collected. Spines were cross-sectioned with an Isomet Low Speed Saw and prepared as described in Tews (2005). Cleithra from northern pike *Esox lucius* were collected. Cleithra were frozen until analysis, at which time they were cleaned by simmering in 60-70°C water for five minutes to remove remaining flesh (Casselman and Crossman 1986). The samples were air dried and read under a dissecting microscope against a black background using reflected light. Year classes were based on size structure and age-structure analysis. Equations from Anderson and Neuman (1996) and Bister et al. (2000) were used to calculate relative weight (W_r).

Reservoir water levels are from Montana Department of Natural Resources and Conservation (DNRC) reservoir contents reports at http://www.dnrc.mt.gov/wrd/water_op/water_measurement_prog/default.asp (DNRC 2013).

Discharge on Big Spring Creek was measured at three gaging locations. Stage height at the Ash Street Bridge was measured with a Stevens Recorder. Stage height at the Hatchery and Mill Ditch locations were measured electronically with a Trutrack data logger encased in a pipe. Flow was measured at different discharges with a Marsh McBirney Flowmate model 2000 to develop or confirm rating curves. Water temperatures on area waters were monitored using Onset temperature loggers.

Brown trout *(Salmo trutta)* redd surveys were completed on Big Spring Creek during clear-water conditions by one person with polarized glasses walking downstream. A redd was counted if it had a defined upstream margin, a depression, and a pillow consisting of loose, sorted substrates that was not covered with periphyton. All redds were tallied and a GPS waypoint recorded.

RESULTS AND DISCUSSION

Large Reservoirs

Twenty-three reservoirs were sampled in 2013 with fish captured in all of them. October water levels of DNRC reservoirs were near or above average, with the exception of Martinsdale Reservoir, which was down significantly from 2012 and 66% of the long-term average (Figure

2). The other Meagher County DNRC reservoir, Bair, was also down from 2012 levels, although not substantially and holding 92% of the long-term average pool. Water levels in Ackley Lake and Yellow Water Reservoir were both up from 2012, at 112% and 294% of the long-term average respectively. Inflow/outflow and stream flow records are not available for most Central Montana reservoirs. Snowpack in the Judith and Musselshell basins was below average in March 2013 as indicated by snow-water equivalents (Figure 3), however, substantial rainfall in the spring of 2013 led to an above-average water year (Figure 4). These conditions led to many reservoirs at or near full pool, with many spilling in May and June. A summary of the large reservoir sampling can be found in Table 1.

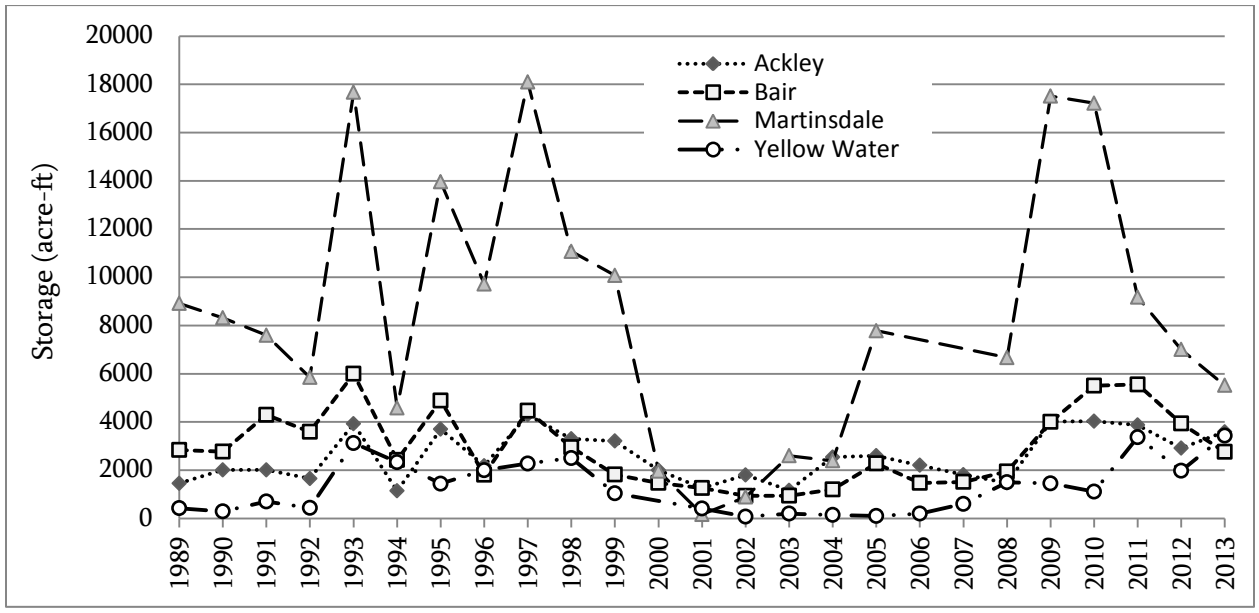

Figure 2. October water storage of Lewistown area DNRC reservoirs in acre-feet.

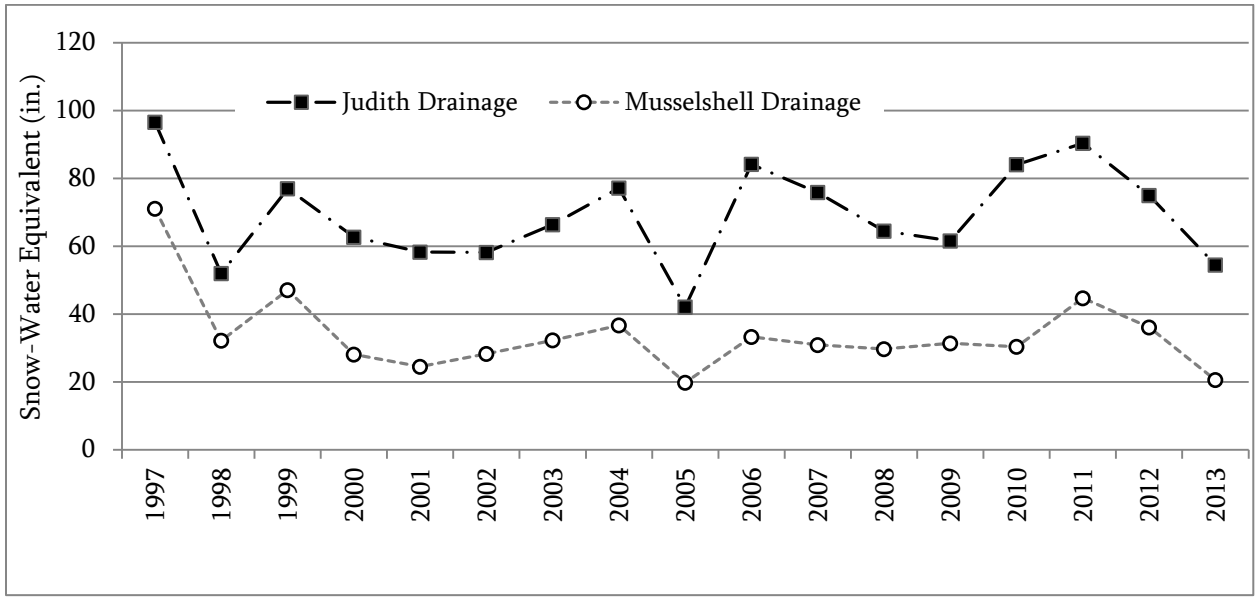

Figure 3. March snow-water equivalents in the Judith and Musselshell drainage taken from NRCS SNOTEL sites. Data available at National Resource and Conservation Service (NRCS).

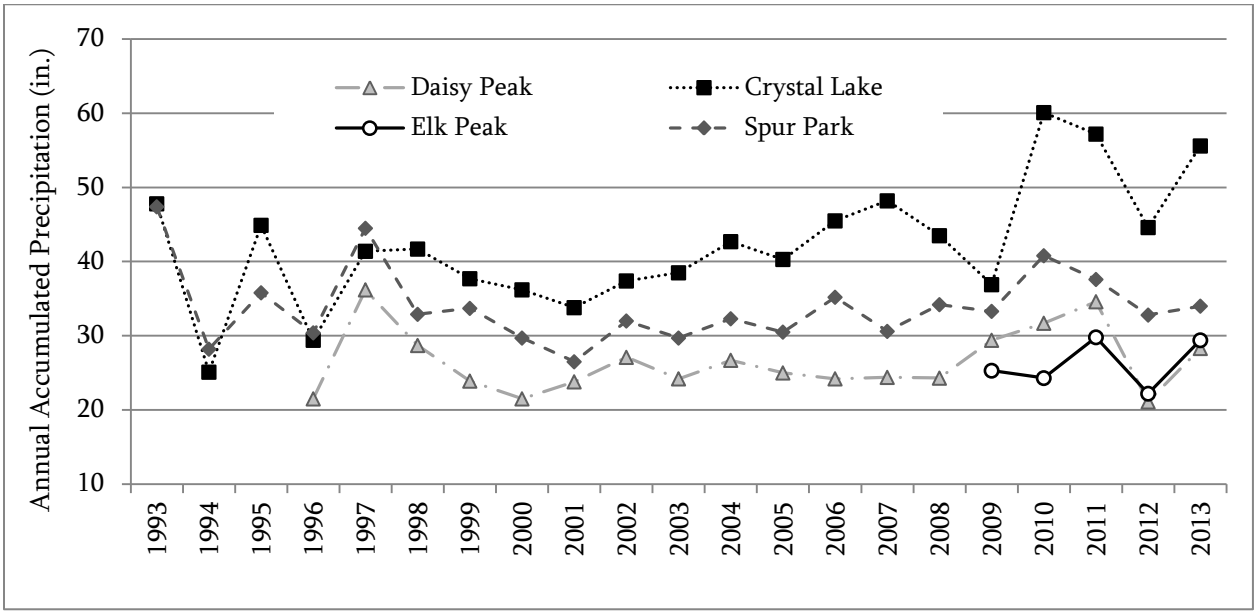

Figure 4. Annual accumulated (October 1 – September 30) precipitation at four NRCS monitoring locations. Daisy Peak and Spur Park are located in the Little Belt Mountains at the heads of the Judith and Musselshell basins. Elk Peak is located in the Castle Mountains in the Musselshell basin. Crystal Lake is located in the Big Snowy Mountains in the Judith drainage. Data available at National Resource and Conservation Service (NRCS).

Table 1. Summary of 2013 fisheries sampling on six large reservoirs in the Lewistown management area.

Location (Date) Nets	Species (Stocking Year)	N	Length (inches) Min	Max	Mean	Weight (pounds) Min	Max	Mean	Wr
Ackley	Brown trout	3	13.9	28.4	21.3	1.0	9.6	5.0	105.2
(10/2/2013)	Longnose Sucker	20	7.2	18.5	15.1	0.2	2.6	1.6	
1 Sinker	Rainbow trout	44	8.3	16.2	13.7	0.2	1.3	0.9	84.3
1 Floater	2013	6	8.3	9.4	8.7			0.2	90.8
	2012+	38	11.1	16.2	14.4	0.5	1.3	1.0	83.3
	White sucker	70	7.1	18.1	14.5	0.2	2.6	1.4	98.0
Bair	Rainbow trout	78	7.5	18.1	12.4	0.2	1.8	0.6	82.5
(9/3/2013)	2013	10	7.5	8.5	8.1			0.2	98.1
1 Sinker	2012+	68	10.2	18.1	13.0	0.4	1.8	0.7	80.2
1 Floater	Westslope cutthroat	4	9.4	11.4	10.7	0.3	0.6	0.5	93.8
	White sucker	179	6.7	18.0	11.5	0.1	2.2	0.7	84.8
East Fork	Brook trout	1							
(9/9/2013)	Northern pike	8	16.9	28.6	22.2	1.1	6.8	3.2	103.7
2 Sinkers	White sucker	44	12.8	18.7	16.1	0.9	2.9	1.9	99.7
2 Floaters	Yellow perch	49	5.4	11.7	8.8	0.6	0.9	0.4	101.2

(4/25/2013)	Bluegill	1			7.5				97.5
5 Large Trap Nets	Brook trout	1			16.1				87.2
	Longnose sucker	1			10.8				
	Northern pike	28	17.3	33.9	21.8	1.0	10.8	2.6	93.1
	White sucker	81	8.1	19.4	16.5	0.2	3.7	2.1	102.9
	Yellow perch	4722	5.6	12.1	8.2	0.1	1.0	0.3	91.0
Martinsdale	Longnose sucker	3	13.3	14.7	14.2	0.9	1.2	1.0	
(9/3/2013)	Rainbow trout	18	8.6	17.8	13.8	0.3	2.1	1.2	98.3
1 Sinker	2013	6	8.6	9.8	9.2			0.3	107.5
1 Floater	2012+	12	14.9	17.8	16.1	0.3	2.1	1.6	93.7
	White sucker	176	9.6	16.1	13.9	0.4	1.6	1.1	92.2
Petrolia	Carp	24	8.1	22.8	16.4	0.3	4.9	2.4	90.2
(9/5/2013)	Northern pike	6	26.1	41.5	32.5	4.2	20.9	10.2	104.2
2 Sinkers	Shorthead redhorse	1			17.0			2.4	
2 Floaters	White sucker	5	10.0	14.8	12.5	0.4	1.2	0.8	85.1
	Walleye	15	9.3	19.7	14.9	0.2	2.6	1.2	88.9
	Yellow perch	146	5.9	11.4	7.3	0.1	0.8	0.2	101.1
(5/2/2013)	Carp	32	13.9	26.6	19.0	1.4	7.2	3.4	95.3
5 Large Trap Nets	Northern pike	7	20.9	40.7	27.8	2.0	20.1	6.2	93.5
	White sucker	1			9.1			0.3	84.0
	Walleye	40	13.7	25.7	19.6	0.9	6.7	3.0	92.8
	Yellow perch	20	6.6	11.2	9.4	0.1	0.7	0.4	90.9
Yellow Water	Carp	60	4.5	18.4	11.7	0.1	3.0	1.2	99.3
(9/5/2013)	Longnose sucker	2	7.8	8.1	8.0	0.2	0.2	0.2	
1 Sinker	Rainbow trout	7	6.1	13.4	11.3	0.1	0.9	0.6	93.4
1 Floater	White sucker	60	8.7	15.0	11.6	0.3	1.4	0.7	88.0

Ackley Lake

Ackley Lake experienced above average water levels in 2013, continuing the period of at or above average October storage since 2009. Rainbow trout *Oncorhynchus mykiss* numbers were slightly down from the 25-year average in fall gill nets, ending the general upward trend from 2008 to 2012 (Figure 5). White sucker *Catostomus commersoni* numbers fell from those sampled in 2012, but remained above average with 35 fish per net night. Both species continued the upward trend in average length, with rainbow trout and white sucker averaging 13.6 and 14.5 inches respectively (Figure 6). Rainbow trout Wr continued its general downward trend since 2009, falling below the long-term average of 86 (Figure 7). White sucker condition continues to

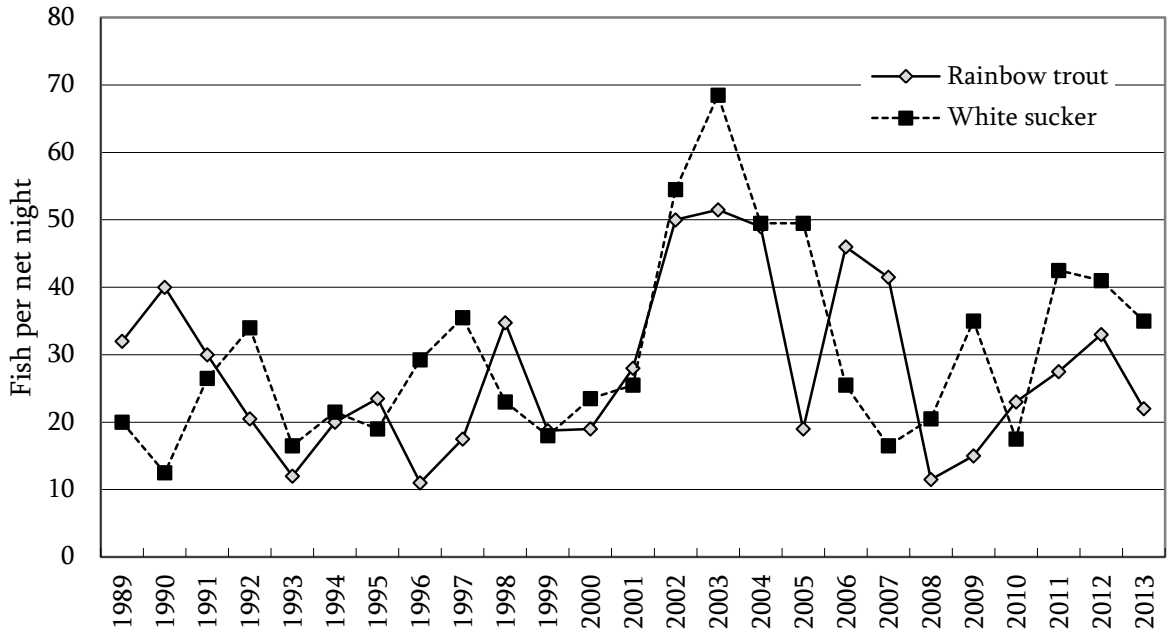

Figure 5. Fall gillnetting catch per unit effort (fish per net night) of rainbow trout and white sucker in Ackley Lake from 1989 to 2013.

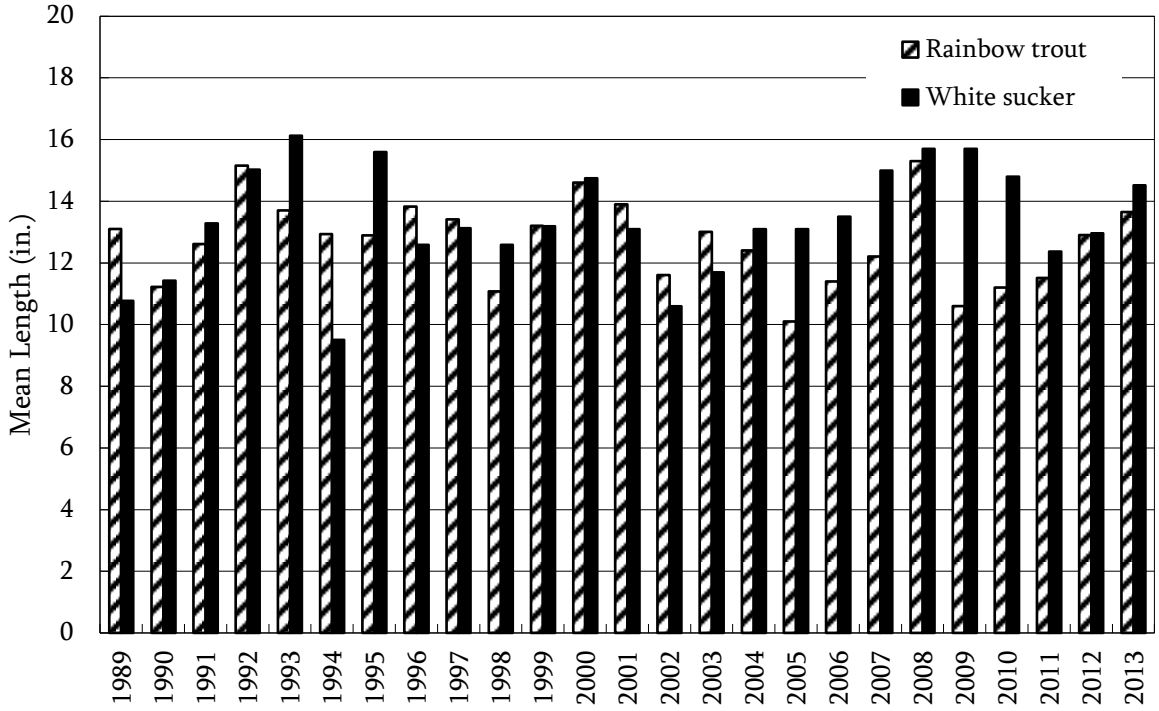

Figure 6. Mean length (inches) of rainbow trout and white sucker in Ackley Lake sampled during fall gillnetting from 1989 to 2013.

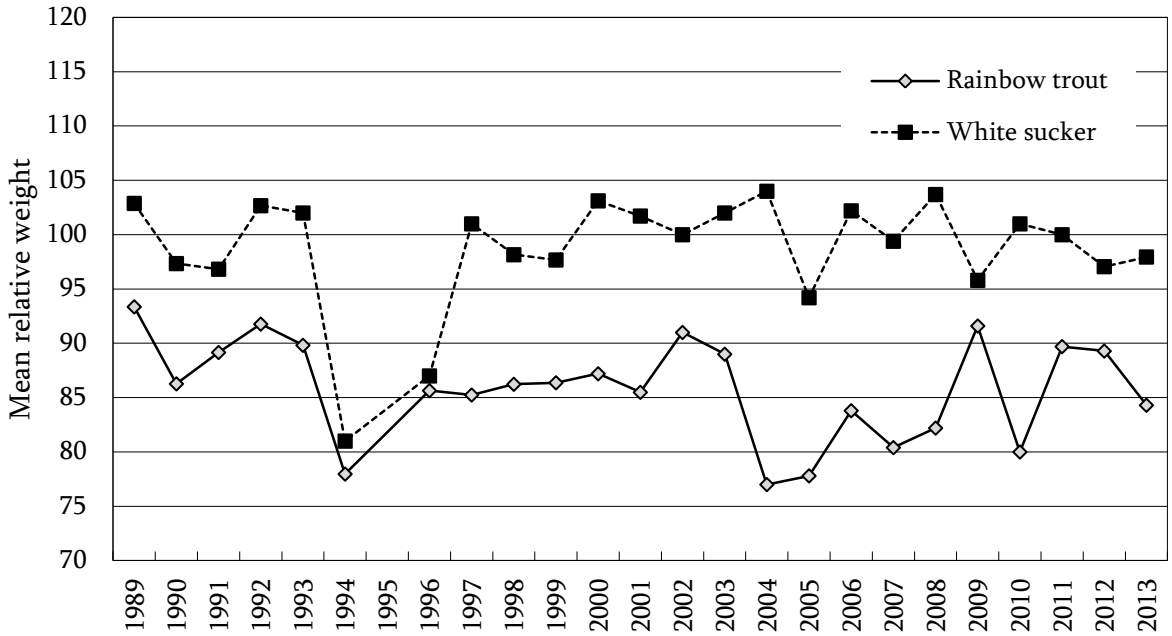

Figure 7. Mean relative weight (Wr) of rainbow trout and white sucker in Ackley Lake captured during fall gillnetting from 1989 to 2013.

hold steady, averaging relative weights close to 100. Other fish species sampled in Ackley included longnose sucker *Catostomus catostomus* and brown trout *Salmo trutta*.

The fishery in Ackley Lake has suffered from white sucker numbers limiting game fish performance in the past due to interspecific competition, similar to the dynamic described in Brodeur et al. 2001. Due to this, in 2005 and 2006 intensive efforts of mechanically suppressing white sucker numbers occurred (Tews and Horn 2006; 2008). This led to short-term improvements in the number and condition of rainbow trout over the period of 2007-2011. Recent sampling efforts indicate that white sucker numbers are returning to pre-suppression levels and rainbow trout condition is on the decline. Future management actions such as altering the stocking program or mechanical suppression may be necessary to improve angler satisfaction on Ackley Lake.

Bair Reservoir

The water level in Bair Reservoir continued to decline from the peak in 2010-11 and was at 92% of normal in October 2013. Rainbow trout CPUE in fall gill nets continued to improve from the lows of the late 2000's (Figure 8). White sucker CPUE is also increasing in recent years and was well above the long-term average in 2013. The mean length of rainbow trout remains above the long-term value, with fish averaging 12.4" (Figure 9); however, the condition of rainbow trout is poor, with a mean W_r of 82 (Figure 10). Mean white sucker length and W_r were near the long-term average in 2013. The steady increase in white sucker CPUE and poor rainbow trout Wr indicates that interspecific competition is likely limiting rainbow trout production in Bair Reservoir. Future management actions, such as altering the stocking regime or mechanical sucker removals, may be implemented to improve the fishery. Westslope cutthroat trout

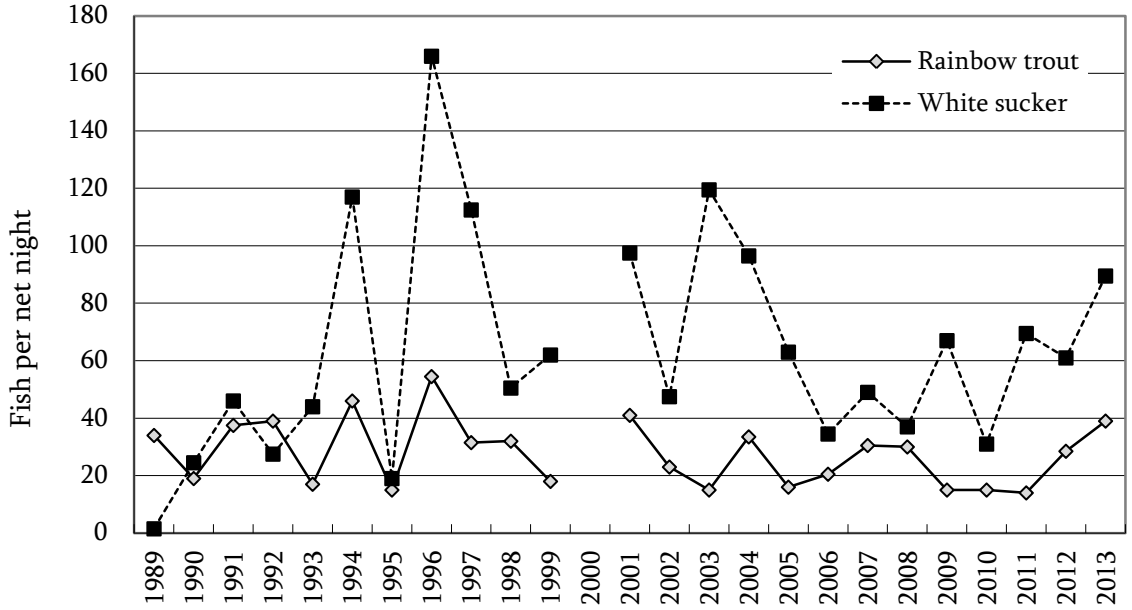

Figure 8. Fall gillnetting catch per unit effort (fish per net night) of rainbow trout and white sucker in Bair Reservoir from 1989 to 2013.

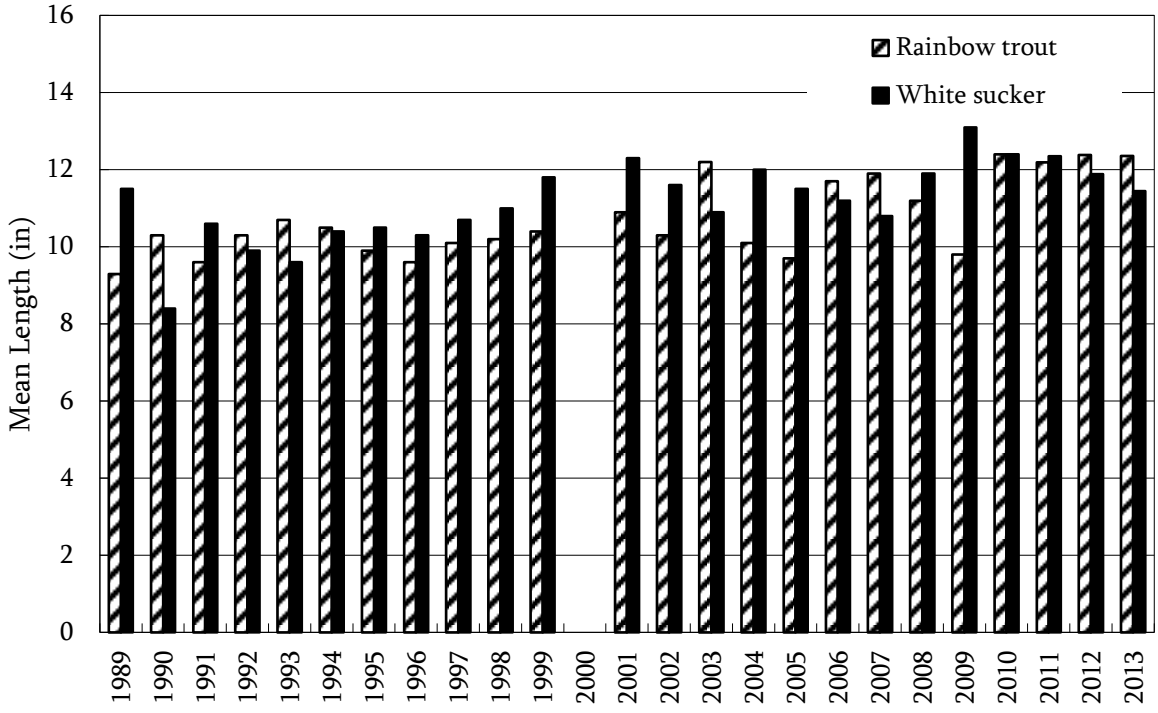

Figure 9. Mean length (inches) of rainbow trout and white sucker in Bair Reservoir sampled during fall gill netting from 1989 to 2013.

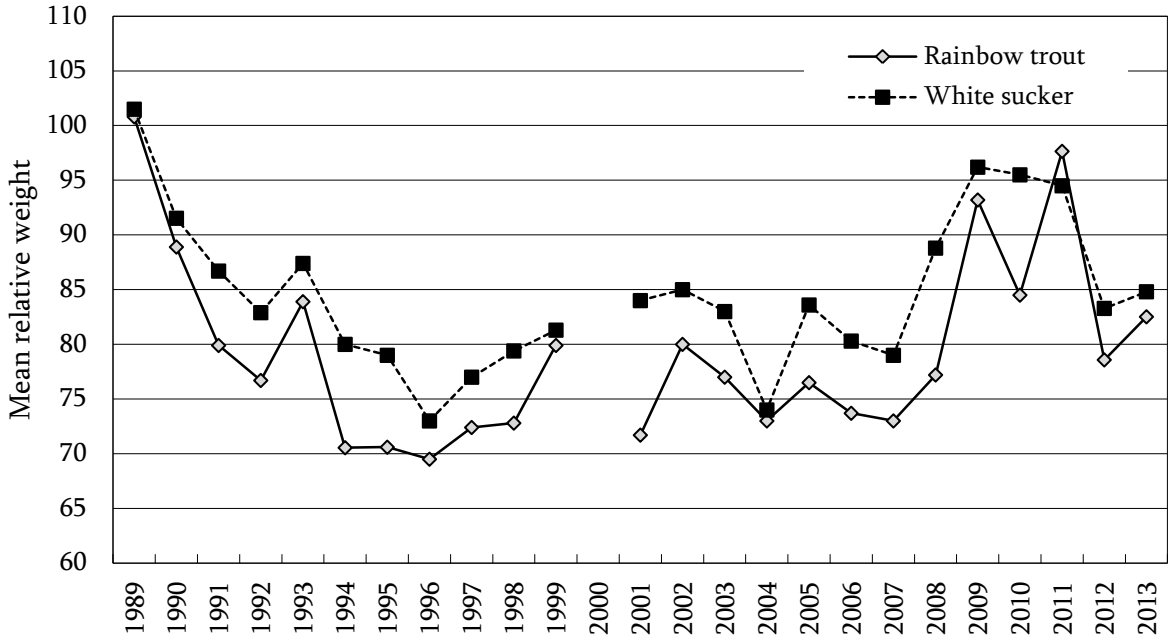

Figure 10. Mean relative weight (Wr) of rainbow trout and white sucker in Bair Reservoir captured during fall gill netting from 1989 to 2013.

Oncorhynchus clarki lewisi were sampled in low numbers in 2013. The cutthroat appear to perform well in Bair, averaging 10.6" in length and a W_r of 94.

East Fork Reservoir

East Fork Reservoir experienced a drawdown in the summer of 2012 to repair the release gate. These repairs went well and the reservoir was at ~75% full-pool in January 2013 and close to spilling after runoff and spring rains. FWP monitoring in 2013 suggests that the fishery of East Fork is recovering well from the drawdown. Yellow perch catch rates during fall gillnetting were slightly lower than the long-term average (Figure 11); however, spring trap netting caught more than 4,000 perch which suggests that there are ample perch numbers for the population to reach a full recovery to pre-drawdown numbers soon (Figure 12). Sampled yellow perch averaged a little more than 8 inches and 0.3 pounds. Northern pike numbers were near the long-term average with a mean length of 17" and the largest fish measuring 34". Additional species sampled in East Fork were bluegill, brook trout *Salvelinus fontinalis*, longnose sucker, and white sucker.

In 2013, 113 yellow perch were sampled for age analysis, and ranged in size from 5.2" to 12.0". These fish represented eight age-classes: age-3 to age-10 (Table 2). Low sample sizes precluded fish age-8 and older from inclusion in the table.

East Fork Reservoir has experienced two major events to impact the fishery in recent years. Flooding in 2011 resulted in the reservoir exceeding capacity and evacuating via the emergency spillway for the first time since construction. Subsequently, fish were displaced from the reservoir during this event; however, it is impossible to quantify what percentage of the

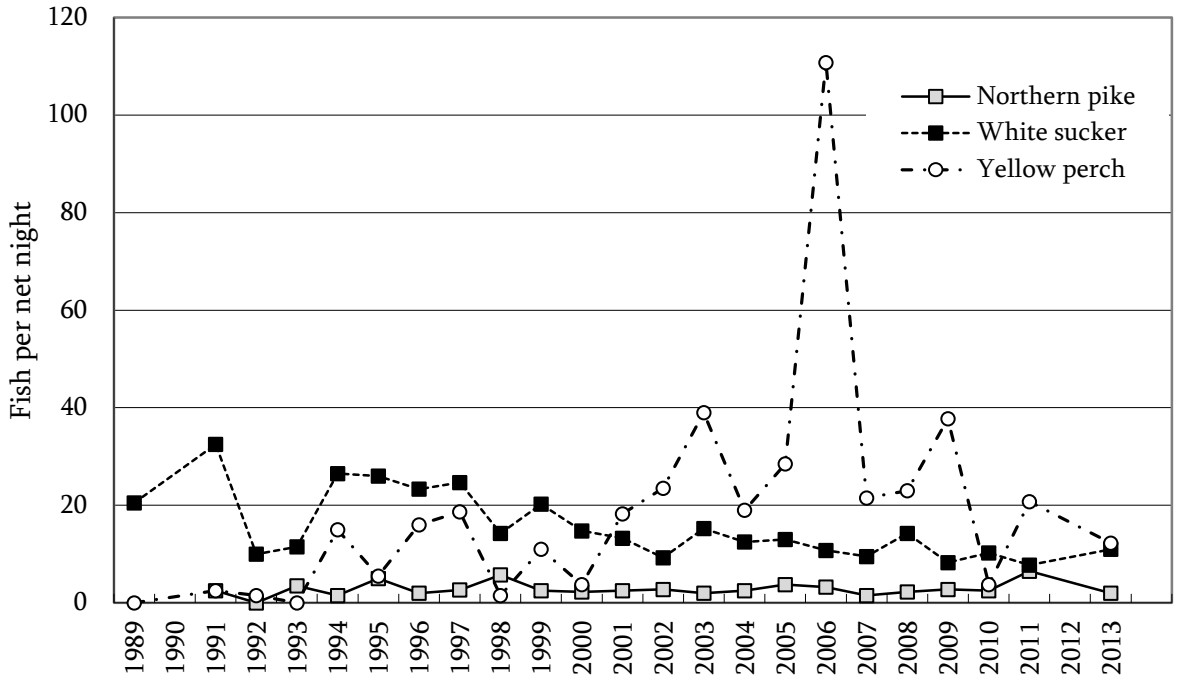

Figure 11. Fall gillnetting catch per unit effort (fish per net night) of common species in East Fork Reservoir from 1989 to 2013.

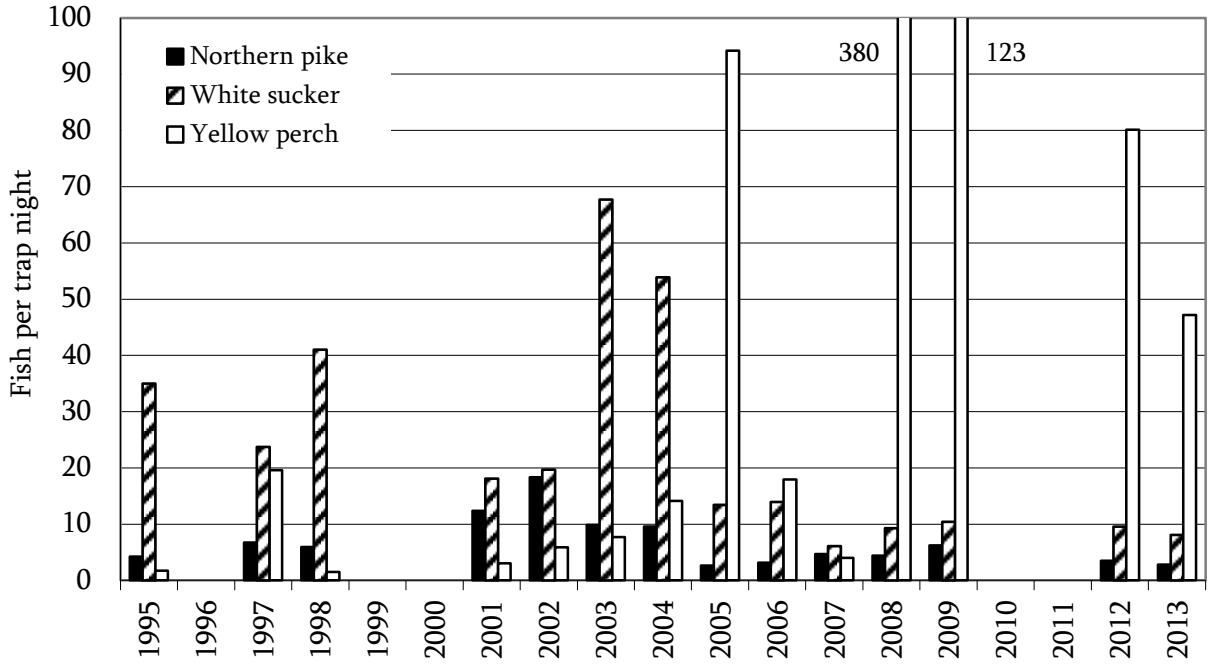

Figure 12. Spring trap netting catch per unit effort (fish per trap night) of common species in East Fork Reservoir from 1995 to 2013.

Table 2. East Fork Reservoir yellow perch age-class summary from 2003 to 2013 showing mean length in inches (min-max) and sample size (N).

Year	Age-3	N	Age-4	N	Age-5	N	Age-6	N	Age-7	N
2003	6.1 (5.2-6.9)	12	7.2 (6.5-8.3)	16	7.9 (6.8-9.0)	7	9.3 (8.3-10.2)	2		
2004	6.2 (5.7-7.2)	18	8.2 (7.0-9.9)	8	8.9 (8.2-9.5)	2	10.1 (9.7-10.4)	2		
2005	6.5 (5.5-7.8)	24	8.3 (7.0-9.5)	36	9.4 (8.0-10.4)	5	9.8 (8.3-10.8)	4		
2006	5.6 (5.2-5.9)	9	6.4 (5.6-7.4)	30	8.1 (6.5-10.0)	22	9.1 (7.6-11.9)	12	9.0 (8.6-9.4)	2
2007	6.3 (5.9-6.8)	7	7.2 (6.4-8.7)	10	7.4 (7,0-7.9)	5				
2008	5.9 (5.2-6.3)	12	6.6 (6.2-7.0)	11	7.6 (6.6-9.7)	23	8.7 (7.1-11.0)	27	9.6 (9.1-10.3)	5
2009	5.6	1	5.8	1	6.2 (5.8-6.9)	7	6.4 (5.9-6.9)	9	6.9 (6.3-7.5)	7
2010										
2011			8.1 (7.0-10.3)	21	8.7 (7.9-9.6)	15	9.0 (7.7-10.6)	8	9.0 (8.1-10.7)	3
2012	5.5 (5.4-5.5)	2			8.0 (6.6-10.0)	8	9.9 (8.0-10.6)	6	9.3 (7.4-10.8)	16
2013	5.2	1	6.0 (5.6-6.5)	12	6.8 (5.8-7.9)	25	8.5 (6.5-11.0)	26	9.3 (7.1-11.6)	30

population was transported downstream. Additionally, in summer of 2012, the reservoir repairs resulted in another large influx of fish lost downstream into Big Spring Creek.

A reduction in annual growth is apparent in 2013 age-4 and age-5 fish. This suggests a high density population experiencing increased competition. Despite the large fish loses in 2011 and 2012, the fish that remained in the reservoir following draining were concentrated into several small pools, which likely resulted in short-term stunting to take place in these age-classes. A rebound in annual growth will likely be observed in 2014 sampling following the recapture of available nutrients as the reservoir fills and yellow perch density reduced.

Martinsdale Reservoir

October water storage in Martinsdale Reservoir was 60% of the 10-year average and the lowest since 2004. Rainbow trout numbers were up slightly from 2012, but remain well below the long-term average (Figure 13). The mean length of rainbow trout was 13.8 inches, which is down from the record high in 2012, but above the long-term average of 12.5 inches. Catch rates of white sucker were the second highest on record and nearly 75% above the long-term average. Six fish from the 2013 stocking class were sampled; the average first-year growth of the 2013 stock was down, averaging 5 inches of growth. Martinsdale is stocked with westslope cutthroat trout; however none of these were surveyed in 2013. In addition to rainbow trout and white sucker, longnose sucker were sampled in Martinsdale. Akin to Ackley and Bair, the rainbow fishery of Martinsdale Reservoir appears to be limited by an abundant white sucker population and similar management actions will be considered in efforts to improve the recreational fishing opportunity.

Petrolia Reservoir

Water levels were up in Petrolia Reservoir with the reservoir spilling during spring 2013. Petrolia was sampled using five large fyke nets in the spring and with gillnets during the annual fall sampling. In the fall gillnets walleye numbers fell sharply from the recent peak in 2012 while yellow perch catch rates were the highest on record (Figure 14). The influx of inundated aquatic vegetation from the high water in 2011 and 2013 has been very beneficial to the yellow perch

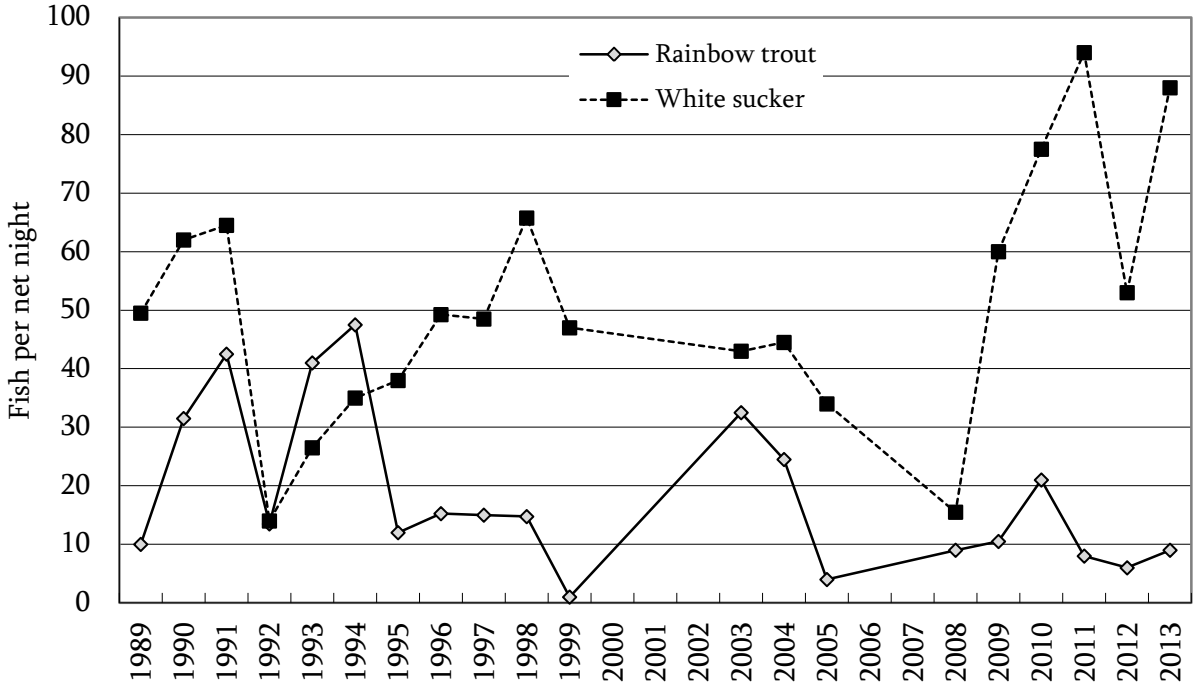

Figure 13. Fall gillnetting catch per unit effort (fish per net night) of rainbow trout and white sucker in Martinsdale Reservoir from 1989 to 2013.

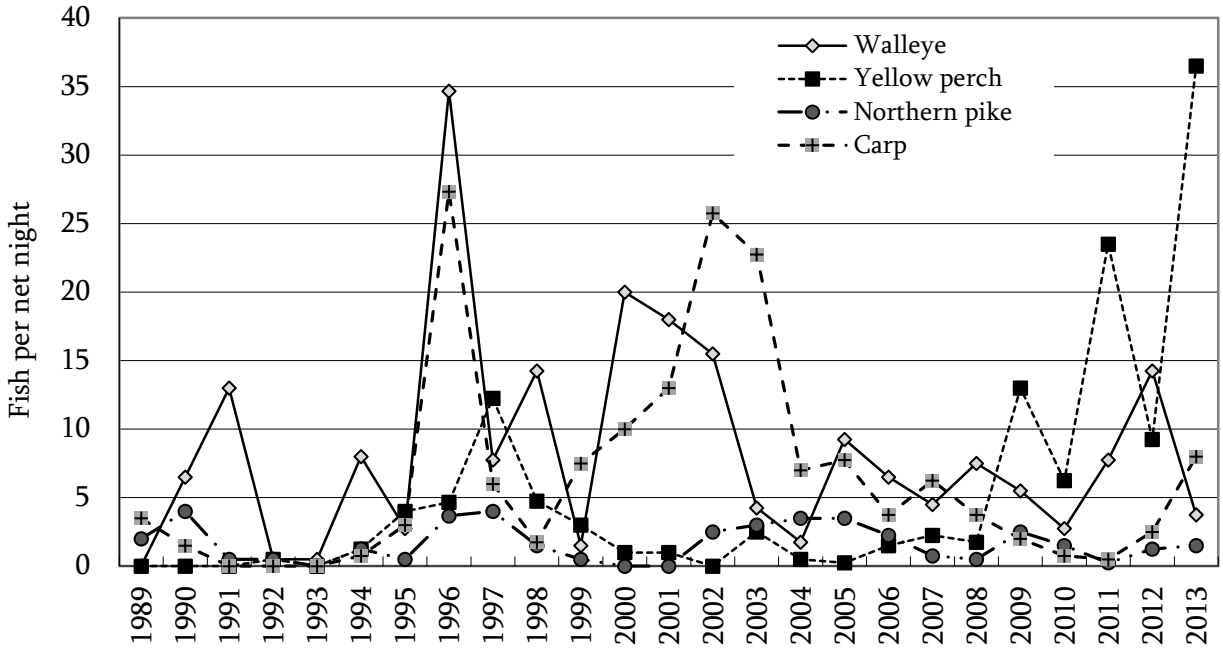

Figure 14. Fall gillnetting catch per unit effort (fish per net night) of common species in Petrolia Reservoir from 1989 to 2013.

population in Petrolia. Walleye had a mean length of 14.9 inches and Wr of 89. Yellow perch average length was down from 2012 at 7.3 inches, but the fish were in very good condition with a Wr of 101. Northern pike were sampled in low numbers in the gillnets. The average length of pike was 32.5 inches, with fish up to 41.5 inches and 20 pounds sampled. Additional species sampled during fall gillnetting included carp *Cyprinus carpio*, shorthead redhorse *Moxostoma macrolepidotum*, and white sucker.

Walleye, northern pike, and yellow perch catch rates improved from 2011 during 2013 fyke netting. Walleye catch rates were the highest observed since 2004, and fish averaged 19.6 inches and Wr of 93.

Aging was performed on nineteen yellow perch, thirty-nine walleye, and four northern pike from Petrolia in 2013. Yellow perch ranged in size from 6.6" to 11.2" and represented four age-classes (Table 3). Walleye ranged in size from 13.7" to 25.7" and represented eight age-classes from age-3 to age-10 (Table 4). Three northern pike age classes were identified: age-5 (26.4"), age-7 (34.5-37.0"), and age-19 (41.5").

Table 3. Yellow perch age-class summary from 2004 to 2013 showing mean length in inches (min-max) and sample size (N) found in Petrolia Reservoir.

Year	Age-2	N	Age-3	N	Age-4	N	Age-5	N	Age-6	N
2004			10.7	1			12.3	1		
2005										
2006					8.5	1				
2007										
2008	4.6 (3.6-5.8)	5	6.7 (5.8-7.9)	19	8.0 (6.8-9.1)	6	10.1 (9.1-10.9)	4		
2009					6.8 (5.8-7.8)	7	7.8 (7.7-7.9)	3	8.1 (7.6-8.7)	12
2010	6.6 (5.8-7.9)	15	9.0 (7.2-10.2)	4	9.8 (8.8-10.8)	6	11.0 (10.1-12.0)	4		
2011	5.9 (5.7-6.0)	5	7.8 (5.8-9.9)	37	8.0 (5.8-10.4)	13	8.0 (7.0-9.0)	7	11.1	1
2012										
2013			7.2 (6.6-7.7)	2	9.6 (8.0-11.1)	4	9.5 (8.6-10.5)	12	10.9 (10.7-11.2)	2

Table 4. Walleye age-class summary from 2004 to 2013 showing mean length in inches (min-max) and sample size (N) found in Petrolia Reservoir.

Year	Age-3	N	Age-4	N	Age-5	N	Age-6	N	Age-7	N
2004	13.8 (12.6-15.1)	11	15.6 (14.4-17.4)	25	16.6 (16.1-17.3)	6	17.4 (17.0-17.9)	4		
2005	15.5 (13.9-16.7)	3	19.8	1						
2006	11.6 (10.1-13.0)	17	14.1 (12.7-15.4)	9	16.7	1				
2007										
2008			13.4 (11.6-15.8)	29	15.2 (13.4-16.3)	13	17.9 (15.4-21.1)	9		
2009			13.2	1	13.8 (13.5-14.0)	2	15.1 (14.0-17.0)	3	16.4 (15.0-17.7)	2
2010	10.7 (7.9-13.1)	5	12.5 (10.0-18.7)	27	17.5 (14.2-20.1)	13	19.5 (15.0-25.2)	3	19.2 (18.8-20.1)	2
2011	10.7 (9.5-11.7)	9	12.2 (11.8-13.0)	5	13.7 (10.5-15.8)	12	16.7 (16.2-17.1)	2		
2012										
2013	13.7	1	15.9 (15.4-16.2)	6	16.6 (16.1-17.5)	4	18.1 (16.7-21.2)	5	19.9 (17.8-23.3)	11

Yellow perch growth rates are higher in Petrolia than other reservoirs in the management area. Perch reach adequate size to be recruited into sampling gear at age-3. Despite higher catch rates, aging data does not suggest that densities are impacting growth. Age-5 yellow perch average size and size range are comparable to those observed since 2008. Low perch densities due to increased water levels, increased nutrient availability, and warmer water temperatures are all likely factors contributing to observed growth rates.

Petrolia Reservoir walleye are recruited into the sampling gear at age-3. Walleye growth rates appeared to improve in 2013 from 2008-2011 data. Available forage fishes, primarily yellow perch, have increased in recent years. Additionally, increased reservoir elevation and extended spill periods in 2011 and 2013 have reduced intraspecific competition as reservoir area has increased and walleye migrated downstream into Flatwillow Creek.

Yellow Water Reservoir

October water storage in Yellow Water Reservoir was the highest on record at 247% of the 10-year average. After the flood flows of 2011 and 2013, which first reintroduced the species, carp and white sucker dominate the fishery of Yellow Water. Rainbow trout catch rates (Figure 15) and average length were the lowest on record. Carp catch rates were similar to 2012, while white sucker numbers were at the highest level since 2011.

It is unclear what has occurred at Yellow Water in recent years. The rainbow trout sampled in 2013 were from one or two stocking classes judging from the length range sampled (6.1 to 13.4 inches). The reservoir was stocked with 10,000 4" and 1,000 9" rainbow trout in 2012 and 2013. Either the influx of carp and white sucker has drastically reduced growth rates and the fish sampled came from the 2012 and 2013 stockings, or there was a fish-kill event and all fish sampled came from the 2013 stocking. Future monitoring in 2014 will be used to determine if growth rates have declined or a kill took place in the winter/spring of 2012-2013.

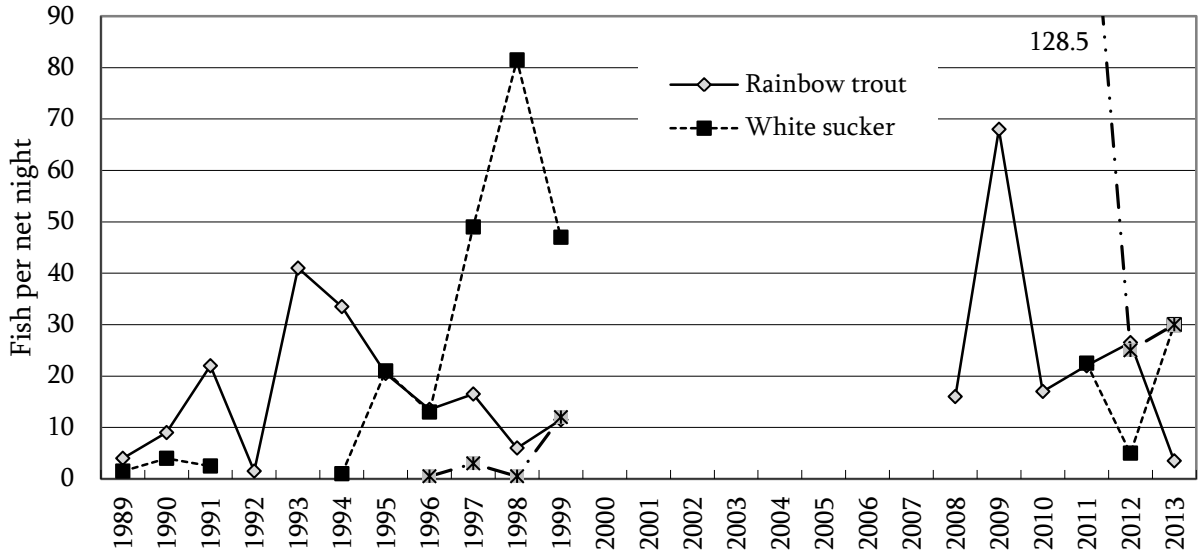

Figure 15. Fall gillnetting catch per unit effort (fish per net night) of common species in Yellow Water Reservoir from 1989 to 2013.

Small Reservoirs

A total of 15 small reservoirs were sampled in the Lewistown area during 2013. Fish were sampled in all reservoirs. Dry Blood Reservoir and Upper and Lower Carter Ponds were sampled with fyke nets, the remaining reservoirs were sampled using gill nets. Table 5 provides a summary of the small reservoir sampling performed in 2013.

Table 5. Summary of 2013 fisheries sampling on 15 small reservoirs in the Lewistown management area.

Location (Date) Nets	Species (Stocking Year)	N	Length (inches) Min	Max	Mean	Weight (pounds) Min	Max	Mean	Wr
Bonanza	Brook trout	9	7.2	16.1	11.2	0.2	1.9	0.8	122.0
(9/3/2013)	Rainbow trout	20	8.7	21.9	11.5	0.3	3.9	0.9	127.1
1 Sinker									
Box Elder Creek	Rainbow trout	11	5.7	10.7	9.0	0.1	0.5	0.3	94.6
(7/17/2013)	White sucker	37	6.6	11.1	9.0	0.1	0.6	0.3	87.4
1 Sinker	Yellow perch	59	5.5	10.3	8.0	0.1	0.4	0.2	79.5
1 Floater									
Bubs	Largemouth bass	27	10.7	13.4	11.4	0.6	1.3	0.8	103.6
(5/6/2013)									
1 Floater									
Drag Creek	Bluegill	12	3.7	5.8	4.3	0.03	0.12	0.05	93.6
(7/11/2013)									
1 Sinker									
1 Floater									
Dry Blood	Largemouth bass	23	5.9	13.6	9.8	0.1	2.2	0.7	126.8
(7/11/2013)									
2 Large Fyke									
Hansen	Rainbow trout	36	6.0	18.1	8.8	0.1	2.1	0.4	108.1
(7/22/2013)									
1 Sinker									
Jakes	Sauger	4	17.7	19.9	19.1	1.4	2.8	2.2	84.2
(5/6/2013)	Yellow perch	519	5.2	13.9	7.0	0.1	1.3	0.1	76.1
1 Sinker									
1 Floater									
Lower Carter	Bluegill	436	3.9	9.8	5.2	0.03	1.12	0.11	102.1
(6/5/2013)	Rainbow trout	32	8.2	20.7	16.1	0.2	3.5	1.9	99.1
2 Large Fyke	Yellow perch	3	8.4	11.4	10.0	0.2	0.8	0.5	86.5
Lower Hassler	Rainbow trout	1	-	-	10.2	-	-	0.5	-

(7/22/2013) 1 Sinker									
Manuel #2 (7/17/2013) 1 Sinker	Rainbow trout	40	10.6	18.8	13.5	0.5	2.4	1.1	107.0
Payola	Largemouth bass	1	-	-	17.5	-	-	3.1	101.8
(5/29/2013)	White sucker	19	12.8	15.9	14.2	0.9	2.1	1.4	105.7
1 Sinker	Yellow perch	20	5.9	10.6	8.3	0.1	0.5	0.3	96.2
Rostad	Rainbow trout	7	6.5	12.9	9.2	0.1	0.8	0.4	91.3
(9/3/2013)	White sucker	16	11.6	15.6	12.9	0.7	1.3	0.8	88.4
1 Floater									
Slivka #2 (7/23/2013) 1 Sinker	White sucker	9	7.4	9.1	8.2	0.2	0.3	0.3	97.4
South Fork Blood (5/29/2013) 1 Floater	Largemouth bass	15	6.8	14.0	10.9	0.2	1.9	0.9	104.9
Upper Carter	Bluegill	193	3.3	8.4	4.6	0.02	0.44	0.09	104.3
(6/4/2013)	Rainbow trout	105	6.9	16.2	11.8	0.2	1.4	0.6	88.8
2 Large Fyke	Yellow perch	9	8.4	16.1	11.4	0.3	1.0	0.8	98.1
Upper Hassler (7/22/2013) 1 Sinker	Rainbow trout	6	10.7	12.0	11.4	0.5	0.8	0.7	115.3
Urs (7/23/2013) 1 Sinker	Rainbow trout	2	13.4	19.8	-	1.3	3.7	-	127.1
Whisker	Black crappie	4	6.2	6.4	6.3	0.17	0.19	0.18	139.7
(5/6/2013)	Largemouth bass	125	9.1	14.2	11.0	0.4	1.7	0.8	113.7
1 Sinker 1 Floater									

Jakes Reservoir

Sauger *Sander canadense* catch rates continued to decline in 2013, indicating that the fish stocked in 2003 are aging out. Mean length of sauger was 19.1". A total of four sauger were captured, three of which were tagged in 2012, the other in 2009. Average annual growth was

0.89 inches. Yellow perch mean length was 7.0". Yellow perch condition in Jakes Reservoir remains poor, although up slightly from 2012, with a mean Wr of 76.

The decline in yellow perch Wr follows closely the decline in sauger CPUE as the stocked fish age out (Figure 16). This indicates that predation on yellow perch has declined, resulting in high levels of intraspecific competition and thus the poor condition, decreasing trend in average length, and the compressed age-structure of the perch population (Table 6).

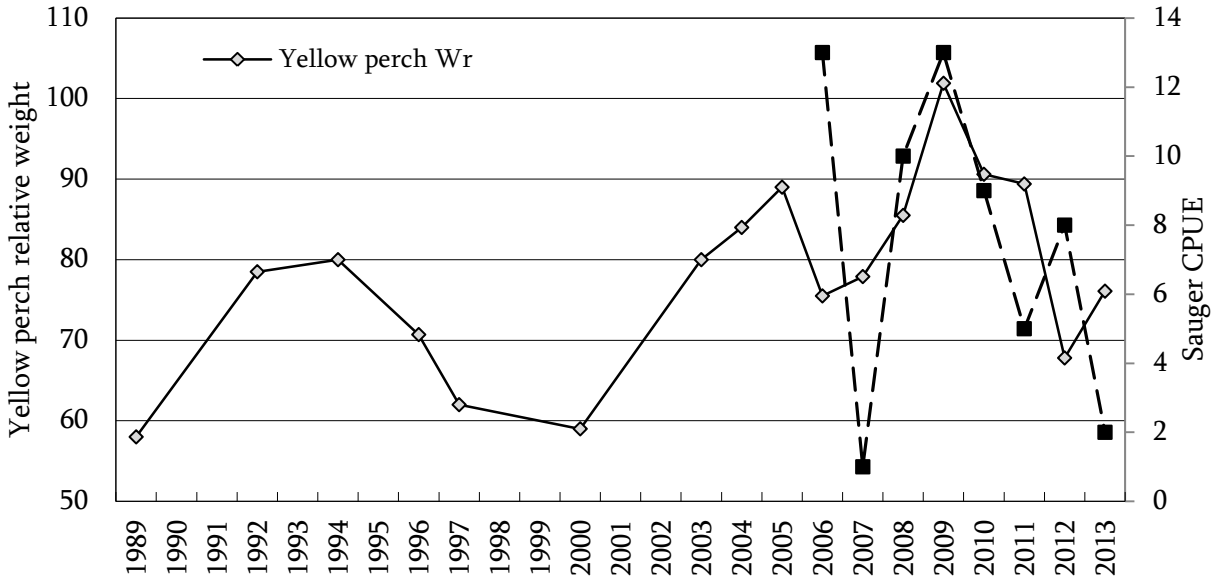

Figure 16. Mean yellow perch Wr and sauger catch per unit effort (CPUE) in Jakes Reservoir from 1989 to 2013.

Table 6. Yellow perch age-class summary from 2003 to 2013 showing mean length in inches (min-max) and sample size (N) found in Jakes Reservoir.

Year	Age-3	N	Age-4	N	Age-5	N	Age-6	N	Age-7	N
2003	7.5 (6.8-8.1)	9	8.1 (7.4-8.5)	6	8.1	2				
2004			9.7 (9.3-10.1)	11	9.9	1	10.3	1		
2005	7.2 (6.7-7.7)	14	8.1 (7.4-9.2)	7	9.0 (8.2-9.8)	2				
2006	6.2 (5.5-7.2)	27	7.4 (6.6-8.2)	17	8.0 (7.6-8.7)	6	9.6 (9.5-9.7)	2		
2007	6.6 (5.8-7.6)	12	7.2	1						
2008	6.2 (6.0-6.6)	9	6.9 (6.3-7.6)	16	7.6 (6.6-8.1)	11	7.8 (7.5-8.1)	3		
2009	5.5 (4.5-6.3)	3	6.0 (5.9-6.1)	4	6.8 (6.6-7.2)	6	7.1 (6.6-7.6)	5	7.8 (6.5-9.2)	14
2010	6.0 (5.6-6.6)	3	7.2 (6.5-7.9)	9	7.6 (7.1-8.1)	2	8.9	1	8.5 (7.9-9.4)	3
2011	5.8 (5.5-5.9)	7	6.4 (5.6-7.3)	21	7.7 (6.4-9.1)	18	8.1 (7.3-10.7)	13	9.9 (8.2-11.7)	2
2012	5.4	1	6.0 (5.8-6.3)	19	7.2 (6.3-8.3)	24	7.7 (6.0-9.2)	11	8.7	1
2013	5.3	1	6.6 (5.4-8.3)	37	7.5 (5.8-8.8)	31	9.5 (7.4-11.6)	2	13.5 (13.2-13.9)	2

The stocking of sauger in Jakes improved yellow perch condition and average length, as well as provided an excellent sauger fishery, because of this additional sauger stocking occurred in the

fall of 2013. FWP personnel collected sauger from the Missouri River between Cow Creek and Fred Robinson Bridge for a wild fish transfer to Jakes Reservoir. A total of 83 sauger with an average length of 13.4 inches were transferred. Additional sauger transfers will take place annually for up to five years.

Missouri Breaks Reservoirs

In addition to Jakes Reservoir, eight Missouri Breaks reservoirs were sampled in 2013.

Box Elder Creek Reservoir recently had an illegal introduction of yellow perch which appears to have negatively impacted the rainbow trout fishery. Fifty-nine yellow perch were sampled averaging 8.0 inches and a Wr of 79. Rainbow trout average length was 8.9", with the largest fish measuring 10.7".

Largemouth bass were the only species sampled in **Bubs Reservoir**. Twenty-seven largemouth bass were captured. The average length was 11.4", with fish weighing up to 1.3 pounds. The bass were in good condition with a mean Wr of 103.

Twelve bluegill were sampled in **Drag Creek Reservoir**. Bluegill had an average length of 4.3 inches and appear to be stunted. Approximately 2,000 largemouth bass are stocked in Drag Creek annually, however, none were surveyed in 2013 and only 5 have been captured in sampling from 2010-13. The apparent poor performance of largemouth bass and compressed age-structure of the bluegill population indicate that an alternative predatory fish may be necessary to improve the fishery in Drag Creek.

Dry Blood Reservoir was sampled using two large fyke nets. Largemouth bass were the only species collected. Twenty-three fish were sampled with an average length of 9.7" and Wr of 126. A wild fish transfer of black crappie from Tongue River Reservoir to Dry Blood occurred in 2011. No crappie were sampled in 2012 or 2013, indicating that the transfer was not successful.

Manuel Reservoir #2 was surveyed for the first time since 2009. Rainbow trout appear to be performing well, as 40 fish were collected with an average length of 13.5" and a Wr of 106. Rainbows up to 18.8" weighing more than two pounds were sampled.

Largemouth bass, white sucker, and yellow perch were found in **Payola Reservoir**. A single, 17.5 inch largemouth bass was sampled. Nineteen white suckers were collected. Yellow perch averaged 8.3" in length with a mean Wr of 96.

Fifteen largemouth bass were found during fisheries monitoring of **South Fork Blood Reservoir**. Length ranged from 6.8 to 14.0 inches with an average of 10.9 inches. The fish were found to be in good condition, with a mean Wr of 105.

Whisker Reservoir appears to have recovered well from the winterkill event in 2010-11. Largemouth bass and black crappie were sampled in 2013. One hundred twenty-five largemouth bass were collected ranging in length from 9.1" to 14.2". Four black crappie were sampled with an average length of 6.3 inches. The condition of fish in Whisker was high, with largemouth and crappie having mean relative weights of 113 and 141 respectively.

Lewistown/Denton/Winifred Area Reservoirs

Seven small reservoirs were surveyed in the Lewistown/Denton/Winifred area during 2013.

Upper Carter Pond & Lower Carter Pond were each sampled with 2 large fyke nets. Continued monitoring of the illegal introduction of bluegill in 2013 indicated that the species population densities were high in both waterbodies. Illegally introduced yellow perch were also found in both ponds. A total of 193 and 436 bluegill were captured in Upper and Lower Carter Pond with an average length of 5.0 inches. Nine yellow perch, averaging 11.4", were sampled in Upper Carter Pond. Three perch were found in Lower Carter, with an average length of 10.0".

The negative impacts of the illegal introductions on the rainbow trout fishery are more pronounced in Upper Carter. One hundred five rainbow trout were collected in the Upper Pond. The average length was 11.8 inches, with fish up to 16.2 inches sampled. Rainbow trout Wr fell substantially, from 108 in 2012 sampling to 89 in 2013. The rainbow trout in Lower Carter Pond were larger and in better condition than in the upper pond. Thirty-two rainbow trout were captured, ranging in length from 8.2 to 20.7 inches with fish weighing more than 3 pounds. The mean Wr of Lower Carter rainbow trout was 99.

The continued proliferation of illegally introduced species in the Carter Pond complex is having and will continue to have negative impacts on the popular rainbow trout fisheries the ponds provide. Management actions will be required to remove the illegal introductions from the system.

Hansen Reservoir was sampled with a single sinking gill net. Thirty-six rainbow trout were collected, with an average length of 8.8 inches and Wr of 108. Fish up to 18.0" in excess of 2 pounds were surveyed.

Rainbow trout were the only species sampled in **Upper Hassler Reservoir & Lower Hassler Reservoir**. Six trout averaging 11.3" were collected in Upper Hassler, with a Wr of 116. A single rainbow trout measuring 10.2 inches was found in Lower Hassler. The apparent lack of production and discussions with the landowner suggest that rainbow trout are not performing well in Lower Hassler Reservoir. Largemouth bass will be stocked in 2014 in an attempt to improve the recreational fishing opportunity the reservoir provides.

Slivka Reservoir #2 experienced a springkill event after ice-off in the spring of 2013, according to the landowner. Largemouth bass were present in the reservoir prior to the springkill event. Summer sampling corroborated the landowner's report, as no largemouth bass were sampled. White suckers were present in the gillnets, averaging 8.2 inches.

A sinking gill net was fished in **Urs Reservoir**. The net was found on the bank of the reservoir when FWP personnel returned to pull it. It appeared that a beaver was caught in the net and someone pulled it in, attempting to free the beaver. Two rainbow trout were found in the net. The trout were in very good condition with an average Wr of 128. The largest fish was 19.8" and weighed 3.7 pounds.

<u>Meagher County Reservoirs</u>

In addition to Bair and Martinsdale Reservoirs, two small reservoirs were sampled in Meagher County during 2013.

Fisheries monitoring of **Bonanza Reservoir** indicates that it provides a high-quality recreational fishery. Nine brook trout and 20 rainbow trout were collected in 2013 monitoring. The brook trout ranged in length from 7.2 to 16.1 inches and had a mean Wr of 122. Rainbow trout averaged 11.5 inches and had a Wr of 127. Rainbow trout up to 21.9" and close to 4 pounds were captured.

Rainbow trout and white sucker were found in **Rostad Reservoir**. Seven rainbow trout ranging in length from 6.5 to 12.9 inches were sampled. The rainbow trout represented two years of hatchery stockings. Sixteen white suckers were collected. The stocking of Rostad Reservoir does not appear to be a worthwhile venture as it is not producing a quality or desirable recreational fishing opportunity; because of this the reservoir will no longer be stocked.

Streams

A total of 13 streams were surveyed in the Lewistown management area during 2013. Fish were sampled in all surveys with three exceptions. A discussion of the findings from those surveys follows. Table 7 provides a summary of catch statistics from the stream surveys.

Additionally, physical parameters were monitored on streams in the Lewistown area. Flow measurements were taken at three locations on Big Spring Creek. Water temperature data was collected via thermographs at two locations on Big Spring Creek, three locations on South Fork Judith River, and one on each fork of the Musselshell River.

Table 7. Summary of 2013 fisheries sampling on 13 streams in the Lewistown management area.

Waterbody (Date) Location Section Length (ft)	Species	N	Length (inches) Min	Max	Mean	Mean Weight (pounds)	Wr
Big Spring Creek	Brown trout	451	8.2	19.2	13.0	0.8	93.3
(8/21,22,28,29/2013)	Mountain whitefish	21	12.4	16.8	14.9	1.4	112.7
Burleigh	Northern pike	4	14.5	20.7	17.1	1.2	99.3
5840	Rainbow trout	329	5.9	15.4	12.4	0.7	92.8
	Yellow perch	16	7.4	10.2	8.4	0.3	85.7
(8/19,20,26,27/2013)	Brown trout	442	6.7	21.7	11.7	0.6	89.6
Machler	Mountain whitefish	145	8.5	16.2	11.2	0.5	97.3
3410	Rainbow trout	152	3.9	17.8	11.9	0.7	89.1
(8/19,20,26,27/2013)	Brown trout	537	3.9	18.9	11.4	0.6	88.8
Carroll Trail	Mountain whitefish	220	8.1	17.6	12.1	0.7	102.0
5200	Northern pike	2	19.0	25.2	22.1	3.3	110.1
	Rainbow trout	159	5.3	15.9	12.0	0.6	88.0
Careless Creek (8/13/2013)	SURVEYED - NO FISH PRESENT						

Swanz Property 200							
Cottonwood Creek (Meagher County) (11/7/2013) Cottonwood Ck Rd. 850	Brook trout	1	-	-	11.9	0.6	92.2
	Brown trout	55	5.5	17.5	14.1	1.0	88.3
	Cutthroat trout	2	10.6	14.6	12.6	0.7	73.5
	Rainbow trout	1	-	-	5.2	0.1	-
Dry Wolf Creek (8/15/2013) Above USFS Campground 400	Brook trout	17	4.5	9.5	7.4	0.2	123.4
	Westslope cutthroat	20	2.6	13.1	7.6	0.36	102.5
Half Moon Creek (7/15/2013) River mile 4.0 500	Westslope cutthroat	91	1.9	10.4	4.9	0.2	81.9
Little Trout Creek (7/31/2013) River mile 4.5 500	Brook trout	1	-	-	3.4	-	-
	Fathead minnow	9	1.6	2.4	-	-	-
	Lake chub	39	2.1	6.0	-	-	-
	Longnose dace	291	1.5	3.8	-	-	-
	White sucker	77	3.3	13.1	-	-	-
McCartney Creek (7/30/2013) River mile 3.3 1,000	Brook trout	21	2.5	8.5	5.6	0.1	123.3
	Brown trout	5	14.9	18.0	15.8	1.6	99.1
	Mottled sculpin	1	-	-	2.8	-	-
	Rainbow trout	3	9.4	11.1	10.4	0.5	115.0
N. Fk. Flatwillow Creek (7/30/2013) River mile 11.7 500	Brook trout	18	4.3	11.2	7.9	0.2	99.0
	Brown trout	24	4.5	20.0	12.5	0.8	92.1
	Longnose sucker	45	6.0	15.8	10.7	0.5	-
	Rainbow trout	4	4.5	5.7	5.3	0.1	87.6
	White sucker	1	-	-	8.9	-	-
Ross Fork Creek (8/1/2013) River mile 49.3 -	SURVEYED - NO FISH PRESENT						
(8/1/2013) River mile 36.6 500	Brook trout	2	7.5	8.0	7.8	0.2	97.5
	Fathead minnow	1	-	-	1.7	-	-
	Lake chub	70	2.2	4.3	-	-	-
	Longnose dace	22	1.9	3.0	-	-	-
	White sucker	39	2.3	9.3	-	-	-

(8/12/2013)	Brook trout	4	6.7	8.6	7.6	0.1	98.3
River mile 14.2	Carp	4	2.1	6.0	-	-	-
500	Lake chub	29	2.8	4.9	-	-	-
	Longnose dace	67	1.2	3.2	-	-	-
	Mountain sucker	1	-	-	5.0	-	-
	Northern redbelly dace	2	2.0	2.0	2.0	-	-
	White sucker	62	1.5	11.2	-	-	-
(8/12/2013)	Brown trout	1	-	-	11.4	-	-
River mile 8.1	Carp	1	-	-	2.5	-	-
500	Lake chub	1	-	-	1.9	-	-
	Longnose dace	21	1.1	3.2	-	-	-
	Longnose sucker	5	4.6	12.5	8.3	0.29	-
	Mountain sucker	5	3.2	5.7	-	-	-
	Rainbow trout	1	-	-	12.2	-	-
	White sucker	33	6.3	16.3	12.1	0.8	94.3
(8/12/2013)	Brook trout	1	-	-	7.2	-	-
River mile 0.7	Brown trout	20	6.8	13.7	11.6	0.6	86.9
150	Longnose dace	2	-	-	-	-	-
	Mountain sucker	1	-	-	3.9	-	-
	White sucker	1	-	-	17.1	-	-
S. Fk. Flatwillow Creek	Brook trout	41	2.2	10.6	6.3	0.2	103.9
(7/31/2013)	Brown trout	1	-	-	11.9	-	-
BLM grazing exclosure 500	White sucker	4	2.8	3.3	3.1	-	-
S. Fk. Musselshell River (11/7/2013) River mile 6.8 750	Brown trout	55	6.8	19.6	12.5	0.7	83.0
W. Fk. Cottonwood Ck (Fergus County) (7/25/2013) River mile 2.4 500	Westslope cutthroat	48	2.3	11.8	5.8	0.1	92.7
Willow Creek (Little Snowy Mtns) (7/31/2013) River mile 66.1 500	SURVEYED - NO FISH PRESENT						

Big Spring Creek

Mark-recapture population estimates were performed on the Burleigh, Machler, and Carroll Trail sections of Big Spring Creek (Table 8). Population trends of total trout ≥ 10 inches in the Machler and Carroll Trail sections are up slightly from 2012, but all three sections continue to fall from the recent peak in 2009-10 (Figure 17). Species composition changes continue to occur in Big Spring Creek, with rainbow trout numbers declining drastically (Figure 18). Additional species sampled in Big Spring Creek included brown trout, mountain whitefish *Prosopium williamsoni*, northern pike, and yellow perch. Catostomid species and mottled sculpin *Cottus bairdi* were observed but not sampled.

The Burleigh section estimate of 823 total trout ≥ 10 inches per mile is well above the 10-year (113%) and long-term (145%) average. Rainbow trout larger than 10 inches continue to decline in the Burleigh section, with the 2013 estimate of 335 fish per mile being 82% of the 20-year average (Figure 19). Meanwhile, the estimate of brown trout ≥ 10 inches was the second highest on record at 488 fish per mile, which is more than 220% of the 20-year average (Figure 20). The mean length of rainbow and brown trout in the Burleigh section was 12.4 and 13.0 inches respectively.

Table 8. Summary statistics from 2013 Mark-Recapture population estimates on three sections of Big Spring Creek.

Brown Trout

Section (Length)	Date Marked	# Marked	# Captured	# Recaptured	#/mile 6-10 inches	#/mile ≥ 10 inches
Burleigh (5840 ft)	8/21	261	190	90	6	488
Machler (3410 ft)	8/19	209	233	66	239	897
Carroll Trail (5200)	8/19	251	281	64	265	872

Rainbow Trout

Section (Length)	Date Marked	# Marked	# Captured	# Recaptured	#/mile 6-10 inches	#/mile ≥ 10 inches
Burleigh (5840 ft)	8/21	178	150	67	24	335
Machler (3410 ft)	8/19	71	70	21	42	311
Carroll Trail (5200)	8/19	71	82	13	25	434

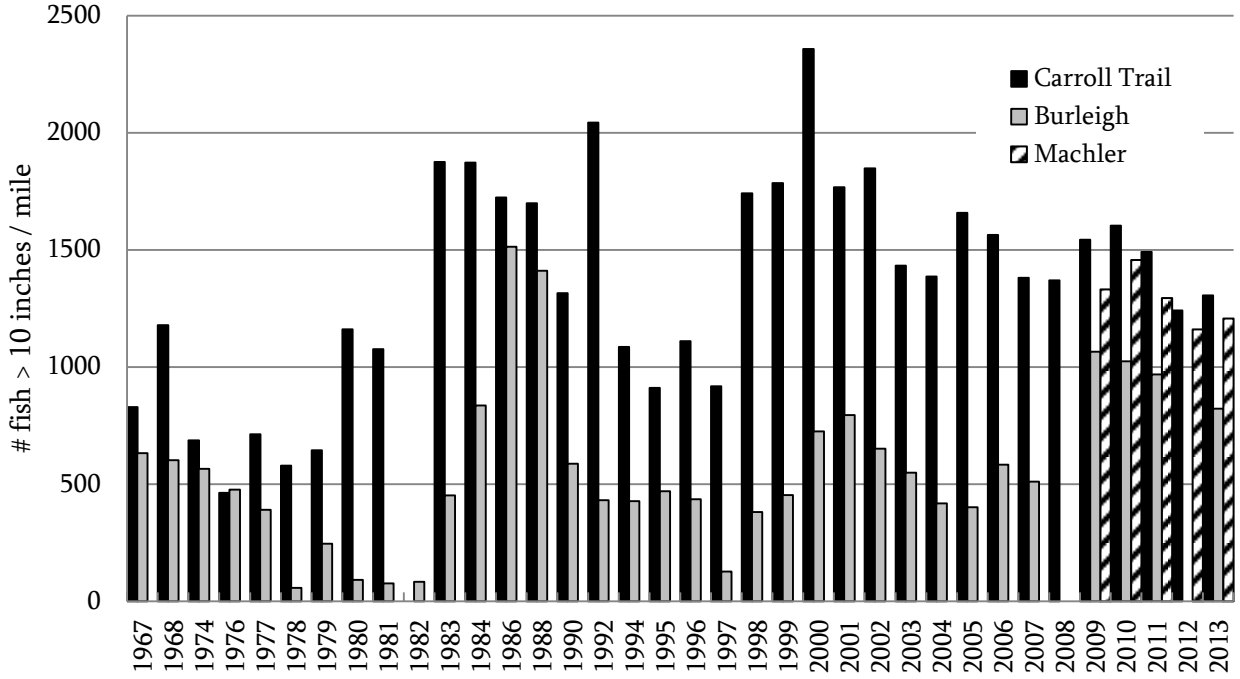

Figure 17. Population estimates of total trout larger than 10 inches per mile in three sections of Big Spring Creek from 1967 to 2013.

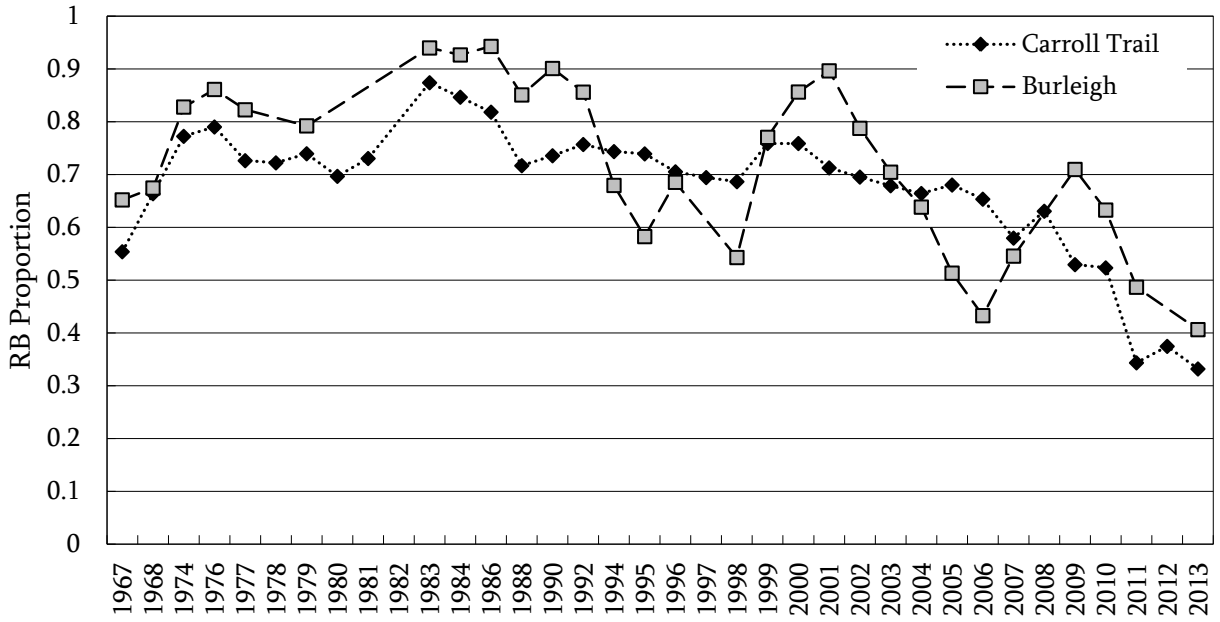

Figure 18. Proportion of rainbow trout in population estimates of total trout larger than 10 inches per mile in two long-term monitoring sections on Big Spring Creek from 1967 to 2013.

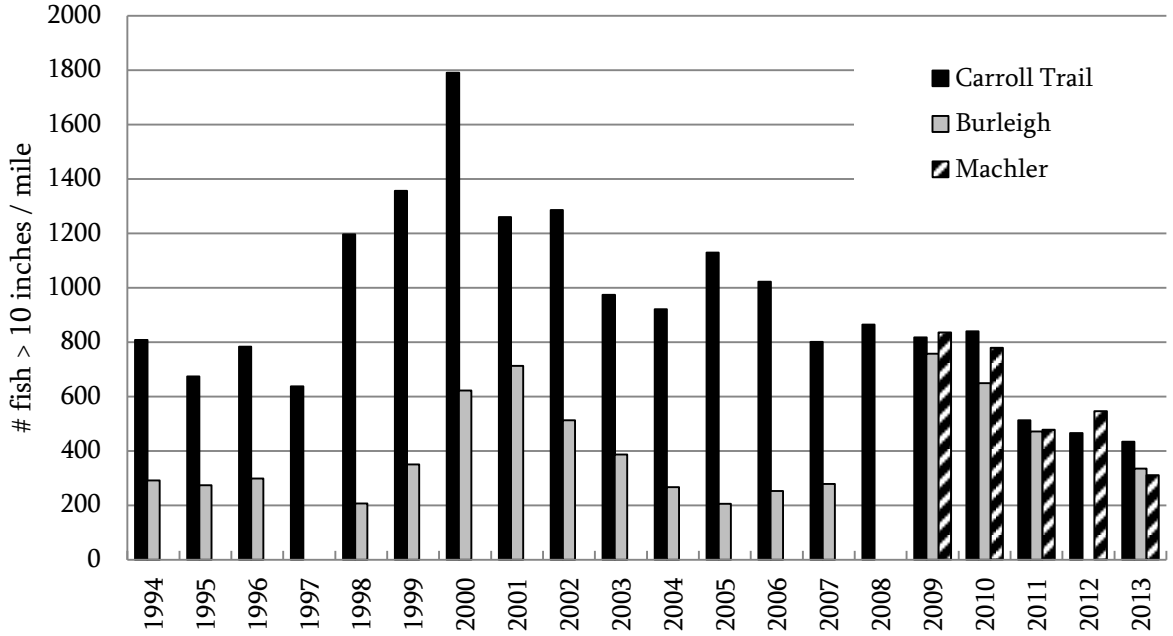

Figure 19. Population estimates of rainbow trout larger than 10 inches per mile in three sections of Big Spring Creek from 1994 to 2013.

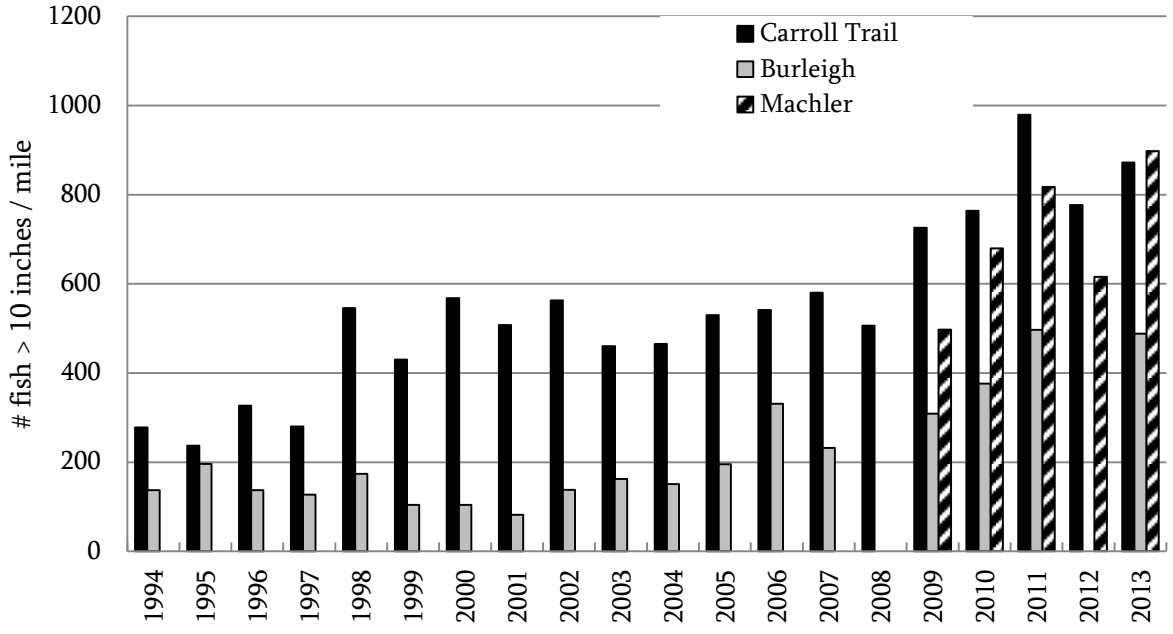

Figure 20. Population estimates of brown trout larger than 10 inches per mile in three sections of Big Spring Creek from 1994 to 2013.

A channel restoration project is planned on the Machler section of Big Spring Creek to remeander a straightened portion of the creek. The Machler section has been sampled annually since 2009 as part of pre-restoration monitoring. The 2013 population estimate of 1,208 total trout ≥ 10 inches remained similar to the estimates of 2011-2012 (Figure 17). Similar to the other sections of the creek, rainbow trout numbers are down and brown trout numbers are at all-time highs on the Machler section (Figure 19 and 20). Rainbow trout averaged 11.9 inches in length. Brown trout averaged 11.7 inches and fish up to 21.7 inches were sampled.

The Carroll Trail estimate of total trout ≥ 10 inches remains steady at 90% of the 10-year average and 97% of the long-term average (Figure 17). The species composition changes occurring in Big Spring Creek are most pronounced at the Carroll Trail Section. Rainbow trout estimates in 2013 are the second lowest on record at 434 fish per mile, which is 47% of the 20-year average (Figure 19), while the 2013 brown trout estimate of 872 was the second highest on record (Figure 20).

Estimating the number of juvenile (6 -10 inches) rainbow trout in Big Spring Creek has been difficult in recent years because of very low catch rates. The low catch rates indicate that the numbers of juvenile rainbows in the Burleigh and Carroll Trail sections are extremely low and in sharp decline (Figure 21). These findings suggest that very few rainbow trout are available to recruit into the adult population. There are two likely causes for the sharp decline in rainbow trout production in Big Spring Creek. The first is whirling disease, which was initially found in the creek in 2003-04, shortly after which declines in the rainbow trout population were first observed. The other reason for the decline in rainbow trout stems from the high flows of 2011 and 2013. The high flows have likely scoured away rainbow trout redds and washed any emerged fry away.

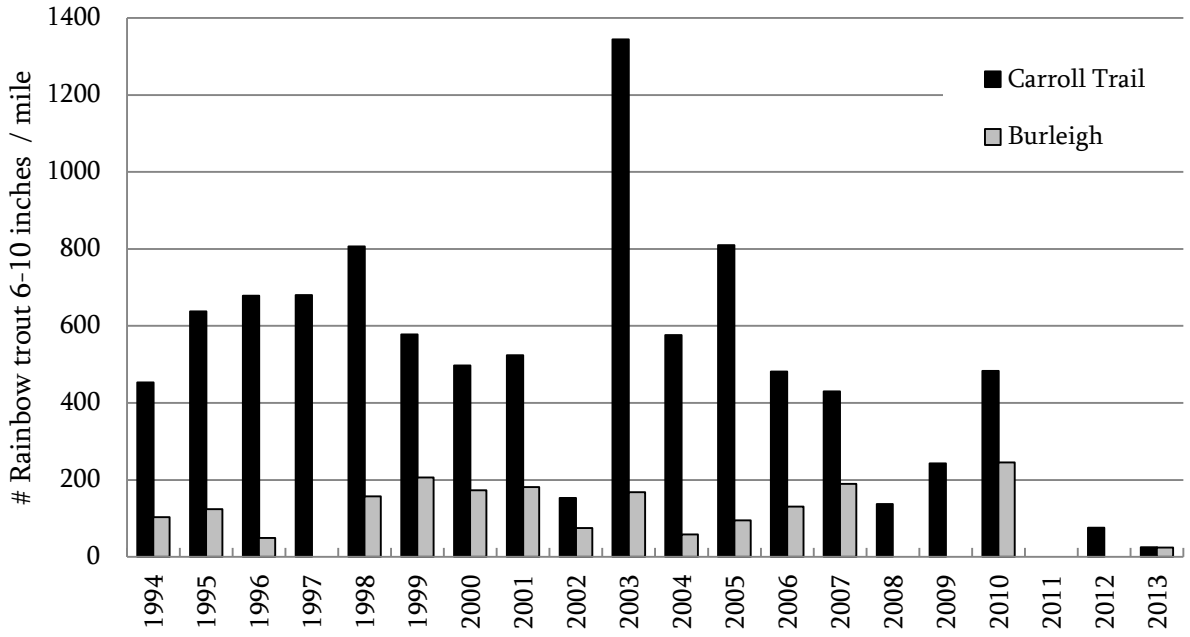

Figure 21. Population estimates of juvenile rainbow trout 6 – 10 inches per mile in two sections of Big Spring Creek from 1994 to 2013.

The short-term outlook for rainbow trout in Big Spring Creek is not good. However, there is some light at the end of the tunnel. Research of whirling disease and FWP data has indicated that the severity of whirling disease falls following high flows (MacConnell and Vincent 2002; Hallett and Bartholomew 2007; Figure 22); this is explained by high flows scouring away fine sediments which are the preferred habitat of one of the life-cycles of whirling disease. Following the flows of 2011 and 2013, there might be a window of low whirling disease severity in which rainbow trout might successfully spawn and recruit to the adult population.

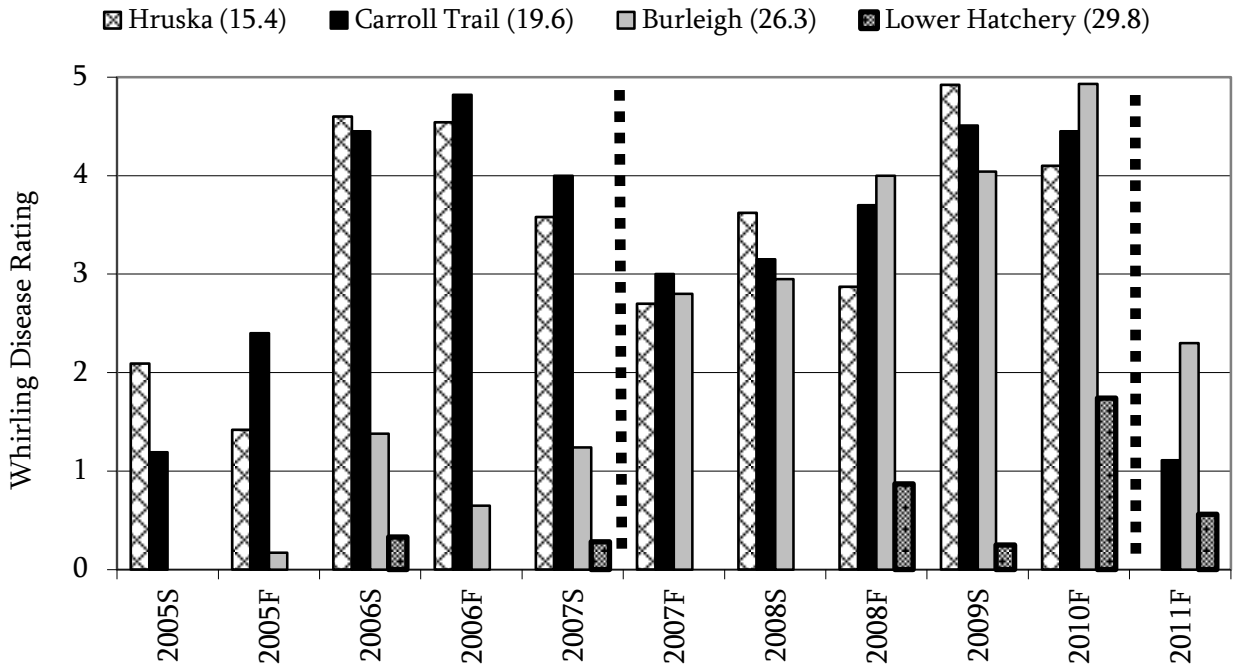

Figure 22. Whirling disease severity ratings of rainbow trout at four locations (river mile in parenthesis) on Big Spring Creek from spring 2005 to fall 2011. Vertical dashed lines indicate high water years.

Judith River Drainage Streams

Ross Fork Creek was sampled for the first time since 1968. Five different sections throughout Ross Fork Creek were surveyed. Additionally, **Little Trout Creek**, a 2nd-order tributary, was sampled in the Ross Fork drainage. There has been a surge of development in the Ross Fork drainage in recent years, including a petroleum pipeline and storage facility, a large commercial feedlot operation, livestock grazing, and continued irrigation development and demands. These factors were the impetus for a thorough evaluation of the fishery within the Ross Fork basin.

With the exception of the survey section at river mile 49.3, which was dry at the time of the sampling, fish were captured at all survey locations. The most common species present in the surveys were longnose dace *Rhinichthys cataractae*, lake chub *Couesius plumbeus*, and white sucker. Northern redbelly dace *Phoxinus eos*, a state species of special concern, was also found in low numbers during the monitoring of Ross Fork Creek. Additional fish species sampled

included carp, fathead minnow *Pimephales promelas*, longnose sucker, mountain sucker *Catostomus platyrhynchus*, a larval stonecat *Noturus flavus*, and three salmonid species, brook trout, brown trout, and rainbow trout.

Interestingly, salmonids were sampled at all survey locations. A large portion of Ross Fork Creek provides marginal salmonid habitat and surveys indicated low numbers of the species present. The one exception occurred at the lowest survey section, just upstream from the confluence with the Judith River. At this location, salmonid densities, especially of brown trout, were very high. A complete survey was not performed at this location due to the gear and effort not being able to efficiently sample the section. It is hypothesized that this portion of Ross Fork provides thermal refugia for trout in the Judith River, which is chronically dewatered and experiences high summer temperatures. These findings suggest that further investigation into the habitat and fishery of Ross Fork and the Judith is warranted.

A three-pass depletion estimate was performed on **Dry Wolf Creek** at the monitoring section just upstream of the U.S. Forest Service campground at the handicap fishing access. Brook trout and westslope cutthroat trout were sampled. The westslope cutthroat trout population in Dry Wolf Creek is slightly hybridized, but managed as a conservation population.

The estimate of brook trout ≥ 4 inches per 1,000 feet was higher in 2013 than the most recent estimate which was performed in 2009, while westslope cutthroat trout estimates were down slightly. It was estimated that there were 42.5 brook trout and 40 westslope cutthroat trout ≥ 4 inches per 1,000 feet (Table 9). Brook trout averaged 7.4 inches in length and westslope cutthroats averaged 7.6 inches. The proportion of westslope cutthroat trout in Dry Wolf continues to hold close to 50%.

Table 9. Summary statistics of three-pass depletion estimate on Dry Wolf Creek.

Species	Size Class	Removal Pattern	Total Catch	Pop Est	Pop Est Std Err	Lo Conf Intvl	Up Conf Intvl	Capt Prop
Brook trout	≥ 4 in.	12 4 1	17	43	0.69	41.6	44.4	0.69
Westslope cutthroat	≥ 4 in.	13 3	16	40	0.88	38.3	41.7	0.77

West Fork Cottonwood Creek was sampled to collect genetic samples of the westslope cutthroat trout population. The population was established above a natural barrier via a wild fish transfer from a nearby tributary stream. Forty-eight westslope cutthroat trout sampled, averaging 5.8", the largest being 11.8" in length. Genetic samples were collected from 25 fish.

Musselshell River Drainage Streams

A section of **Careless Creek** was surveyed just downstream from the U.S. Forest Service boundary. The creek was flowing, however no fish were sampled. The lack of periphyton on the substrate indicated that the flow in the section was not perennial.

A depletion estimate was completed on **Half Moon Creek** at the monitoring section at river mile 4.0 in order to assess the westslope cutthroat trout population. Genetic samples were also

collected on 50 fish. Westslope cutthroat trout were the only species sampled. It was estimated that there were 105 fish ≥ 4 inches per 1,000 feet (Table 10). This estimate is drastically higher than the most recent estimate of 30 fish ≥ 4 inches per 1,000 feet which was performed in 2011. These findings indicate that the cutthroat population has recovered well from the 2011 flooding, which caused major channel alterations and scour. The current population in Half Moon appears to be robust. Westslope cutthroat trout averaged 4.9 inches in length with the largest being 10.4 inches.

Table 10. Summary statistics of two-pass depletion estimate on Half Moon Creek.

Species	Size Class	Removal Pattern	Total Catch	Pop. Est	Pop. Est Std Err	Lo Conf Intvl	Up Conf Intvl	Capt Prop
Westslope cutthroat	≥ 4 in.	47 9	56	105	2.14	101.0	109.2	0.81

The fishery of **McCartney Creek** was evaluated in an effort to determine if westslope cutthroat trout were present and if the habitat would be suitable for westslope cutthroat trout. It was hypothesized that cutthroat trout might have been flushed downstream from Half Moon Creek during the high flows of 2011; however none were found during 2013 monitoring. Species sampled included brook trout, brown trout, and rainbow trout. Brook trout were the most prevalent species, while browns and rainbows were present in low numbers.

Sampling on **North Fork Flatwillow Creek** found brook trout, brown trout, longnose sucker, rainbow trout, and white sucker present. A 2006 survey approximately four river miles upstream found only brook trout present in North Fork Flatwillow. Population estimates were completed using a three-pass depletion estimate. The population of brook trout was estimated to be 42 fish ≥ 4 inches per 1,000 feet and brown trout were estimated to be 50 fish ≥ 4 inches per 1,000 feet (Table 11). No estimate was performed on rainbow trout because of the low number of fish sampled. Brown trout in excess of 20 inches and close to three pounds were sampled.

Table 11. Summary statistics of three-pass depletion estimate on North Fork Flatwillow Creek.

Species	Size Class	Removal Pattern	Total Catch	Pop. Est	Pop. Est Std Err	Lo Conf Intvl	Up Conf Intvl	Capt Prop
Brook trout	≥ 4 in.	12 6 0	18	42	4.67	33.0	51.0	0.5
Brown trout	≥ 4 in.	15 8 1	24	50	1.52	47.0	53.0	0.6

Monitoring of a grazing exclosure on **South Fork Flatwillow Creek** was performed in 2013. The exclosure was built in 2009 via a collaborative effort among the Bureau of Land Management, FWP, and the Snowy Mountain Chapter of Trout Unlimited. Brook trout, brown trout, and white sucker were sampled during a three-pass depletion estimate. It was estimated that there were 68 brook trout ≥ 4 inches per 1,000 feet (Table 12). The findings from 2013 sampling suggest the exclosure might have benefited the brook trout fishery in South Fork Flatwillow, with the total catch and average length being the second highest documented on this section of the South Fork.

Table 12. Summary statistics of three-pass depletion estimate on South Fork Flatwillow Creek.

Species	Size Class	Removal Pattern	Total Catch	Pop. Est	Pop. Est Std Err	Lo Conf Intvl	Up Conf Intvl	Capt Prop
Brook trout	≥ 4 in.	23 7 3	33	68	1.52	62.1	73.9	0.66

The headwaters of **Willow Creek** in the Little Snowy Mountains were surveyed in 2013. There was no prior documented sampling history on this portion of the creek. The creek provided adequate habitat and flow at the time of sampling, however no fish were captured.

The **South Fork Musselshell River** and its tributary **Cottonwood Creek** were sampled in November in an effort to evaluate brown trout spawning and the fisheries resources of the system. These streams are chronically dewatered during summer, often going dry for significant portions of the irrigation season. The surveys indicated that both streams are used for brown trout spawning, with redds and spawning fish evident at both sampling locations. Brook trout, brown trout, cutthroat trout, and rainbow trout were sampled at the Cottonwood Creek section. Brown trout up to 17.4 inches and cutthroat up to 14.6 inches were found. Brown trout were the only species surveyed in the South Fork Musselshell, with fish up to 19.6 inches and in excess of 2 pounds sampled.

Redd Surveys

Brown trout redd surveys were conducted December 16-18, 2013 at six fishing access sites on Big Spring Creek. Trend counts were completed as early as 2002 at four of these sites (Table 13). 2013 counts increased from 2012, and were above average at all sites. Machler and Reed and Bowles FAS had the highest concentration of redds on record for those sites. Numbers were comparable to those observed in 2011; another year that Big Spring Creek experienced flood flows. The inundation of floodplain, bedload transfer, and removal of bank stabilizing vegetation likely results in an increase of available spawning gravels in the system.

Table 13. Brown trout redd count trends on Big Spring Creek from 2002 to 2013.

Section	Date	# of Redds	Section Length (ft)	# of Redds / 1,000 ft												
				02	03	04	05	06	07	08	09	10	11	12	13	Avg.
Burleigh	17-Dec	181	11,563	22	20	15	14	9	8	8	10	10	15	14	16	13.4
Lazy KB	16-Dec	18	900	-	16	17	10	9	11	-	9	34	27	14	20	16.7
Machler	18-Dec	83	3,410	-	-	-	-	-	-	-	4	10	21	11	24	14.0
Carroll Trail	18-Dec	110	5,600	31	-	13	9	16	13	15	12	18	19	11	20	16.1
Reed & Bowles	16-Dec	113	3,749	19	-	12	16	11	8	-	19	21	20	22	30	17.8

Flow Measurements and Discharge

In 2013, Montana Fish, Wildlife, and Parks operated three gaging stations on Big Spring Creek: Hatchery, Ash Street, and Mill Ditch (Appendix 3). A fourth station, Reed and Bowles, remains

inactive due to damaged infrastructure. Lowland snowpack melted gradually increasing discharge 10 to 50 cubic feet per second (cfs) during March and April. Four flood control reservoirs were constructed in the 1970's on tributaries of Big Spring Creek that receive high elevation snowpack runoff; most notable, East Fork Spring Creek Reservoir. These reservoirs collect runoff and mediate downstream release into Big Spring Creek; thus, high elevation snowmelt cannot be readily discerned at gaging site hydrographs. The hydrograph peaked on June 3, 2013, the result of heavy rains that inundated the drainage from May 30 to June 3.

Peak discharge at the **Hatchery Gaging Station** exceeded 2011 values, reaching an estimated 344 cfs. Base flow fluctuated from 141 to 148 cfs. Four discharge measurements were taken at the site in 2013 and applied with late-2012 measurements to develop a rating curve. A polynomial equation provided best fit within the range of measurements. When stage exceeded the highest measured discharge of 215 cfs at 2.46 stage, a linear equation was applied to estimate discharge that more accurately predicted the actual flows.

Watercress rejuvenation at the gaging site in 2013 influenced TruTrax measurements and required application of a vegetation correction (Figure 23). Watercress growth began impacting instrumentation on August 1, 2013 and increased until November 9, 2013. The correction was then reversed and will continue to be applied into 2014 as the vegetation decays to base levels.

As in 2011, flooding occurred at the **Ash Street Gaging Station** in 2013. As stage height exceeds 3.90, the floodplain becomes inundated and total discharge is no longer captured within the gaging site channel/bridge location. From June 1 to June 9, 2013, stage height exceeded 3.90; during this period the hydrograph peaked at an estimated 790 cfs. Baseflow has increased approximately 20 cfs from a range of 139 to142 cfs in Winter 2012/13 to a range of 157 to 161 cfs in Winter 2013/14. This increase can be attributed to an increased contribution from East Fork Spring Creek. During Winter 2012/13 release from East Fork Reservoir was reduced to expedite the filling process following dam repairs.

A linear equation, derived from five discharge measurements taken post-2011 flood, was applied to the daily mean stage height from January 1 to June 9, 2013. Four discharge measurements were taken at the site in 2013 following the hydrograph peak. These measurements were used to generate a new rating curve. A power equation provided best fit within the range of measurements and was applied on June 10, 2013 coinciding with the highest measured discharge of 582 cfs at 3.90 stage. The gaging station malfunctioned from July 20 to August 27; a void in data is illustrated during this timeframe.

The **Mill Ditch Gaging Station** peaked at 901 cfs on June 4, 2013. The Mill Ditch rating curve was developed from six flow measurements of which a power equation provided best fit. When estimated discharge exceeds the highest discharge measurement of the rating curve, 502 cfs, a linear equation is used to alleviate gross overestimate of flow. From May 31 to June 15, 2013, estimated discharge exceeded the confidence of the rating curve and the linear equation was employed.

Baseflow for Winter 2013/14 is 109 cfs; 87 cfs higher than Winter 2012/13. By subtracting Mill Ditch discharge from Ash Street discharge, an average discharge of 57 cfs has traveled through the channelized reach of Big Spring Creek that passes under Lewistown since August 28, 2013 (Figure 24).

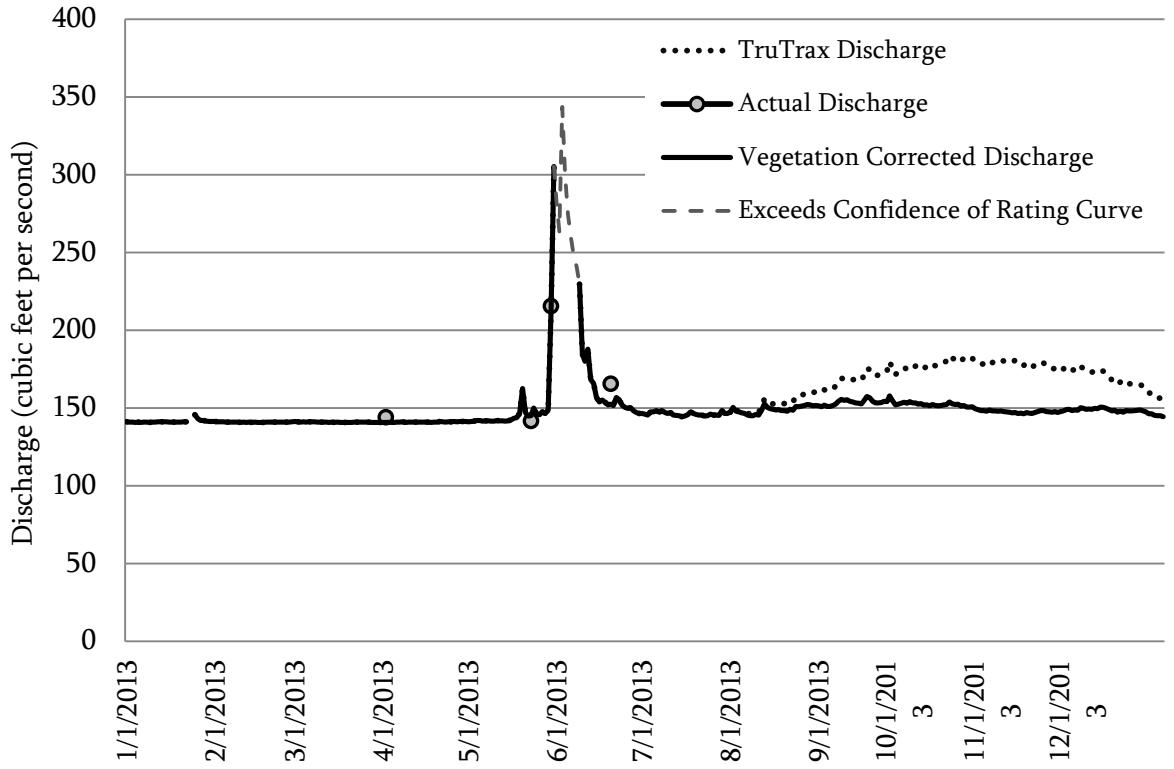

Figure 23. Big Spring Creek Discharge at Hatchery gaging station (with and without vegetation correction).

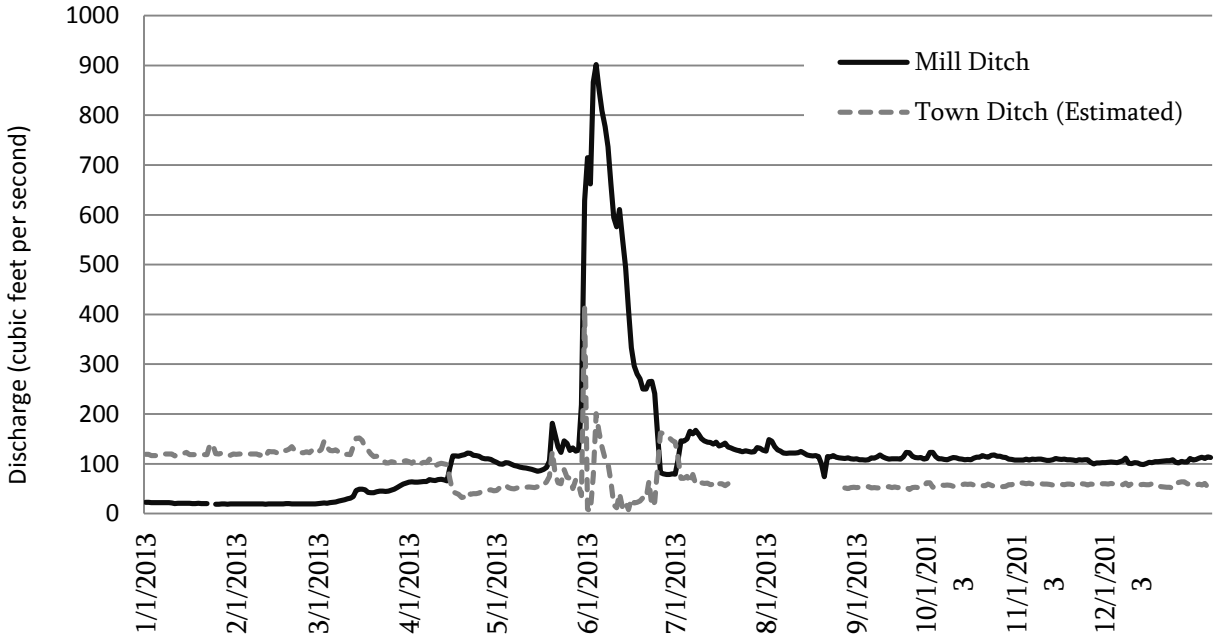

Figure 24. Big Spring Creek discharge at Mill Ditch gaging station and associated estimated discharge of Lewistown channel.

Thermographs

In 2013, Montana Fish, Wildlife, and Parks deployed nine thermographs for temperature monitoring. Seven were retrieved, one was lost to 2013 flooding, and one remains unrecovered (Table 14). The two thermographs impacted by flooding were located in the Lower Musselshell watershed. The Mosby bridge thermograph was lost, and the Flatwillow Creek thermograph is currently unrecovered; awaiting the reconstruction of the USGS gaging station and removal of large concrete slabs preventing extraction. Thermograph data is available in Appendix 4.

Table 14. Summary of Lewistown area thermograph deployment during 2013.

Site	Lat/Long	Date Deployed	Date Retrieved	Avg. July	Avg. August	Status
Big Spring Creek (Burleigh)	N 47.02699 E -109.37709	1/1/2013	12/31/2013	55.3	54.3	redeployed
Big Spring Creek (Hruska)	N 47.11312 E -109.50900	1/1/2013	12/31/2013	60.7	59.2	redeployed
Musselshell River (North Fork)	N 46.54181 E -110.44278	4/16/2013	10/24/2013	61.5	63.1	recovered
Musselshell River (South Fork)	N 46.46246 E -110.31851	4/16/2013	10/24/2013	66.9	64.9	recovered
Musselshell River (Mosby)	N 46.99429 E -107.88903	4/17/2013	-	-	-	lost
Flatwillow Creek (Hwy 500)	N 46.92860 E -107.93280	4/17/2013	-	-	-	unrecovered
South Fork Judith River (Russian)	N 46.71890 E -110.42520	7/2/2013	10/24/2013	51.1	50.6	recovered
South Fork Judith River (Bluff Mt.)	N 46.74490 E -110.33750	7/2/2013	10/24/2013	54.3	54.3	recovered
South Fork Judith River (Dry Pole)	N 46.78040 E -110.29960	7/2/2013	10/24/2013	-----	-----	recovered

Big Spring Creek average July and August temperatures exceeded the average temperatures of the five-year period by 1 to 2°F, with the exception of August 2011 at Hruska. Temperature at Burleigh and Hruska peaked on July 3 at 63.7°F and 70.2°F respectively. July 3 was the only day water temperature exceeded 70°F in 2013.

Maximum water temperatures in the North Fork Musselshell River exceeded 70°F a total of 22 days in June-August, 2013. Peak temperature was 72.4°F on July 3. In the South Fork Musselshell River, maximum water temperatures exceeded 70°F a total of 63 days from July to September 2013. The highest temperature reading of 78°F occurred on July 26.

As in 2004 and 2008, thermographs were deployed at three locations below major tributaries on the South Fork Judith River. The Dry Pole thermograph was compromised soon after placement, and did not collect sufficient data to warrant summary. The Russian Creek and Bluff Mountain thermographs reached peak temperature on July 17, 2013 at 57.2°F and 62.1°F respectively. Average July and August temperatures exceeded 2004 and 2008 values by 1 to 2°F.

HABITAT PROTECTION

Spring flooding led to numerous infrastructure projects in the Lewistown area which required either Natural Streambed and Land Preservation Act '310' permits or Montana Stream Protection Act '124' permits. In 2013, 39 '310' permits were inspected by FWP personnel and 15 '124' permits were issued in the Lewistown area. Environmental assessments were performed for 14 of the '124' permits.

A total of 4 private ponds were inspected for fish stocking in the Lewistown area during 2013, each with an environmental review. Additional environmental reviews were performed for the Jakes Reservoir wild fish transfer and 3 FWP stocked ponds which may potentially be stocked with new species.

Multiple meetings, grants, and environmental assessments were evaluated/written for the Machler Restoration Project. The final land acquisitions necessary for the project were completed in 2013, with plans to break ground in the autumn of 2014.

EDUCATIONAL OUTREACH

Lewistown staff acted as chairman for the Aquatic Ecology dimension of the Montana Envirothon and North American Envirothon in 2013. The 2013 current issue focused on sustainable rangeland management and presentations included: riparian health and grazing, Montana water law, and fish identification. Thirty-three teams competed at the state competition hosted in Lewistown and teams representing fifty-six states, providences, and territories participated in the North American competition hosted in Bozeman.

FWP, in conjunction with BLM and USFWS, hosted a Kid's Fishing Day at Upper and Lower Frog Ponds in June. Participants were educated on Montana fish identification, water safety, fly tying, and fishing techniques.

FWP personnel met with the Fergus High School Outdoor Club for an electrofishing demonstration. Eight high school students took part in the demonstration, which included a brief discussion on fisheries work, electrofishing safety, and backpack electrofishing a portion of Little Casino Creek. Students netted fish and performed length/weight measurements of rainbow trout, white sucker, and fathead minnow.

ACKNOWLEDGEMENTS

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Appendix 1. List of water bodies referred to in this report.

16-4300	Ackley Lake
18-7750	Bair Reservoir
16-0310	Big Spring Creek
	Bonanza Reservoir
18-7220	Box Elder Creek Reservoir
18-7335	Bubs Reservoir
18-0900	Careless Creek
18-1380	Cottonwood Creek (Meagher County)
18-7560	Drag Creek Reservoir
16-1260	Dry Wolf Creek
16-4950	East Fork Reservoir
18-2940	Half Moon Creek
16-5535	Hansen Creek Reservoir
16-6070	Jakes Reservoir
16-2060	Little Trout Creek
16-4621	Carter Pond - Lower
16-2170	Lower Hassler Reservoir
18-8341	Manuel Reservoir #2
18-8380	Martinsdale Reservoir
18-3750	McCartney Creek
18-4560	North Fork Flatwillow Creek
18-8700	Payola Reservoir
18-8720	Petrolia Reservoir
16-3120	Ross Fork Judith River
18-8860	Rostad Reservoir
16-8290	Slivka Reservoir #2
18-9150	South Fork Blood Creek Reservoir
18-5610	South Fork Flatwillow Creek
18-5670	South Fork Musselshell
16-4620	Carter Pond - Upper
	Upper Hassler Reservoir
16-8660	Urs Pond
16-4020	West Fork Cottonwood Creek
16-8805	Whisker Reservoir
18-6840	Willow Creek (Little Snowy Mountains)
18-9500	Yellow Water Reservoir

Appendix 2. List of fish species referred to in this report.

Bluegill	*Lepomis macrochirus*
Brook trout	*Salvelinus fontinalis*
Brown trout	*Salmo trutta*
Carp	*Cyprinus carpio*
Fathead minnow	*Pimephales promelas*
Lake chub	*Couesius plumbeus*
Largemouth bass	*Micropterus salmoides*
Longnose dace	*Rhinichthys cataractae*
Longnose sucker	*Catostomus catostomus*
Mottled sculpin	*Cottus bairdi*
Mountain sucker	*Catostomus platyrhynchus*
Mountain whitefish	*Prosopium williamsoni*
Northern pike	*Esox lucius*
Northern redbelly dace	*Phoxinus eos*
Rainbow trout	*Oncorhynchus mykiss*
Sauger	*Sander canadense*
Shorthead redhorse	*Moxostoma macrolepidotum*
Stonecat	*Noturus flavus*
Walleye	*Sander vitreus*
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*
White sucker	*Catostomus commersoni*
Yellow perch	*Perca flavescens*

Appendix 3. Mean daily discharge (cfs) at Big Spring Creek gage sites.

Big Spring Creek – Hatchery Gaging Station

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	141	141	141	141	141	283	146	147	151	154	148	149
2	141	141	141	141	141	263	146	150	151	153	148	150
3	141	141	141	141	142	344	146	148	152	154	148	150
4	141	141	141	141	142	300	147	148	151	153	148	149
5	141	141	141	141	142	274	147	147	151	153	148	149
6	141	141	141	141	142	260	148	146	152	153	147	149
7	141	141	141	141	142	248	147	145	152	153	147	150
8	141	141	141	141	142	241	148	145	154	152	147	150
9	141	141	141	141	142	230	147	145	156	152	147	151
10	141	141	141	141	142	185	146	146	155	151	147	151
11	141	141	141	141	142	180	147	146	155	152	147	150
12	141	141	141	141	142	188	145	148	154	152	146	149
13	141	141	141	141	142	168	145	153	154	151	147	148
14	141	141	141	141	142	166	145	150	153	152	147	149
15	141	141	141	141	142	157	144	150	153	152	147	147
16	141	141	141	141	142	154	145	149	153	152	147	148
17	141	141	141	141	143	155	146	149	155	154	148	147
18	141	141	141	141	144	154	148	149	157	153	148	148
19	141	141	141	141	147	152	147	148	157	152	148	148
20	141	141	141	141	163	153	146	148	154	153	148	148
21	141	141	141	141	147	152	146	148	153	151	148	148
22	141	141	141	141	145	157	145	149	153	152	147	149
23	Equipment Failure	141	141	141	145	155	145	149	154	151	148	149
24		141	141	141	150	152	145	151	154	151	147	148
25	146	141	141	141	146	150	146	151	154	151	148	147
26	143	141	141	141	146	150	146	151	158	150	148	146
27	142	141	141	141	148	150	146	152	155	149	149	146
28	142	141	141	141	146	148	145	152	152	148	149	145
29	142		141	141	149	147	148	152	153	148	148	145
30	141		141	141	212	147	147	151	153	148	149	145
31	141		141		305		146	152		149		145

Appendix 3 continued. Mean daily discharge (cfs) at Big Spring Creek gage sites.

Big Spring Creek – Ash Street Gaging Station

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	142	139	144	167	149	724	223		162	166	169	164
2	142	139	149	165	152	657	221		161	166	169	173
3	139	139	167	170	157	790	217		161	167	169	157
4	139	139	154	170	160	700	217		161	167	167	161
5	139	139	149	165	154	687	225		162	167	166	162
6	139	139	149	167	149	675	227	E	164	167	166	161
7	142	139	152	167	147	667	239	Q	164	167	166	157
8	142	139	149	178	147	636	227	U	166	167	169	157
9	142	136	149	167	144	597	219	I	169	167	167	159
10	142	139	147	162	144	577	213	P	166	167	167	161
11	136	134	149	167	144	564	207	M	164	169	167	162
12	139	144	149	170	144	651	205	E	164	169	167	161
13	142	144	170	167	142	567	201	N	162	171	167	161
14	142	144	198	165	139	518	200	T	164	173	166	159
15	144	142	201	162	139	418	198		162	171	167	159
16	139	142	196	160	139	363	196	F	162	173	169	159
17	139	147	180	157	147	318	198	A	166	174	167	159
18	139	147	170	154	157	303	198	I	176	173	167	159
19	139	149	162	149	180	296	194	L	171	171	166	162
20	139	154	157	152	306	282		U	167	169	162	164
21	139	147	160	165	237	280		R	166	167	159	169
22	139	147	157	160	196	330		E	164	167	162	167
23	139	142	154	157	183	280			164	167	162	164
24	139	142	147	157	234	265			164	167	162	169
25	139	144	147	157	214	252			173	169	162	166
26	139	142	152	157	198	245			185	169	162	166
27	142	147	152	157	183	241			176	169	164	171
28	139	142	154	157	193	233		162	171	169	162	171
29	136		160	157	185	231		162	167	169	161	171
30	136		165	152	183	227		162	167	169	162	167
31	139		167		214			162		169		166

Appendix 3 continued. Mean daily discharge (cfs) at Big Spring Creek gage sites.

Big Spring Creek – Mill Ditch Gaging Station

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	23	20	20	63	103	715	79	125	110	109	109	106
2	22	19	21	64	100	662	108	149	108	108	109	111
3	22	19	21	63	99	866	146	145	108	111	109	101
4	22	19	21	63	103	901	146	135	108	113	108	101
5	22	19	22	64	102	851	150	128	108	112	107	103
6	22	19	23	65	99	809	165	126	112	110	107	102
7	22	20	24	65	97	777	160	122	112	109	108	99
8	22	19	25	68	95	737	167	121	114	108	111	99
9	22	19	26	67	94	663	160	122	118	109	110	101
10	22	20	28	67	92	595	151	122	114	108	109	103
11	20	19	30	68	91	576	146	121	111	112	109	102
12	21	19	31	69	90	610	144	122	110	113	108	104
13	21	20	34	67	89	554	143	125	110	113	108	105
14	21	20	47	66	87	494	140	122	110	117	108	105
15	21	20	49	93	85	410	143	118	110	115	106	106
16	21	20	49	116	86	333	136	116	109	113	108	106
17	20	20	48	116	89	296	137	116	114	117	107	106
18	20	20	43	115	93	281	141	117	123	118	108	108
19	21	20	42	117	106	271	134	115	122	115	108	103
20	20	20	42	118	181	250	132	100	115	116	103	101
21	20	20	44	121	158	250	130	74	113	113	100	105
22	20	20	45	121	134	265	128	115	112	113	102	103
23	Equipment Failure	19	45	117	123	265	126	114	113	110	102	104
24		20	45	117	146	241	124	117	109	109	102	111
25	19	20	45	116	141	158	127	113	111	108	103	107
26	19	20	47	112	127	83	125	112	123	108	103	109
27	20	20	49	110	132	80	123	111	123	107	103	111
28	20	20	52	110	126	79	124	111	114	108	103	114
29	19		56	109	127	79	133	112	110	109	103	110
30	19		60	106	219	80	131	110	110	108	104	114
31	19		61		629		127	110		110		113

Appendix 4. Minimum, mean and maximum water temperatures (ºF) from Lewistown area waters in 2013.

Big Spring Creek - Burleigh FAS (Coordinates = N 47.026990, E 109.377089)

	January			February			March			April			May			June		
Date	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
1	48.0	48.3	48.7	48.0	49.0	50.5	47.9	49.7	52.9	47.2	50.0	54.2	46.8	49.9	54.4	47.9	51.1	54.7
2	46.9	47.6	48.7	47.6	48.6	50.7	48.9	49.8	52.2	47.7	50.7	55.0	47.6	51.5	56.6	49.6	51.7	55.8
3	47.0	48.0	50.1	47.8	48.9	50.7	44.9	48.4	50.2	48.8	50.5	53.4	49.2	50.9	52.5	47.1	48.7	50.4
4	47.5	48.5	50.0	47.8	49.1	51.0	44.1	46.4	48.9	48.0	50.4	53.8	50.2	51.6	53.6	46.6	47.8	49.6
5	47.3	48.4	50.0	48.5	49.3	51.5	45.6	47.7	51.2	49.3	50.9	52.9	48.9	52.4	57.3	45.9	50.5	55.9
6	47.3	48.6	50.1	48.0	49.0	50.9	47.2	48.4	50.4	48.5	50.7	53.8	49.6	53.3	58.3	48.0	51.7	56.4
7	48.0	48.8	50.0	47.4	48.7	50.8	47.2	48.7	51.5	47.5	50.2	52.5	50.3	53.9	58.8	49.5	52.9	57.0
8	48.2	48.7	48.9	47.5	48.6	50.7	47.5	48.8	51.4	46.4	48.0	50.3	50.7	54.0	58.7	50.6	54.2	58.5
9	48.6	49.3	50.4	47.3	48.4	50.8	47.0	48.8	51.7	45.9	48.6	52.9	50.8	54.1	58.6	51.6	55.4	60.7
10	45.5	47.7	49.0	46.8	47.4	48.0	47.2	49.2	52.9	46.5	49.9	54.3	51.0	53.7	58.2	52.6	56.6	61.6
11	45.7	46.3	46.8	46.3	47.9	50.9	47.5	48.4	49.2	48.9	50.5	53.2	49.9	52.9	57.2	53.0	54.9	56.4
12	46.7	47.2	48.2	46.8	48.5	51.1	47.1	48.9	51.3	48.0	49.8	53.3	51.0	54.5	59.7	52.6	56.0	60.0
13	46.6	47.3	48.1	47.2	48.6	49.6	47.8	49.9	53.6	47.8	49.5	51.6	52.1	55.2	60.3	53.3	54.9	56.7
14	46.9	47.6	48.6	47.3	48.3	50.5	46.9	48.3	50.3	46.9	47.6	49.1	51.2	54.0	58.3	52.2	54.3	57.2
15	47.6	48.7	49.8	48.1	49.1	51.1	47.2	48.4	50.4	46.2	48.1	50.8	50.8	54.0	58.2	50.8	54.6	58.8
16	47.7	48.3	49.6	48.3	49.4	51.9	46.6	48.2	51.5	47.4	49.2	52.2	51.3	53.1	57.6	51.5	55.2	59.1
17	47.6	48.5	50.3	47.2	48.1	49.0	44.7	47.1	48.7	46.9	48.8	51.1	51.5	52.9	54.4	52.8	56.7	61.4
18	48.1	48.8	50.2	47.1	48.4	50.8	45.0	46.7	47.9	46.3	49.3	53.0	52.1	52.7	53.5	53.9	57.8	62.6
19	47.8	48.6	49.8	47.0	48.0	49.5	46.7	48.2	51.5	48.2	50.0	51.8	51.7	52.0	52.7	54.4	57.8	62.3
20	47.2	47.7	48.4	47.3	48.2	50.0	46.7	48.9	51.8	48.5	50.3	53.0	51.3	53.4	56.6	52.9	55.8	58.8
21	47.6	48.5	50.3	47.1	48.4	51.1	47.6	48.8	50.6	47.1	48.4	50.1	50.1	54.1	58.8	52.0	54.0	55.7
22	47.2	48.5	50.7	47.3	48.7	50.9	46.5	47.5	48.8	46.9	49.3	52.8	50.9	52.6	54.5	51.4	53.5	55.9
23	47.7	48.2	48.8	47.9	48.8	50.2	46.1	47.4	49.6	46.6	49.4	53.5	50.9	52.0	53.6	51.0	55.3	59.7
24	47.9	49.0	49.9	47.2	48.6	51.5	46.1	47.7	50.1	48.0	50.5	54.0	50.8	53.9	57.8	52.8	55.6	58.3
25	47.8	49.1	50.9	47.5	48.8	51.1	46.2	48.7	52.3	48.4	51.3	55.3	50.8	54.1	58.4	54.1	57.2	60.9
26	48.9	49.6	51.3	47.7	48.7	50.2	47.1	49.5	53.6	48.8	52.3	56.8	51.1	54.4	57.9	54.3	57.0	60.6
27	48.1	49.0	49.9	47.2	48.7	51.1	47.5	50.1	54.0	50.3	52.2	55.9	51.3	53.8	56.5	53.9	57.5	61.8
28	47.6	48.2	49.5	47.4	49.0	50.8	48.0	50.5	54.4	50.0	52.6	57.1	51.0	53.5	57.2	54.3	58.3	62.6
29	46.2	47.0	48.2				48.5	50.2	52.8	48.0	50.3	51.7	52.1	52.9	54.1	55.2	58.9	63.6
30	46.1	47.4	48.9				48.3	50.1	53.4	47.8	49.0	51.4	50.4	51.7	52.6	55.4	59.2	63.3
31	45.6	47.8	50.2				47.6	49.4	52.6				48.3	49.1	50.4			

Appendix 4 continued. Minimum, mean and maximum water temperatures (ºF) from Lewistown area waters in 2013.

Big Spring Creek - Burleigh FAS (Coordinates = N 47.026990, E 109.377089)

	July			August			September			October			November			December		
Date	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
1	55.8	59.5	63.5	53.9	55.5	58.7	51.9	54.5	58.9	49.6	51.2	54.1	48.4	49.3	50.5	48.4	48.8	49.2
2	55.7	59.4	63.7	53.8	55.9	59.3	52.2	54.8	58.8	49.6	51.4	54.0	48.1	49.4	51.1	45.6	48.0	49.5
3	56.2	59.4	63.7	53.6	56.2	60.0	52.5	54.9	58.8	49.7	50.3	50.8	48.1	49.0	50.0	45.3	45.9	46.4
4	57.1	59.0	62.2	53.2	56.1	60.4	53.2	55.0	58.8	49.0	50.2	52.2	47.5	48.3	49.6	44.9	45.6	46.3
5	55.2	58.0	61.9	53.3	55.6	59.4	53.0	55.0	58.7	48.2	50.1	52.4	46.8	47.9	49.6	44.8	45.5	46.8
6	55.3	58.5	62.2	52.6	55.5	59.7	53.2	55.4	59.5	49.5	51.2	54.2	47.6	48.7	50.0	44.4	44.9	45.8
7	55.5	58.3	62.8	52.8	55.7	60.0	53.6	54.8	57.4	49.4	51.2	54.4	47.4	48.8	50.2	44.1	45.0	46.7
8	54.6	57.6	61.6	53.2	55.8	59.9	53.2	54.8	58.5	49.5	50.6	52.4	48.5	49.2	49.9	44.6	45.8	46.9
9	54.6	57.9	62.0	53.5	55.6	60.0	52.6	53.6	55.7	48.7	50.3	53.1	48.1	48.9	50.6	45.5	46.6	47.6
10	54.4	58.1	62.4	53.3	55.7	59.8	51.7	54.1	58.0	49.2	50.6	53.0	48.2	48.9	49.6	46.3	46.9	47.6
11	55.4	57.3	59.7	53.6	55.7	58.4	51.9	54.2	57.7	49.3	49.9	50.6	47.6	48.5	50.3	45.6	47.0	48.5
12	54.7	57.4	61.2	53.3	55.2	59.8	51.6	54.0	58.2	48.5	50.1	52.4	47.7	49.0	51.6	47.4	48.3	49.5
13	54.4	57.2	61.0	53.1	55.6	59.7	52.3	54.0	56.4	49.2	50.3	52.2	48.9	49.6	51.1	47.9	48.3	49.3
14	54.8	57.1	60.7	53.8	56.0	60.1	52.7	54.5	58.2	49.7	50.2	50.9	48.0	49.1	50.8	47.7	48.1	49.4
15	54.2	57.3	61.8	53.0	55.8	59.9	51.6	54.1	58.0	48.4	50.0	52.7	47.7	48.6	50.2	47.9	48.2	48.9
16	54.0	56.7	59.5	53.1	55.7	60.0	52.3	54.4	58.3	48.1	49.2	50.8	47.0	48.9	49.7	47.7	48.3	49.2
17	54.8	57.3	61.8	53.1	55.6	59.2	52.2	53.3	55.1	48.1	49.1	50.8	46.8	47.6	49.0	47.2	48.4	49.5
18	54.5	57.5	61.5	53.6	55.9	60.1	51.4	52.5	53.3	48.4	49.7	52.2	47.5	48.7	50.1	47.0	48.4	49.2
19	53.9	57.0	60.8	52.8	55.6	60.0	50.9	52.4	54.9	48.7	50.0	51.8	47.1	49.3	50.8	45.3	46.0	47.2
20	53.9	56.9	60.8	52.5	55.3	59.6	50.3	52.6	56.4	49.6	50.5	52.6	45.5	46.6	47.0	45.5	47.0	48.6
21	54.0	57.1	61.5	52.3	55.0	58.8	50.6	53.1	56.9	49.8	50.7	52.1	45.8	46.7	49.0	47.0	47.3	47.6
22	54.2	57.1	61.5	52.7	55.4	59.9	51.6	53.1	56.0	49.2	50.6	53.2	46.2	47.3	49.3	45.8	46.6	47.5
23	53.6	56.8	61.3	53.6	55.5	59.5	51.0	52.7	55.0	49.7	50.9	53.3	46.8	47.9	50.3	45.7	47.7	49.5
24	54.0	57.0	61.8	53.6	55.4	59.0	50.4	51.8	53.3	49.3	50.8	53.3	47.2	48.2	49.9	46.9	47.7	48.6
25	54.0	56.9	60.9	53.1	55.3	59.1	51.2	51.7	52.5	49.1	50.4	53.0	47.3	48.1	49.6	46.4	47.5	49.3
26	53.4	56.5	60.9	53.4	55.5	59.4	49.9	50.7	51.6	48.9	50.2	52.9	47.6	48.5	50.3	47.6	48.3	49.7
27	53.6	56.4	60.7	53.0	55.3	59.5	49.6	51.1	54.1	48.5	49.7	52.2	47.6	48.5	49.8	48.0	48.5	49.8
28	54.0	55.4	59.3	52.9	55.0	59.1	50.1	51.7	54.1	47.6	48.0	48.9	47.3	48.2	50.2	44.6	46.5	48.2
29	53.4	54.9	57.8	52.6	54.9	58.8	51.0	51.7	53.0	47.6	48.5	50.0	47.7	48.4	50.1	46.8	47.5	48.8
30	53.4	55.2	58.2	53.3	55.3	59.1	50.0	51.3	52.6	47.4	48.7	51.1	48.5	49.1	50.1	47.4	48.1	49.1
31	52.9	56.0	60.3	52.2	54.6	58.4				48.4	49.3	50.9	48.4	49.3	50.5	47.9	48.4	48.9

Appendix 4 continued. Minimum, mean and maximum water temperatures (ºF) from Lewistown area waters in 2013.

Big Spring Creek - Hruska FAS (Coordinates = N 47.1130, E -109.5096)

	January			February			March			April			May			June		
Date	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
1	40.4	41.5	42.3	43.1	44.5	46.5	42.1	45.5	49.0	42.7	48.0	53.1	41.6	47.2	51.5	47.7	52.3	57.2
2	38.5	39.6	40.8	40.6	43.2	45.3	43.9	46.2	47.6	43.6	49.6	54.8	43.9	50.7	56.6	51.0	53.3	55.3
3	37.6	39.7	41.8	41.7	43.7	46.1	39.3	44.0	46.2	46.2	50.1	53.3	47.0	50.0	53.0	47.6	49.7	52.6
4	39.3	41.4	43.3	42.4	43.9	45.8	35.0	38.1	40.9	44.6	49.0	52.7	48.9	51.4	54.4	46.5	48.1	50.1
5	41.1	42.3	43.6	43.3	45.2	47.2	36.3	40.7	44.4	46.9	49.9	52.7	46.8	53.0	58.6	45.6	51.6	57.7
6	40.0	42.1	44.2	42.8	44.4	45.8	40.0	43.2	45.4	45.1	49.4	53.1	48.2	55.1	61.3	49.4	54.2	58.5
7	41.2	43.0	44.4	40.3	42.9	44.7	41.7	44.9	48.1	46.6	49.0	51.5	49.9	56.4	61.5	51.2	55.5	59.4
8	42.1	43.1	44.4	40.8	43.3	45.0	41.0	44.8	47.9	41.0	44.0	46.6	50.7	56.8	62.0	52.2	56.5	60.4
9	42.4	44.0	45.6	39.7	42.8	44.8	41.4	44.6	47.6	40.2	44.9	49.8	51.1	57.2	62.5	52.9	57.6	62.4
10	37.1	41.9	44.9	38.6	40.6	44.1	40.8	44.9	48.1	40.7	47.2	52.5	51.2	56.3	61.0	53.7	58.5	63.1
11	34.9	35.6	37.1	36.0	39.6	42.9	42.4	43.7	46.5	46.1	49.5	52.3	49.5	54.5	58.8	54.9	56.8	59.8
12	35.8	37.8	39.1	39.3	42.3	44.8	40.5	43.6	46.3	44.5	48.3	52.2	51.6	57.6	62.3	53.6	58.1	62.9
13	37.8	38.8	40.0	42.2	43.3	44.5	43.9	46.0	50.0	45.4	47.3	49.8	53.7	59.8	64.6	55.1	56.4	58.8
14	37.7	39.2	40.4	39.9	42.0	44.4	42.1	44.7	46.6	41.7	43.2	45.8	52.1	56.9	60.0	53.1	55.3	58.2
15	39.8	42.2	44.6	41.0	43.7	46.3	43.3	45.4	47.4	40.1	43.9	48.1	51.1	56.3	60.3	51.7	56.4	61.1
16	41.0	41.8	43.2	41.7	45.0	48.0	42.1	44.7	47.6	41.8	45.5	49.2	51.8	55.0	57.6	52.7	57.5	62.1
17	39.8	42.2	44.3	41.5	43.0	46.2	39.8	43.2	45.2	42.3	45.5	48.5	52.2	54.7	56.3	54.5	59.4	64.4
18	42.2	43.5	45.0	40.2	42.5	45.8	37.1	39.8	42.2	40.7	45.9	49.6	52.4	53.8	55.3	56.4	61.5	66.2
19	41.8	42.9	44.1	38.7	41.0	42.9	40.3	43.7	47.7	44.4	47.8	50.4	51.6	52.5	53.5	57.9	61.3	64.3
20	39.2	40.5	42.2	38.7	41.3	43.4	40.6	44.6	47.9	45.8	48.4	50.7	51.3	54.0	57.8	54.9	58.6	62.2
21	40.1	41.8	44.2	38.9	42.4	45.2	43.9	45.5	47.6	43.8	45.3	48.9	50.4	55.5	60.5	53.6	55.9	57.8
22	38.8	41.7	43.8	39.9	43.2	45.8	41.5	42.8	45.0	41.5	45.8	50.2	51.2	54.3	57.6	52.2	55.3	58.2
23	41.5	42.2	43.8	42.5	43.8	45.6	37.8	41.8	45.9	41.4	46.7	50.3	50.3	52.5	54.5	51.5	57.3	63.0
24	42.3	43.7	45.6	39.8	43.1	46.1	38.0	42.2	46.0	44.2	49.1	54.0	50.4	55.0	59.3	55.0	59.3	63.0
25	41.0	43.5	45.8	40.2	43.4	45.9	38.4	43.9	48.8	45.9	51.0	55.3	51.5	56.0	59.7	56.9	60.9	65.3
26	44.4	46.0	48.0	41.6	43.1	45.1	41.1	46.1	50.8	46.8	53.1	58.6	52.0	56.8	60.6	57.0	60.4	62.8
27	43.5	44.7	45.9	39.2	42.9	45.9	42.2	47.7	52.3	49.0	52.9	55.1	52.2	55.9	59.1	56.2	61.3	66.3
28	41.0	42.5	43.8	41.1	44.0	46.6	43.8	48.9	52.9	49.1	53.5	58.1	50.9	55.6	60.3	57.2	62.8	67.9
29	36.2	39.1	42.2				45.7	49.0	51.1	46.5	50.3	54.2	52.3	53.8	55.7	58.7	64.0	68.8
30	36.2	39.1	41.8				44.9	48.7	52.7	43.1	45.5	48.2	50.6	52.0	53.8	59.4	64.6	69.2
31	36.0	39.3	43.8				43.8	47.5	51.3				48.6	49.2	50.6			

Appendix 4 continued. Minimum, mean and maximum water temperatures (ºF) from Lewistown area waters in 2013.

Big Spring Creek – Hruska FAS (Coordinates = N 47.1130, E -109.5096)

	July			August			September			October			November			December		
Date	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
1	60.0	65.2	69.5	57.2	60.3	63.3	53.1	58.5	63.1	46.4	49.8	52.9	44.3	45.9	47.7	44.0	44.8	45.9
2	59.9	65.2	69.9	55.9	59.5	62.9	54.3	59.2	62.9	47.7	50.7	52.9	43.2	45.5	47.7	40.1	43.9	45.3
3	60.4	65.6	70.2	55.5	60.0	63.5	55.1	59.7	63.6	47.4	48.5	51.4	43.0	45.3	47.8	33.9	35.4	39.9
4	61.4	65.0	67.1	55.4	60.4	64.8	56.0	60.3	64.5	46.2	48.0	50.2	41.9	43.2	44.4	34.0	34.7	35.9
5	58.8	62.9	67.1	55.3	59.8	63.0	55.7	60.2	64.4	43.7	47.3	50.1	40.1	42.2	43.9	32.6	34.0	35.7
6	58.1	63.0	67.1	54.6	59.5	63.6	56.4	60.6	64.6	46.4	49.9	53.0	41.6	43.7	45.5	32.2	33.2	34.7
7	59.0	63.3	68.1	55.1	60.2	64.8	57.2	59.8	62.6	46.4	50.0	53.2	41.8	44.0	46.6	31.9	32.5	33.5
8	57.9	61.9	65.3	55.9	60.7	64.3	55.3	58.4	61.5	47.0	49.3	51.5	44.8	45.5	46.7	32.4	34.2	35.9
9	57.2	62.2	67.1	56.2	60.2	63.8	54.2	56.7	59.3	44.6	47.7	50.4	43.3	44.9	46.5	34.1	36.3	38.6
10	57.5	63.3	68.4	55.6	60.3	64.4	52.3	56.9	61.1	45.5	48.6	51.2	43.9	44.6	45.6	37.6	38.5	39.5
11	59.1	62.4	65.2	56.9	60.8	63.5	52.9	57.7	61.7	46.6	47.7	50.0	42.2	43.7	45.3	36.1	38.1	40.7
12	57.4	61.7	65.6	56.1	59.9	63.6	52.6	57.3	60.8	44.7	47.4	49.8	41.6	44.4	47.0	40.3	42.0	43.8
13	57.4	62.1	66.5	55.0	59.6	63.6	53.7	57.4	59.7	45.7	48.0	49.4	45.1	46.6	48.3	42.2	43.1	44.4
14	57.3	61.8	65.6	56.4	60.9	65.3	55.4	58.0	60.2	47.1	48.2	49.1	43.5	44.9	46.3	41.3	42.7	44.1
15	57.3	62.6	67.2	55.3	60.8	65.3	52.5	57.2	60.9	44.8	47.6	50.3	41.7	43.8	45.4	42.0	42.9	43.7
16	56.9	61.4	64.6	55.7	60.7	64.4	54.2	58.3	61.5	43.7	45.8	48.0	43.6	44.7	45.7	41.8	42.9	43.9
17	57.9	62.1	67.5	55.6	60.5	64.5	53.2	55.4	58.9	44.3	45.8	47.2	39.7	41.8	43.5	40.8	42.6	44.6
18	58.0	63.2	67.7	56.2	61.1	65.6	51.9	53.7	56.1	43.9	46.7	49.0	41.2	43.2	45.2	41.7	44.0	44.9
19	57.0	62.5	67.3	55.3	60.7	65.0	49.7	53.0	56.7	44.9	47.4	49.3	43.9	45.6	47.7	35.8	37.5	41.5
20	56.6	62.4	67.6	54.6	60.1	64.3	48.7	53.3	57.3	47.1	48.4	49.6	35.8	39.1	43.8	35.3	37.7	40.9
21	57.2	62.8	67.8	54.5	59.5	63.2	49.6	54.5	58.2	47.2	48.8	50.1	34.4	37.0	39.7	40.0	40.6	41.1
22	57.6	62.9	68.0	55.0	60.1	64.4	51.8	54.6	57.0	46.1	48.8	51.3	36.5	39.1	41.2	37.0	38.6	40.0
23	56.8	62.4	67.5	56.8	60.6	63.9	51.1	53.9	55.9	46.6	49.3	51.7	38.2	40.8	43.1	36.0	39.3	44.0
24	57.5	63.0	67.8	56.3	59.9	63.5	48.7	51.5	53.0	46.4	49.3	51.7	40.2	42.2	44.1	40.9	42.9	44.1
25	57.8	62.9	67.6	55.4	60.1	64.0	50.6	51.4	52.5	45.6	48.6	51.1	40.5	42.3	43.8	38.7	40.5	42.2
26	56.5	61.8	67.0	56.3	60.6	64.6	48.5	49.3	50.8	44.9	48.0	50.6	41.3	43.3	45.4	41.4	43.0	44.8
27	56.6	61.7	66.6	55.8	60.3	63.6	46.8	49.9	53.3	44.2	47.0	49.2	42.8	44.0	45.8	42.5	44.2	45.7
28	57.2	60.7	65.3	55.4	59.8	64.1	47.6	50.8	53.0	42.1	43.6	47.2	40.5	42.6	44.4	37.8	40.3	44.8
29	55.4	58.6	62.6	54.7	59.4	63.5	50.0	51.4	52.5	41.9	43.4	45.5	41.1	43.2	44.9	38.5	40.3	42.1
30	55.9	59.1	62.5	56.1	60.2	63.7	49.1	50.4	52.2	41.5	44.2	46.4	44.3	45.4	46.7	41.3	42.7	44.0
31	54.9	60.6	66.1	54.3	59.0	62.7				43.4	45.2	46.4	44.3	45.9	47.7	43.4	43.9	44.6

Appendix 4 continued. Minimum, mean and maximum water temperatures (ºF) from Lewistown area waters in 2013.

South Fork Judith River – below Russian Creek (Coordinates = N 46.7189, E -110.4252)

	June			July			August			September			October			November		
Date	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
1							48.9	51.1	53.3	44.9	48.3	51.7	36.7	38.3	39.8			
2							49.2	51.1	53.7	46.3	49.7	53.0	36.5	37.9	39.1			
3				47.5	52.4	56.9	47.2	50.2	53.3	47.9	50.9	53.6	34.1	35.6	38.0			
4				47.8	51.5	54.5	46.3	50.0	53.5	51.1	52.9	55.5	33.4	34.5	36.0			
5				47.0	51.0	55.1	46.7	49.9	52.6	49.3	51.9	54.4	32.2	34.0	35.9			
6				45.9	50.4	54.6	45.9	49.3	52.4	49.8	52.0	54.2	35.3	36.9	38.7			
7				47.0	51.3	55.4	46.0	49.3	52.3	43.7	51.3	54.7	36.2	37.9	39.5			
8				46.6	49.8	52.1	46.3	49.7	52.3	45.4	47.6	50.2	36.2	37.7	38.8			
9				44.6	49.6	54.3	48.0	50.7	53.6	45.9	47.6	49.5	33.6	35.6	37.3			
10				45.7	50.8	55.3	47.3	50.3	53.6	43.9	46.8	49.5	34.1	36.1	38.2			
11				47.5	50.4	52.7	47.0	49.8	52.4	44.5	47.2	50.0	34.8	36.1	37.0			
12				45.6	50.0	54.0	46.8	49.8	52.1	44.4	47.2	49.6	32.3	34.3	36.1			
13				46.4	50.6	54.3	47.3	50.3	53.3	46.2	48.7	51.0	34.0	35.2	36.6			
14				47.8	51.3	54.9	47.3	50.6	53.6	49.0	50.6	52.8	34.6	35.4	36.4			
15				47.1	51.7	55.5	46.9	50.6	53.9	46.1	48.6	50.0	32.0	33.2	35.2			
16				47.7	51.2	53.6	48.3	51.5	54.7	47.0	49.2	51.7	32.0	33.1	34.3			
17				49.0	52.8	57.2	48.1	51.4	54.3	45.5	47.0	48.6	32.4	33.5	34.7			
18				47.9	52.2	55.8	49.0	52.0	55.1	44.4	45.2	46.8	32.0	32.7	33.2			
19				46.9	51.4	55.3	47.4	51.1	54.5	42.5	43.7	45.2	33.2	34.4	35.9			
20				46.7	51.2	55.2	47.1	50.6	54.0	39.4	41.9	44.4	34.2	34.8	35.7			
21				46.6	51.3	55.3	46.2	49.7	52.7	39.8	42.8	45.7	33.7	35.1	36.8			
22				47.5	51.7	55.3	46.8	50.3	53.8	43.0	44.9	46.8	34.1	35.2	36.5			
23				46.8	51.2	55.0	50.0	52.1	54.8	42.2	43.6	45.1	33.5	34.6	35.7			
24				47.8	52.1	56.0	49.1	51.7	54.5	39.7	41.9	43.3	33.7	34.8	35.9			
25				48.3	51.9	54.6	48.6	51.7	54.5	38.5	40.9	42.2						
26				48.1	52.4	56.3	48.8	51.5	53.6	36.3	37.3	38.3						
27				48.9	52.8	55.9	48.4	51.0	53.2	34.4	36.2	37.4						
28				48.5	51.1	53.4	48.0	50.7	53.2	37.2	38.8	40.6						
29				47.7	49.7	51.1	47.4	50.5	53.6	40.1	40.6	41.6						
30				46.6	49.1	51.5	49.4	51.7	54.4	38.7	40.1	40.8						
31				46.0	50.2	53.9	46.4	49.3	51.7									

Appendix 4 continued. Minimum, mean and maximum water temperatures (ºF) from Lewistown area waters in 2013.

South Fork Judith River – below Bluff Mountain Creek (Coordinates = N 46.7449, E -110.3375)

	June			July			August			September			October			November		
Date	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
1							51.6	54.3	57.5	48.8	52.9	57.8	38.0	40.1	42.2			
2							52.0	54.6	58.5	49.8	53.8	57.8	37.5	39.7	41.5			
3				50.7	54.8	60.0	50.2	54.0	59.2	51.1	54.9	58.5	34.6	36.5	40.2			
4				51.2	54.1	56.9	49.2	53.7	59.1	54.4	57.1	60.7	34.4	35.7	37.6			
5				50.6	53.8	58.2	49.9	53.4	57.0	52.3	55.8	59.1	32.6	35.0	37.7			
6				48.8	52.8	57.2	49.0	52.9	56.8	53.0	56.3	59.7	35.9	38.0	41.2			
7				49.8	53.4	58.2	49.0	52.5	56.6	54.0	56.6	59.4	36.5	38.9	41.9			
8				49.6	52.3	55.5	49.2	53.1	57.1	49.7	52.2	54.6	36.8	38.4	40.3			
9				47.5	52.1	57.8	50.8	54.4	59.1	48.9	51.6	55.1	34.4	36.7	38.8			
10				48.9	53.4	58.7	50.8	54.3	58.5	47.0	50.8	54.9	35.2	37.4	39.8			
11				50.9	53.2	55.0	50.6	53.4	57.5	47.0	50.9	54.8	36.0	37.2	38.4			
12				49.0	52.9	57.1	49.0	52.4	57.2	47.6	51.1	54.9	33.3	35.5	37.8			
13				49.3	53.4	58.8	49.8	53.5	58.3	49.6	52.3	55.4	33.8	35.5	37.1			
14				50.7	54.6	60.2	50.2	53.8	57.6	51.9	54.0	56.9	34.7	35.7	36.9			
15				51.1	55.4	60.8	49.5	54.0	59.2	49.1	52.4	55.6	32.5	34.3	35.9			
16				51.0	54.4	58.2	51.2	55.2	60.0	50.4	53.0	56.1	32.4	33.9	35.5			
17				52.2	56.0	62.1	50.8	55.0	59.4	48.5	50.4	52.4	32.8	34.3	35.7			
18				51.2	55.4	60.9	51.8	55.6	60.1	47.2	48.4	50.2	32.3	33.8	35.2			
19				50.3	54.8	60.6	50.4	54.9	60.0	45.4	46.9	48.9	33.5	35.2	37.2			
20				49.7	54.3	59.4	49.5	54.2	59.2	41.9	45.4	49.1	34.5	35.5	36.3			
21				50.0	54.7	60.5	49.0	53.4	57.8	42.6	46.3	50.1	33.8	35.7	38.2			
22				51.4	55.4	60.8	50.4	54.5	59.5	45.3	47.7	50.4	34.1	35.8	37.8			
23				50.2	55.0	60.8	53.4	56.0	59.6	44.1	45.9	48.0	33.5	35.2	36.9			
24				51.6	56.0	61.3	52.4	55.7	59.7	42.1	44.3	46.0	34.0	35.6	37.3			
25				51.5	55.5	59.3	52.0	55.9	59.8	41.4	43.0	44.7						
26				52.2	56.5	62.1	52.2	55.6	58.8	37.3	38.8	41.1						
27				52.7	56.8	61.2	51.5	54.7	57.6	36.2	38.4	40.8						
28				51.7	54.7	58.4	51.3	54.5	58.2	38.3	40.6	43.5						
29				50.9	53.1	55.6	50.7	54.7	59.1	41.7	42.5	43.8						
30				49.9	52.9	56.3	52.8	56.1	60.3	40.3	41.9	43.1						
31				49.0	53.8	59.4	49.6	53.6	57.6									

Appendix 4 continued. Minimum, mean and maximum water temperatures (ºF) from Lewistown Area Waters in 2013.

North Fork Musselshell River – below Cooper Creek (Coordinates = N 46.5418, E -110.4427)

	April			May			June			July			August			September		
Date	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
1				35.9	42.1	49.4	46.0	51.2	57.4	54.3	62.9	70.8	57.5	61.5	66.3	54.7	61.3	68.1
2				36.5	44.7	54.5	49.2	53.7	59.2	53.9	63.4	72.2	57.5	62.1	68.5	55.3	61.1	66.1
3				41.1	45.3	49.0	46.4	48.3	52.2	56.1	64.5	72.5	57.9	62.8	68.0	56.9	62.6	67.8
4				43.5	46.3	50.3	43.5	46.8	51.2	55.2	62.7	68.9	57.3	63.3	70.6	60.5	64.2	68.4
5				39.8	47.9	56.9	45.0	51.4	59.1	54.7	60.5	66.3	57.2	62.1	66.6	57.5	62.8	67.8
6				42.2	50.6	60.2	48.0	54.5	61.6	52.7	60.5	68.6	58.1	63.4	70.2	59.0	63.3	68.6
7				44.1	51.2	57.7	49.8	55.0	59.4	54.1	61.1	67.0	57.6	63.7	71.0	59.1	63.3	68.1
8				45.5	52.4	60.9	50.4	55.7	62.1	53.6	60.3	65.4	58.5	64.0	70.5	56.3	60.9	65.5
9				46.4	51.6	57.0	48.9	56.1	63.7	52.9	61.0	69.4	59.7	63.8	69.6	55.6	59.4	63.2
10				44.8	52.0	60.0	48.6	55.8	63.7	53.6	62.8	71.4	60.2	64.6	71.6	53.6	59.8	66.4
11				44.7	51.9	59.1	51.9	55.5	59.7	55.5	60.4	65.7	59.3	63.3	68.4	53.2	59.6	65.4
12				46.5	53.5	60.3	50.1	54.3	60.3	52.4	59.4	66.3	58.2	62.8	68.0	53.1	59.2	64.9
13				48.8	56.0	63.8	50.9	55.2	59.9	53.3	61.4	69.7	58.9	63.4	69.6	55.0	60.0	64.2
14				47.3	54.4	60.9	47.9	52.1	56.4	54.4	61.5	69.0	59.0	64.2	70.9	57.8	61.0	64.8
15				47.1	53.4	58.8	45.7	53.0	61.2	54.0	61.5	68.0	56.7	63.6	71.1	54.2	58.5	62.9
16	32.8	35.5	38.1	46.9	51.4	55.4	46.8	54.6	62.3	54.6	60.7	66.2	57.4	63.7	70.4	54.6	59.6	64.4
17	32.8	35.9	40.5	47.1	49.5	52.2	48.5	56.0	63.5	56.3	62.6	71.7	56.7	63.1	68.6	53.5	56.2	59.7
18	32.9	38.3	45.0	46.8	50.1	53.3	50.7	58.2	65.8	55.0	62.1	69.9	57.4	63.4	69.6	52.1	54.2	56.6
19	36.4	40.4	45.1	47.3	48.5	51.0	52.5	57.3	62.7	53.4	61.4	69.4	56.6	63.3	70.0	49.7	53.0	57.9
20	38.0	44.4	52.8	46.4	50.2	56.3	48.2	53.3	59.9	53.3	61.2	69.8	55.7	62.6	69.4	46.8	53.1	59.5
21	35.3	39.9	44.3	44.2	51.8	60.3	47.6	52.1	56.9	52.9	61.1	69.7	55.6	62.2	69.0	47.8	54.1	59.7
22	33.6	39.7	48.2	45.9	47.5	51.9	48.3	53.2	58.8	54.0	61.5	69.2	56.0	62.3	69.0	51.3	54.9	58.0
23	33.0	40.3	47.5	45.5	46.9	48.3	47.6	55.2	63.1	53.2	61.4	70.2	59.3	63.2	67.8	50.1	52.6	54.9
24	36.7	43.3	51.3	44.4	50.8	58.1	50.4	57.1	63.6	54.8	62.4	71.1	58.5	63.1	68.0	46.7	49.8	51.8
25	38.8	46.0	54.7	44.9	50.4	54.4	51.9	58.6	65.5	55.3	62.4	70.8	57.4	63.8	70.9	47.0	48.6	50.0
26	40.2	48.0	57.0	45.3	51.4	57.3	53.0	59.3	66.5	56.2	62.8	71.0	57.9	63.7	68.8	45.5	47.8	51.1
27	43.4	48.6	54.8	45.6	51.6	58.2	51.1	59.9	68.9	55.2	61.5	68.0	57.5	63.5	70.1	42.6	46.7	50.6
28	43.7	49.5	56.9	47.0	51.6	57.2	52.2	61.6	70.5	55.3	60.2	64.6	56.7	62.0	66.8	45.6	48.5	52.7
29	41.6	46.4	51.5	48.4	50.2	53.6	53.6	62.0	69.6	55.5	60.6	67.2	57.0	62.8	69.9	46.9	47.8	49.7
30	36.9	41.1	45.7	46.5	48.6	50.8	53.1	61.8	70.3	55.1	59.5	64.0	59.2	64.2	69.7	45.2	47.5	49.7
31				44.7	47.9	51.0				54.0	61.5	69.8	56.1	61.9	68.0			

Appendix 4 continued. Minimum, mean and maximum water temperatures (ºF) from Lewistown Area Waters in 2013.

South Fork Musselshell River – Martinsdale Bridge (Coordinates = N 46.4629, E -110.3187)

	April			May			June			July			August			September		
Date	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
1				38.1	43.2	47.8	48.0	48.5	50.0	62.1	62.9	64.1	61.2	65.6	70.4	57.7	65.2	74.3
2				38.3	45.0	52.5	50.0	50.5	51.4	63.2	69.2	77.9	60.4	66.0	72.6	58.4	64.5	70.2
3				43.4	46.2	48.6	49.6	50.6	51.5	64.2	70.3	77.1	60.8	66.5	73.3	59.7	66.9	76.2
4				44.6	46.5	48.9	47.7	48.4	49.6	62.8	68.8	74.8	59.7	67.3	73.8	63.3	69.2	77.1
5				42.3	49.0	56.9	47.6	48.2	49.6	61.9	67.1	74.1	60.3	65.6	68.9	62.3	67.4	72.4
6				45.6	52.5	60.3	49.6	50.4	51.9	60.4	66.7	74.3	59.3	65.4	72.1	62.4	67.3	73.1
7				48.5	53.9	58.8	52.0	52.5	53.3	61.3	67.0	74.0	59.1	65.8	72.8	63.7	67.5	72.1
8				48.9	54.1	60.0	52.8	53.4	54.6	61.2	65.1	70.2	59.1	66.8	77.2	59.7	63.5	67.2
9				50.3	53.4	56.5	53.6	54.4	55.3	59.1	65.6	72.7	60.1	66.0	73.6	57.3	61.6	65.7
10				49.1	53.5	58.4	54.3	55.0	55.5	60.1	67.5	75.7	61.6	66.7	75.9	55.8	61.7	67.9
11				48.4	52.5	56.6	55.0	55.4	55.7	62.2	66.4	70.2	58.9	64.7	69.8	57.0	62.6	68.2
12				50.1	54.6	59.0	53.8	54.4	55.2	58.0	64.8	72.0	59.5	65.1	71.2	57.2	62.4	67.7
13				51.3	55.6	59.7	54.7	55.1	55.5	59.4	66.6	74.8	59.5	65.0	71.2	59.1	62.7	65.9
14				49.9	52.8	56.7	53.8	54.5	55.5	60.1	67.2	75.0	59.9	66.1	72.8	60.6	63.6	68.0
15				50.5	52.6	54.9	52.4	53.2	54.0	60.5	67.9	75.4	60.0	67.2	75.1	59.4	62.4	66.3
16	34.2	38.7	44.0	50.3	51.9	53.7	53.6	54.2	55.2	61.5	65.8	69.5	61.4	68.2	74.6	58.2	61.6	65.3
17	33.4	37.7	42.2	49.8	50.6	52.3	54.9	55.4	56.5	61.0	67.1	76.3	62.1	68.3	73.9	56.1	58.1	61.2
18	33.6	40.4	48.5	48.6	49.4	50.4	56.4	56.8	57.9	62.1	68.6	75.9	61.9	68.6	75.1	53.0	54.7	57.3
19	36.4	43.5	51.4	47.7	48.3	49.9	57.7	58.1	58.3	60.8	68.1	75.2	61.6	67.8	73.7	49.6	52.2	55.5
20	39.5	46.5	56.3	46.4	46.9	47.6	55.6	56.7	58.2	60.3	67.7	75.1	60.7	66.8	72.7	47.6	53.6	60.3
21	37.5	41.4	45.3	46.6	47.2	48.3	55.1	55.7	56.4	60.4	68.2	76.1	60.6	66.1	71.9	49.4	55.4	60.5
22	34.9	40.7	48.0	47.8	48.4	48.9	54.5	55.0	55.6	61.7	68.8	75.5	60.0	66.0	72.8	53.6	56.7	59.3
23	35.6	42.0	48.1	47.1	47.3	47.7	54.0	54.6	55.9	60.6	68.2	76.2	63.6	66.7	72.0	51.4	54.4	56.9
24	38.5	43.9	50.5	46.7	47.2	48.6	55.9	56.3	57.2	61.8	69.6	77.9	61.7	66.6	72.9	48.0	50.8	52.9
25	40.4	46.2	52.6	48.2	48.7	49.2	57.1	57.6	58.7	62.7	70.0	77.7	61.7	67.0	73.3	47.3	49.0	50.9
26	43.4	49.8	56.9	48.5	49.0	49.7	57.8	58.4	58.9	62.5	70.0	78.0	61.7	67.1	73.4	44.9	47.6	50.6
27	46.5	50.8	55.7	48.8	49.4	50.3	58.1	58.8	60.2	62.3	68.6	74.2	60.4	67.3	74.9	43.5	47.3	52.4
28	45.9	50.7	56.9	49.7	50.2	50.8	59.6	60.3	61.5	61.4	66.2	71.0	60.8	65.4	69.5	44.8	48.0	51.9
29	44.7	47.6	51.4	50.3	50.6	51.0	60.9	61.6	62.4	59.8	65.3	72.1	59.2	66.5	75.9	46.8	48.3	49.7
30	39.2	43.3	47.7	49.2	49.7	50.4	61.0	61.8	62.8	59.6	64.6	69.9	62.0	68.0	74.8	45.9	47.2	49.7
31				48.1	48.6	49.2				57.7	65.2	73.3	60.7	66.0	72.7			

Appendix 4 continued. Minimum, mean and maximum water temperatures (ºF) from Lewistown Area Waters in 2013.

South Fork Musselshell River – Martinsdale Bridge (Coordinates = N 46.4629, E -110.3187)

	October			November			December		
Date	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
1	42.4	46.0	49.8	35.6	37.9	40.3	35.1	35.9	36.7
2	44.2	47.4	51.0	36.6	39.0	41.8	34.1	36.2	37.1
3	42.4	44.3	47.9	36.9	38.7	40.5	32.1	32.4	34.0
4	40.9	44.1	48.4	34.9	36.6	38.6	32.0	32.1	32.3
5	39.0	42.9	46.8	32.3	34.0	36.2	32.0	32.1	32.3
6	41.6	45.8	49.8	33.1	34.5	36.6	32.0	32.1	32.4
7	43.9	47.9	52.2	33.6	35.7	38.3	32.0	32.0	32.2
8	44.8	47.1	49.6	35.9	36.9	37.8	32.0	32.0	32.2
9	40.7	44.5	48.3	34.0	35.8	37.7	32.0	32.0	32.1
10	41.1	44.6	47.3	35.9	37.1	38.5	32.0	32.0	32.0
11	42.4	44.4	46.6	35.1	36.5	38.1	32.0	32.0	32.1
12	38.9	41.6	44.3	33.1	36.2	40.1	32.0	32.0	32.1
13	39.7	41.9	44.2	37.4	38.8	41.0	32.0	32.0	32.1
14	40.5	42.2	44.6	35.7	36.7	38.0	31.9	32.0	32.1
15	39.6	42.4	45.9	33.0	34.9	36.6	32.0	32.0	32.0
16	39.0	40.5	41.8	34.5	35.4	36.9	32.0	32.0	32.1
17	39.1	40.5	42.2	32.2	33.3	34.8	32.0	32.0	32.2
18	37.1	40.2	44.0	32.0	33.7	36.3	31.9	32.0	32.2
19	38.6	41.2	44.0	35.1	36.8	39.6	31.9	31.9	32.0
20	40.6	42.5	44.8	32.1	34.1	37.7	31.9	32.0	32.0
21	40.3	43.3	47.3	32.0	32.2	33.1	31.9	32.0	32.0
22	42.1	44.9	48.7	32.0	32.2	33.2	31.9	31.9	32.0
23	41.5	44.5	48.0	32.0	32.2	32.7	31.9	32.0	32.0
24	43.2	45.5	48.9	32.0	32.1	32.6	31.9	32.0	32.0
25	42.4	45.2	48.9	31.9	32.1	32.6	31.9	32.0	32.1
26	41.2	44.2	47.4	31.9	32.2	32.8	31.9	32.0	32.1
27	41.0	43.7	46.9	32.1	33.3	34.9	31.9	32.0	32.1
28	36.4	39.4	43.5	32.0	33.2	34.4	31.9	32.0	32.0
29	35.0	36.7	39.3	32.7	34.1	35.9	31.9	32.0	32.1
30	34.4	36.9	40.1	35.0	36.3	38.0	31.9	32.0	32.1
31	35.8	37.9	40.9				32.0	32.0	32.0