Statewide Fisheries Surveys, 2015
Survey of Public Waters
Part 1 – Streams
Region 1

By

Michelle Bucholz
Fisheries Resource Biologist

South Dakota Department of Game, Fish, and Parks

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Introduction

Black Hills streams were surveyed during May – September 2015 to monitor fish populations and to gain an understanding of the distribution and abundances of fish within the Black Hills watersheds. This is also the second year in a process to update the Black Hills Streams Inventory and Classification as part of the Black Hills Fish Management Area Plan. Watersheds that were included in the survey were Spring Creek, Battle Creek, French Creek, Lame Johnny Creek, Beaver Creek South, Fall River, Red Canyon, Pass Creek, and Crow Creek (Figure 1). A few select streams were sampled in the watersheds of Spearfish Creek, Rapid Creek, Boxelder Creek, Elk Creek, Bear Butte Creek, Cold Spring Creek, Cheyenne River, and Whitewood Creek. Most other streams within the Black Hills were surveyed in 2014. Efforts will continue next year to complete the inventory for all Black Hills streams. In 2008 and 2009, a similar effort was made to survey all streams in the Black Hills. This was just after a prolonged drought period in most of western South Dakota from 2002 to 2008 (US Drought Monitor 2009). Since then, most years have received average and above average moisture, which likely has affected the aquatic biota within the area. Additionally, the historic October 2013 blizzard, commonly referred to as Atlas, brought 36 to 72 inches of wet snow to the Black Hills and surrounding area. This single event not only affected the amount of water within every stream and watershed, but also caused excessive habitat changes in the way of countless downed trees, bent over bushes and movement of instream structure. The full effects of these changes are impossible to quantify, but have likely affected the fish communities. Another effect of this blizzard was the inability to access and effectively survey some of the stream reaches that have been previously sampled. For this reason, new reaches were created up or downstream from historic reaches when necessary.

Copies of this report and references to the data can be made with permission from the authors or the Director of the Division of Wildlife. South Dakota Department of Game, Fish, and Parks, 523 E. Capitol, Pierre, South Dakota, 57501-3182.

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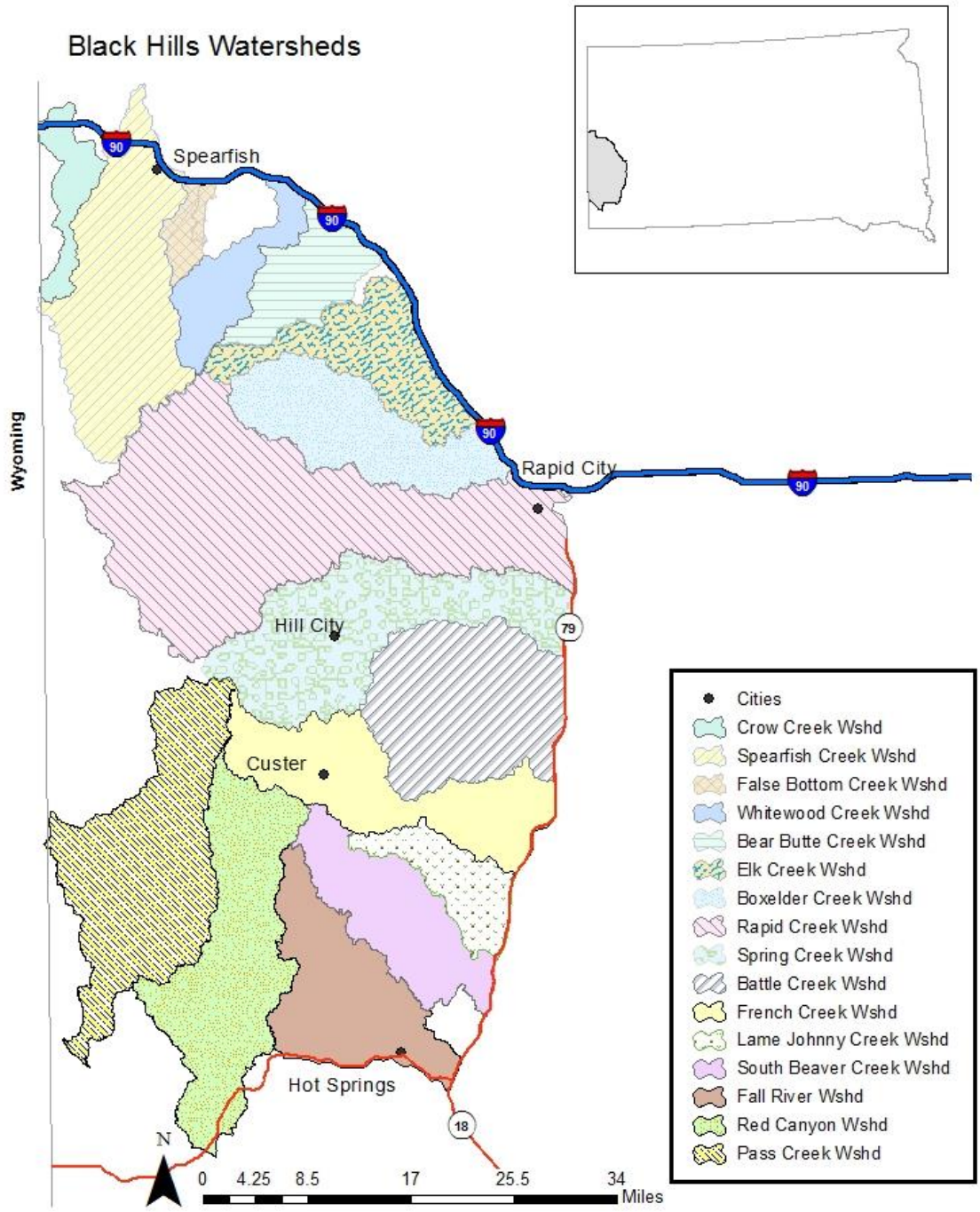

Figure 1. Watersheds included in the 2015 stream fisheries survey within the Black Hills Fish Management Area, South Dakota.

Survey Methods for All Watersheds

Efforts were made to satisfy the assumptions 1) the population is static, 2) capture probability remained constant across sampling periods, and 3) all fish in the population are equally vulnerable to capture (Van Den Avyle and Hayward 1999; Hayes et al. 2007). All sample reaches were 100 m in length. Block nets at the upstream and downstream boundaries were used to prevent fish from emigrating or immigrating within the sample site. Initially, a single pass was conducted. If trout over 200 mm or mountain suckers were captured, then three passes were conducted. In streams with a mean width < 6m, one backpack electrofishing unit was used with crews of two to four people. Captured fish were anesthetized with carbon dioxide, measured to the nearest millimeter total length (TL), weighed to the nearest gram, and returned to the stream after recovery. After 50 individual TL and weights were collected from small fish (<100mm) of a specific species, bulk counts were collected to expedite data collection. For three-pass surveys, a maximum-likelihood estimator was used to estimate catchability and population (Junge and Libosvarsky 1965; cited in Hayes et al. 2007). For single-pass surveys, relative abundance was calculated as CPUE (number of fish captured per 100 m of stream). Abundances and density were compared to past data from individual sites when historical sampling occurred within comparable months. For samples completed in May or June, previous samples in May and June were used for comparison. For samples completed in July or August, previous samples in July or August were used for comparison. As a result of the small sample size, caution must be given when interpreting the data and extrapolating it to the entire stream. Current stream classifications for Black Hills Fish Management Area (BHFMA) stream trout fisheries are found in Table 1.

In addition to fish data, pH, temperature, and specific conductance were collected. Stream widths were measured every ten meters and averaged to obtain an estimate of total area sampled. Stream flow data was also downloaded from the USGS web site for water years 2000-2015 (available at: http://waterdata.usgs.gov/sd/nwis/current/?type=flow). Eighteen species of fish were surveyed during the 2015 season (Table 2).

Table 1. Current trout classifications for streams within the Black Hills Fish Management Area, South Dakota.

Brown trout fisheries -- based on number of fish greater than 200 mm total length (8 in).	
Class BR1	number of wild brown trout exceeds 150 per acre
Class BR2	number of wild brown trout ranges from 25 to 150 per acre
Class BR3	number of wild brown trout is less than 25 per acre
Brook trout fisheries-- based on number of fish greater than 200 mm total length (8 in).	
Class BK1	number of wild brook trout exceeds 150 per acre
Class BK2	number of wild brook trout ranges from 25 to 150 per acre
Class BK3	number of wild brook trout is less than 25 per acre
Rainbow trout fisheries -- based on number of fish greater than 200 mm total length (8 in).	
Class RB1	number of wild rainbow trout exceeds 25 per acre
Class RB2	number of wild rainbow trout is less than or equal to 25 per acre

Table 2. List of species captured during the 2015 survey within the Black Hills Fish Management Area, South Dakota.

Common name	Species code	Scientific name
Brook trout	BKT	*Salvelinus fontinalis*
Brown trout	BNT	*Salmo trutta*
Rainbow trout	RBT	*Oncorhynchus mykiss*
Hatchery rainbow trout	HRB	*Oncorhynchus mykiss*
Brook stickleback	BRS	*Culaea inconstans*
Creek chub	CRC	*Semotilus atromaculatus*
Fathead minnow	FHM	*Pimephales promelas*
Green sunfish	GSF	*Lepomis cyanellus*
Jack Dempsey cichlid	JAD	*Rocio octofasciata*
Largemouth bass	LMB	*Micropterus salmoides*
Longnose dace	LND	*Rhinichthys cataractae*
Longnose sucker	LNS	*Catostomus catostomus*
Mountain sucker	MTS	*Catostomus platyrhynchus*
Plains topminnow	PTM	*Fundulus sciadicus*
Rock bass	ROB	*Ambloplites rupestris*
Sand Shiner	SSH	*Notropis stramineus*
White sucker	WHS	*Catostomus commersoni*
Yellow perch	YEP	*Perca flavescens*

Crow Creek Watershed

County: Lawrence

Fish populations in Crow Creek Watershed within the BHFMA were surveyed during 2015 to monitor fish populations. Crow Creek Watershed's headwaters begin about five miles west of Savoy with the Beaver Creek Forks. About six miles west of Spearfish, Beaver Creek (north) joins Crow Creek, which flows north and drains into the Redwater River about two miles north of I 90. The Crow Creek watershed within the Black Hills Fish Management Area is mostly forested with pine and spruce trees and is managed by the US Forest Service. A few forest service roads cut through the watershed and a few individual houses exist throughout the watershed, but this portion of the Black Hills is largely undeveloped when compared to the rest of the Black Hills. The northern end of the Crow Creek Watershed lies on private land with Crown Creek itself running though McNenny State Fish Hatchery and the Mirror Lakes Game Production Areas. Crow Creek was last stocked in 1995 with catchable rainbow trout, and 1990 with catchable brown trout; however, some fish from McNenny State Fish Hatchery have likely escaped into the creek near hatchery grounds. Both Mirror Lakes are currently stocked with catchable rainbow trout, and Beaver Creek was last stocked with fingerling rainbow trout in 1986. Crow Creek and its tributaries are managed under standard regulations with a daily limit of five trout (in any combination) with one allowed 14 inches or longer.

Crow Creek downstream of McNenny State Fish Hatchery is a wild brown trout fishery and is classified by South Dakota Game, Fish and Parks as a Class I brown trout fishery. Groundwater inputs comprise a large percentage of the annual flow in Crow Creek (Carter et al. 2002), resulting in a stable hydrograph (Burr et al. 2005). Consequently, drought conditions did not seem to have negatively impacted this section of Crow Creek in 2000-2007 like it did in

other Black Hills Streams. Additionally, the historic October 2013 blizzard, commonly referred to as Atlas, brought 36 to 72 inches of snow to the Black Hills and surrounding area with higher accumulations in the northern Black Hills. This single event not only affected the amount of water within every stream and watershed, but also caused excessive habitat changes in the form of downed trees, bent over bushes and movement of instream rocks and sediment. The full effects of these changes are impossible to quantify, but have likely affected the fish communities.

Methods

Sample Methods

Please refer above for methods, species abbreviations, and trout stream classifications.

Sample Locations

During this study, efforts were made to check all drainages for presence of water. Reaches were sampled if they had enough flowing water to sample with two reaches attempted per creek. One reach was sampled in Crow Creek, two in Beaver Creek, and two in Potato Gulch Creek.

Results and Discussion

Five species of fish were captured in the Crow Creek Watershed during 2015 sampling (Table 3). Longnose dace was the most widespread species, located in every site where fish were detected.

Table 3. Population estimates of fish in 100 meter sample reaches of creeks within the Crow Creek Watershed, Black Hills Fish Management Area, during 2015 surveys. Streams are in order from furthest downstream to upstream. Upper confidence interval (95%) is reported in parenthesis.

	BNT <200 mm	BNT ≥200 mm	BKT <200 mm	BKT ≥200 mm	LND	LNS	WHS
Crow\05*	16	29				4	9
Beaver\02			185 (68)	8 (1)	31[#]		
Beaver\03			124 (8)	7			
Potato Gulch\01			90 (6)	2			
Potato Gulch\03			441 (12)	11 (2)	6 (2)		

*single pass site, value is total fish captured

[#]high confidence interval, number is total sampled

Crow Creek (CRW)

Crow Creek site 5 was sampled with a single pass on July 9, 2015. Fish surveyed were 45 brown trout with 29 greater than 200 mm, four longnose sucker, and nine white sucker.

Beaver Creek (BV3)

Beaver Creek site 2 was sampled above the confluence with Potato Gulch Creek on June 2, 2015. Population estimates for brook trout were 185 less than 200 mm and eight greater than 200 mm. Thirty one longnose dace were also surveyed, but confidence intervals were too high to accurately estimate population. The July 2008 single pass survey yielded brook trout with three fish over 200 mm and 94 less than 200 mm and 23 longnose dace were also detected.

Site 3 was created and surveyed on Sept. 16, 2015. The population estimate for brook trout was 130 with seven >200 mm.

Potato Gulch Creek (PGS)

During a July 1, 2008 survey of Potato Gulch Creek site 1, brook trout were the only fish detected with a population estimate of 90 fish <200 mm and two >200 mm. During a single pass in July 2008, there were 59 brook trout with five greater than 200 mm ten longnose dace and one creek chub.

Site 3 was created and surveyed on Sept. 16, 2015 with a population estimate of 441 brook trout under and 11 over 200 mm, and six longnose dace.

Recommendations

1. Manage Crow Creek Watershed as Wild Fish: natural yield and Native Fish.
2. Survey Crow Creek Watershed's tributaries every five to seven years.

Spearfish Creek Watershed

County: Lawrence

Fish populations in the Spearfish Creek Watershed within the BHFMA (Figure 1) were surveyed during May, June and October 2015 to monitor fish populations. The Spearfish Creek Watershed lies between the Crow Creek and False Bottom Creek, and Whitewood Creek Watersheds in the northern Hills. The headwaters of Spearfish Creek lie about 8km (5mi) east of the Wyoming border and 15km (9 mi) west-south-west of Dumont. Spearfish Creek runs north along Hwy 85 until Cheyenne Crossing were it mostly runs along Hwy 14A until the city of Spearfish. It continues to run north through Spearfish and crosses I90 just west of the Hwy 85 exit. It experiences a loss zone between Bridal Veil Falls and the city of Spearfish, partially due to the diversion of water to Homestake power plant #1. Water returns to the creek prior to the city campground on the south end of town.

The majority of Spearfish Creek and its tributaries are managed as a wild trout (natural yield) fishery with standard regulations of a daily limit of five trout (in any combination) with one allowed 14 inches or longer. A one-mile reach of Spearfish Creek from the Maurice Intake upstream to the Hydro #2 building is currently managed with catch and release regulations for rainbow trout. Other trout species may be harvested according to standard regulations. This reach of Spearfish Creek is unique in that it contains the only naturally reproducing rainbow trout population in the BHFMA capable of maintaining a Class I rainbow trout (> 25 fish ≥200 mm / surface acre) fishery. No creeks within the watershed have been stocked since 1990 except for Iron Creek and East Spearfish Creek. Iron Creek was last stocked in 1997 with brook trout, and East Spearfish Creek was last stocked in 2005 with brown trout. Iron Creek Lake is stocked with around 6,800 catchable rainbow trout annually from April to September.

The last effort to survey tributaries in the Spearfish Creek Watershed was in 2008. Furthermore, Spearfish Creek experienced high flow conditions in 2015 exceeding 200 CFS in May and June (USGS 2016). Most of the streams within the watershed could not be surveyed due to high flows and turbid water.

Methods

Sample Methods

Please refer above for methods, species abbreviations, and trout stream classifications.

Sample Locations

During this study, only a few creeks were sampled due to high flow and time constraints. The remainder of the creeks will be sampled during the 2016 field season. One reach was sampled in Higgins Gulch and Deer Creek and two reaches were sampled in upper Iron Creek (Table 4).

Table 4. Spearfish Creek Watershed brook trout population estimates and estimated number of fish per acre within each site sampled in 2015. Streams are in order from furthest downstream to upstream. Confidence interval (95%) is reported in parenthesis.

Creek Name/ Site #	BKT <200 mm	BKT ≥200 mm	BKT ≥200 mm/acre	BKT class	LND
Higgins Gulch\03	63(9)	2(1)	20	BKT3	
Iron Creek\04					1
Iron Creek/03	16				
Deer Creek/01	No fish				

*single pass site, value is total fish captured

Table 5. Spearfish Creek Watershed brown and rainbow trout population estimates and estimated number of fish per acre within each site sampled in 2015. Streams are in order from furthest downstream to upstream. Confidence interval (95%) is reported in parenthesis.

Creek Name/ Site #	BNT <200 mm	BNT ≥200 mm	BNT ≥200 mm/acre	RBT <200 mm	RBT ≥200 mm	RBT ≥200 mm/acre
Spearfish\354	84(28)	47(6)	190	46(21)	14(2)	57
Iron Creek/03				32	2	75

*single pass site, value is total fish captured

Spearfish Creek (SFC)

Only one site was sampled in Spearfish Creek in 2015. This was reach 354 below the confluence with Cleopatra Creek. Flows were very high all summer and even during the Oct 21st sample flows were still quite high, which made for a difficult sample. Population estimates of brown trout were 131 fish with 47 ≥200 mm, equating to 190 fish per acre (Table 5). This meets the class 1 brown trout fishery classification. Length frequency histogram shows some age class nodes around 80, 180 and 230 mm (Figure 2). This site is within the rainbow trout catch and release area and had a population estimate of 60 fish with 14 ≥200 mm. This was 57 fish ≥200 mm per acre meeting a class 1 rainbow trout fishery.

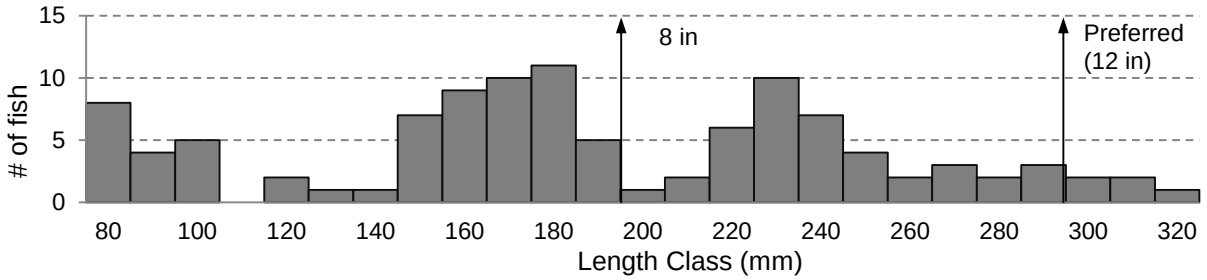

Figure 2. Length frequency histogram of brown trout captured during electrofishing survey of Spearfish Creek site reach 354 on October 21, 2015.

Higgins Gulch (HIG)

Brook trout were the only species of fish captured in Higgins Gulch on May 29, 2015. This site had a population estimate of 65 brook trout with two ≥200 mm . In 2008, 14 of 15 fish captured in a single pass were ≤200 mm.

Iron Creek (ICN)

Iron Creek was only sampled in its upper portions in 2015. A site close to Spearfish Creek was sampled in 2014. Site 4 was created and sampled on June 2, 2015 about half way (1.6 miles) between Tinton Road and Spearfish Creek. Only one longnose dace was captured. In most years there is a loss zone between this area and Spearfish Creek, and trail crossings may also impede fish passage.

Site 3, immediately upstream of Iron Creek Lake, was sampled on May 28, 2015. Population estimates were 16 brook trout ≤200 mm and 34 rainbow trout. Only two of the rainbow trout were ≥200 mm, which is evidence for natural reproduction of fish stocked into Iron Creek Lake.

Deer Creek (DRK)

No fish were captured in Deer Creek during the survey on May 27, 2015.

Recommendations

1. Manage Spearfish Creek Watershed's tributaries as a Wild Fish: Natural Yield and Native Fish.

2. Survey Spearfish Creek Watershed's tributaries every five to seven years.

3. Complete stream surveys and inventory in other tributary streams in the Spearfish Watershed in 2016.

4. Complete an intense survey of Spearfish Creek within 3 years or when water flows allow.

Whitewood Creek Watershed

County: Lawrence

Four sites in Whitewood Creek and one site in Deadwood Creek were sampled within the Whitewood Creek Watershed in 2015. All other tributary creeks were surveyed in 2015. The Whitewood Creek watershed is located in the north central and eastern portions of the BHFMA and continues onto the prairie east of the Black Hills until it eventually reaches the Belle Fourche River near Vale, South Dakota. Size and harvest regulations within the Whitewood Creek watershed are the statewide regulations for trout which is a five fish (any combination) daily limit with only one over 14". Hatchery rainbow trout were last stocked in Whitewood Creek near Deadwood, SD in 2013. Stream flows of Whitewood Creek were high in 2015 with few days in May and June below 100 cfs. Flows reached 479 cfs near the end of May (USGS 2016).

Methods

Please refer above for methods, species abbreviations, and trout stream classifications.

Results and Discussion

Whitewood Creek (WWC)

Site 20 on Whitewood Creek was surveyed on Sept. 9, 2015. In a single pass, one longnose dace, shorthead redhorse and white sucker were captured. This is a difficult site to sample due to high conductivity, high flows, and high turbidity. Catch rates were likely low.

Site 19, upstream of Bighorn Road Bridge, was surveyed in Sept 22, 2015. Population estimates were 98 brown trout (Figure 3) with six ≥200 mm, 147 longnose dace, and three white suckers. Thirty-seven mountain suckers were also captured, but confidence intervals were too high to make an accurate population estimate. This meets a class two brown trout fishery with 26 per acre.

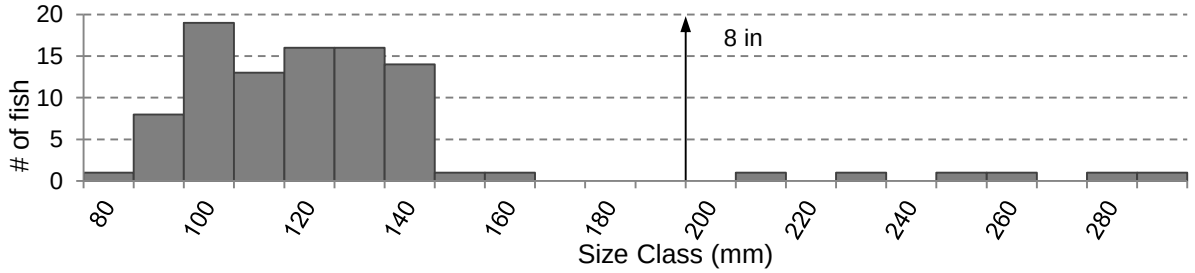

Figure 3. Length frequency histogram for brown trout surveyed at Whitewood Creek site 19 on Sept. 22, 2015.

Site 27, upstream of Crook City, was surveyed on Aug 10, 2015. Population estimates were eight brown trout with four ≥200 mm, 14 creek chub, one green sunfish, 1,256 longnose dace, 978 mountain sucker, and 39 white sucker.

Site 28, above Whitewood Valley Road, was surveyed on Sept. 21, 2015. Population estimates were 11 brown trout with five ≥200 mm, one creek chub, 254 mountain sucker, one white sucker, and 1,010 longnose dace.

Site 24, about one mile downstream of Englewood, was surveyed on June 8, 2015. Population estimates were 84 brook trout with five ≥200 mm (Figure 4), 63 brown trout with 25 ≥200 mm (Figure 5), and one longnose dace. This meets a class two brook trout fishery with 44 per acre and a class one brown trout fishery with 218 per acre. Length frequency histograms show a couple age class nodes for each species (Figures 4 and 5).

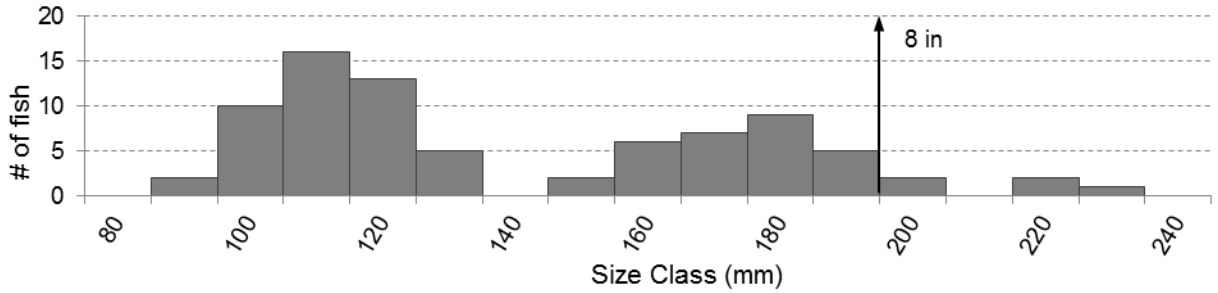

Figure 4. Length frequency histogram for brook trout surveyed at Whitewood Creek site 24 on June 8, 2015.

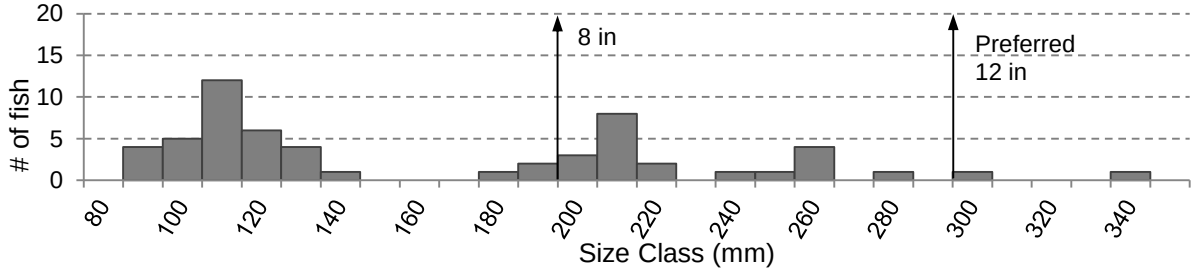

Figure 5. Length frequency histogram for brown trout surveyed at Whitewood Creek site 24 on June 8, 2015.

Deadwood Creek (DWC)

Site 5 on Deadwood Creek, upstream of Deadwood city limits, was surveyed on June 9, 2015. Population estimates were 145 brook trout with three ≥200 mm. The single pass survey in July 2008 yielded 44 brook trout with one ≥200 mm.

Recommendations

1. Continue to manage the Whitewood Creek Watershed under standard regulations as a Wild Fish: Natural Yield and Native Fish and monitor on a 5-7 year basis.

2. Continue to monitor mountain sucker populations in the Whitewood Creek Watershed

Bear Butte Creek Watershed

Counties: Lawrence and Meade

Five sites in Bear Butte Creek proper and two sites in Strawberry Creek were surveyed between May and September 2015. All other tributary creeks in the watershed were surveyed in 2014 to monitor fish populations. The Bear Butte Creek Watershed within the BHFMA is located along a southwest to northeast orientation between Englewood (south of Lead) and Sturgis (Figure 1). Bear Butte Creek's headwaters are located about four miles south of Lead and it flows north east where it drains into the Belle Fourche River about 22 miles east of Sturgis. The watershed is in a pine/spruce forest and managed by the US Forest Service. Historically, the Bear Butte Watershed played an important role in the gold mining activities. Several small gold mines are located within the watershed with the Gilt Edge Mine, a Superfund Site, located on the Strawberry Creek drainage (EPA Region 8). The Bear Butte Watershed is largely undeveloped aside from the towns of Sturgis and Galena and several campsites and tourist facilities along Hwy 385. Recently, this watershed has seen increased human development with a few golf courses and housing developments added. Bear Butte Creek in Meade County was last stocked with catchable Rainbow Trout in 2006, but upper reaches within the BHFMA have not been stocked since 1989. Bear Butte Creek and its tributaries are currently managed under standard regulations with a daily limit of five trout (in any combination) with one 14 inches or longer allowed.

Most of western South Dakota experienced moderate to severe drought from 2002 to 2008 (US Drought Monitor 2014). However, in 2008-2014 average and above average moisture brought relief from the prolonged drought. Bear Butte Creek's 15-year mean flow at the USGS gauging station near Galena for May and June is 29 and 18 CFS respectively (USGS 2016).

Methods

Please refer above for methods, species abbreviations, and trout stream classifications.

Results and Discussion

Six species of fish were captured in the Bear Butte Creek Watershed during 2015 sampling (Tables 6 and 7). The most abundant species in the watershed was brook trout (Table 6). Brook trout and longnose dace were collected in all sites.

Table 6. Population estimates of brook trout in 100 meter survey sites of Bear Butte Creek during 2015 surveys. Sites are in order from furthest downstream to upstream. Confidence interval (95%) is reported in parenthesis.

Creek Name/ Site #	BKT <200 mm	BKT ≥200 mm	≥200 mm/ Acre	BKT Class
Bear Butte\810	169 (6)	73 (1)	699	BKT1
Bear Butte\813 June	32 (5)	2 (1)	29	BKT2
Bear Butte\813 Oct	149 (5)	33 (1)		
Bear Butte\833	243 (6)	41 (1)	423	BKT1
Bear Butte\904	21 (4)	8 (2)	100	BKT2
Bear Butte\16	32 (5)	2 (1)	29	BKT2
Strawberry\02	36 (4)			
Strawberry\03	43 (9)	3	63	BKT2

*single pass site, value is total fish captured

Table 7. Population estimates of non-trout species in 100 meter survey sites of creeks within the Bear Butte Creek Watershed during 2014 surveys. Streams are in order from furthest downstream to upstream. Confidence interval (95%) is reported in parenthesis.

Creek Name/Site #	LND	WHS	MTS	ROB	BLC
Bear Butte\810	14 (7)		1 (4)		
Bear Butte\813 June	27 (2)	2 (1)			
Bear Butte\813 Oct	8#				
Bear Butte\833	6 (7)			1 (4)	
Bear Butte\904	52 (4)	4 (1)	4 (1)		5
Bear Butte\16	27 (2)	2 (1)			
Strawberry\02	4				

*single pass site, value is total fish captured

Bear Butte Creek (BBC)

Site 810 was surveyed on October 7, 2015. Population estimates were 241 brook trout with 73 ≥200 mm, 14 longnose dace and one mountain sucker (table7). This equates to 699 fish per acre ≥200 mm, meeting a class 1 fishery, however, surveys in October would likely be influenced by fall spawning movements of trout and should not be used in determining fishery classifications.

Site 813 was surveyed twice in 2015. The first survey was done on June 9 with a population estimate of 34 brook trout with two ≥200 mm, 27 longnose dace, and two white sucker. The second survey on October 7 yielded a population estimate of 182 brook trout with 33 fish ≥200 mm. Eight longnose dace were also captured. The increase in brook trout at this site in October is likely evidence of spawning movements and data from this date should not be used to determine fishery classification.

Site 833 was surveyed on October 2, 2015. Population estimates were 285 brook trout with 41 fish ≥200 mm, six longnose dace, and one rock bass (Tables 1 and 2).

Site 904 was surveyed on June 9, 2015. Population estimates were 30 brook trout with eight fish ≥200 mm, five black crappie, 52 longnose dace, four mountain sucker, and 4 white sucker (Tables 1 and 2).

Site 16 of Bear Butte Creek, upstream of Hwy 385, was sampled on June 6, 2015. Population estimates were 34 brook trout with two fish ≥200 mm, 27 longnose dace, and two white sucker. A single pass survey of this site in 2010 yielded 38 brook trout with one ≥200 mm and two mountain sucker (Tables 1 and 2).

Strawberry Creek (STB)

Site two of Strawberry Creek was surveyed on June 29, 2015. Population estimates were 36 brook trout <200 mm and four longnose dace. A single pass survey of this site in July 2010 yielded 46 brook trout with one ≥200 mm (Tables 1 and 2). The survey in Sept 2007 yielded a population estimate of 102 brook trout <200 mm.

Site three of Strawberry Creek also surveyed in June 29, 2015. Population estimates were 45 brook trout with three ≥200 mm (Tables 1 & 2). A single pass survey of this site in July 2010

yielded 61 brook trout with 6 ≥200 mm. The September 2007 survey had a population estimate of 18 brook trout <200 mm.

Recommendations

1. Continue to manage the Bear Butte Creek watershed under standard trout regulations as a Wild Fish: Natural Yield and Native Fish and monitor on a 3-5 year basis.

Boxelder Creek Watershed

Counties: Lawrence, Meade, and Pennington

Two sites in the Box Elder Creek Watershed within the Black Hills Fish Management Area were surveyed during June and July 2015 to monitor fish populations and as part of a research project on mountain sucker. All other tributaries in the watershed were surveyed during 2014. The Box Elder Creek Watershed lies between Elk Creek and Rapid Creek Watersheds. The headwaters of Box Elder Creek's forks lie west of Custer Crossing off of highway 385. The creek flows east north of Rapid City and drains into the Cheyenne River south of Wasta, SD. The Box Elder Creek Watershed is in a pine/spruce forest and managed by the US Forest Service. As with the rest of the Black Hills, many forest service roads cut through the watershed with a few houses and ranches present. Sections of Box Elder Creek, Roubaix Lake on Middle Box Elder Creek, and Reausaw Lake on Hay Creek are currently stocked with catchable rainbow trout. Box Elder Creek and its tributaries are managed under standard regulations with a daily limit of five trout (in any combination) with one allowed 14 inches or longer.

Boxelder Creek experienced high flows in 2015, especially during the months of May and June when flows exceeded 414 cubic feet per second (USGS 2016).

Methods

Please refer above for methods, species abbreviations, and trout stream classifications.

Results and Discussion

Boxelder Creek South Fork (BXS)
Site two on Boxelder Creek South Fork was surveyed in Sept. 10. 2015. Population estimates were 131 brook trout with 14 ≥200 mm and 40 longnose dace. Surveys in September could be effected by fall spawning movements and should not be used to determine fishery classification. That being said, this survey yielded a density of 405 brook trout per acre ≥200 mm, meeting a class 1 brook trout classification.

Hay Creek (HAY)
Site 1 on Hay Creek was surveyed on May 13, 2015. Population estimates were 30 brook trout with three ≥200 mm, and four longnose dace. A single pass survey of this site in June 2010 yielded 18 brook trout with two ≥200 mm, and one brown trout <200 mm.

Recommendations

1. Manage Boxelder Creek Watershed's tributaries as Wild Fish: Natural Yield and Native Fish.

2. Survey Boxelder Creek Watershed's tributaries every five to seven years.

3. Continue to monitor mountain sucker populations within Boxelder Creek.

4. Perform an intense three-pass survey on Boxelder Creek within five years.

Spring Creek Watershed

Counties: Pennington

Fish populations in the Spring Creek Watershed within the BHFMA were surveyed during June through September 2015 to monitor fish populations. The Spring Creek Watershed lies between Rapid Creek and Battle Creek Watersheds. The headwaters of Spring Creek lie about eleven miles west of Hill City and the creek flows east through Hill City and enters Sheridan Lake approximately 4.5 miles (7.2 km) east north east (discharge in the Spring Creek headwaters can be found in table 8). After exiting Sheridan Lake, Spring Creek flows east until it drains into the Cheyenne River southwest of Wasta. The creek does experience a loss zone (where flow is lost to underlying geology) near Hwy 79 north of Hermosa and is intermittent from the town of Rockerville downstream most years. The Spring Creek Watershed within the BHFMA is in a pine/spruce forest and managed by the US Forest Service. As with the rest of the Black Hills, many forest service roads cut through the watershed with a few houses and ranches present. Sections of Spring Creek as well as Newton Fork Dam, Sheridan, Sylvan, Sunday Gulch, Mitchell, and Major Lakes are all currently stocked with rainbow trout. Spring Creek and its tributaries are managed under standard regulations with a daily limit of five trout (in any combination) with one allowed 14 inches or longer.

Table 8. Spring Creek's monthly mean flow at the USGS gauging station near Keystone, South Dakota, January 2000 to September 2015.

	Monthly mean stream flow (ft^3/s)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	9	11	15	31	47	23	13	4	2	6	8	6
2001	5	5	11	22	20	28	32	14	8	7	6	4
2002	3	3	6	17	22	11	3	2	5	4	4	3
2003	2	4	13	15	42	25	7	3	2	2	3	2
2004	2	3	8	6	5	2	1	0	0	0	0	0
2005	0	2	3	5	9	9	2	2	0	0	0	0
2006	1	1	6	11	8	7	1	0	0	0	0	0
2007	0	0	5	7	11	4	0	0	0	0	0	0
2008	0	0	1	6	35	51	34	14	7	5	4	3
2009	3	6	10	34	44	31	21	9	5	8	9	6
2010	6	5	10	35	154	128	60	25	12	10	9	7
2011	8	8	14	17	93	128	45	20	13	11	9	8
2012	6	5	11	10	10	10	6	2	0	0	2	2
2013	3	2	3	9	12	7	3	13	5	62	32	16
2014	12	9	16	25	45	87	77	31	21	44	21	16
2015	13	12	10	12	206	434	177	68	30			
Mean	5	5	9	16	48	62	30	13	7	11	7	5

Methods

Please refer above for methods, species abbreviations, and trout stream classifications.

Sample Locations

During this study, efforts were made to check all drainages for presence of water. Reaches were sampled if they had enough flowing water to sample with two reaches attempted per creek. Sampled creeks in the Spring Creek Watershed included: Spring Creek, Horse Creek, China Gulch, Newton Fork Creek, Marshall Gulch, Patterson Creek, Reno Gulch, Sunday Gulch, Tenderfoot Creek, Vonderlehr Creek, Loues Creek, Coon Creek, Negro Creek, Palmer Gulch, and Willow Creek.

Results and Discussion

Eleven species of fish were captured in the Spring Creek watershed during 2015 sampling (Tables 9 and 10). Spring Creek itself excluded, the most abundant and wide spread species in the watershed was brook trout (table 9) followed by longnose dace (table 10), which is reversed from the 2009 survey. In Spring Creek, creek chub and white sucker were the most abundant species.

Table 9. Spring Creek Watershed brook trout population estimates and estimated number of fish per acre within each site sampled in 2015. Streams are in order from furthest downstream to upstream. Confidence interval (95%) is reported in parenthesis.

Creek Name/Site #	BKT <200 mm	BKT ≥200 mm	≥200 mm /acre	BKT class
Spring/07		1	9	BKT3
Spring/04	114(5)	13(0)	187	BKT1
Horse/02				
Horse/01				
Palmer Gulch/02	50(6)	5(0)	169	BKT1
Palmer Gulch/01	23(4)	4(0)	62	BKT2
Willow/01	211(810)	7(2)	129	BKT2
China Gulch/01	1			BKT3
Newton Fork/02	62(1)	10(0)	137	BKT2
Newton Fork/03	7(0)	6(0)		
Marshall Gulch/02	206(7)	12(0)	242	BKT1
Marshall Gulch/01	54(6)	4(0)	48	BKT2
Patterson/02	89	13	240	BKT1
Patterson/01	No fish			
Reno Gulch/01	No fish			
Sunday Gulch/01	34(2)	8(0)	196	BKT1
Sunday Gulch/02	74(3)	2(0)	55	BKT2
Tenderfoot/01	4(0)	2(0)	-	BKT3
Vonderlehr/01				
Loues/01				
Negro/01	147(2)	9(1)	409	BKT1
Coon/01	56(2)	9(0)	288	BKT1

*single pass site, value is total fish captured

Table 10. Population estimates of brown trout, rainbow trout and non-trout species in 100 meter sample reaches of tributary creeks within the Spring Creek Watershed during 2015 surveys. Streams are in order from furthest downstream to upstream. Upper confidence interval (95%) is reported in parenthesis.

	BNT ≥200 mm	RBT ≥200 mm	LND	WHS	MTS	CRC	FHM	GOS	BRS	ROB
Spring/SPR10		19(1)		235(4)		458(7)		1(0)		
Spring/SPR07	3(1)	4(0)				25(1)				8(2)
Spring/SPR04			5(19)							
Horse/02		6(0)				1(0)				11(0)
Horse/01			32(285)		3(1)					
Palmer Gulch/02		1(0)	23(59)			15(1)				
Palmer Gulch/01				12(2)						
Marshall Gulch/02			8(34)							
Marshall Gulch/01			8(34)							
Newton Fork/02			65(3)				11			
Newton Fork/03							1			
Sunday Gulch/01			40(340)							
Loues/01*									1	

*single pass site, value is total fish captured

Spring Creek (SPR)

During the 2015 survey, three historically sampled sites on Spring Creek were surveyed. Site 10, the eastern most intersection of Spring Creek and Sheridan Lake road, was surveyed on May 12th, prior to the increased moisture and flows that started around May 15th. During the survey population estimates were 19 rainbow trout ≥200 mm for a density of 58 per acre. Also, 458 creek chub, eight rock bass, one golden shiner, and 235 white sucker. This area is stocked two to four times annually with catchable (~11 in) rainbow trout. In Aug 2009, 34 creek chub and five white sucker were surveyed in one pass. Surveys in 1997-2002 yielded brown trout, hatchery brown and rainbow trout, longnose dace, creek chub, golden shiner, largemouth bass, rock bass, and white sucker.

At the survey of site 7, upstream from Sheridan Reservoir, on Oct 14, 2015, five species were detected. Population estimates were one brook trout, three brown trout, and four rainbow trout all over 200 mm. Eight rock bass and 25 creek chub were also surveyed. A July 2009 single pass survey found 69 creek chub, 101 longnose dace and 14 white sucker. In Sept 1993, additional species were found including fathead minnow and mountain sucker along with the hatchery rainbow and brown trout, longnose dace, and creek chub.

During the Sept 29 survey of Spring Creek site 4 on the South Dakota Game, Fish and Parks Game Production Area south of Hill City, brook trout and longnose dace were captured. Population estimates were 127 brook trout with 13 ≥200 mm and five longnose dace. In July 2009, 32 brook trout with one ≥200 mm, one brown trout ≥200 mm, and 22 longnose dace were captured in one pass. It should be noted that caution should be used comparing this year's September sample to the July sample. It is likely that trout have begun spawning movements and populations could be different than during summer baseline flows.

Horse Creek (HOC)

In Horse Creek site 1 surveyed on June 17, 2015 longnose dace and mountain sucker were captured with population estimates of 32 and three, respectively. It should be noted that during the survey flows were still high and visibility was low, therefore some fish may have been missed and the confidence interval for longnose dace was over 250. During the May 2009 survey of this site, four longnose dace were captured in a single pass.

Site 2, above Sheridan Lake, was surveyed in Aug 24, 2015. Population estimates were one creek chub, 33 longnose dace, 11 rock bass and six rainbow trout. All of the rainbow trout were over 380 mm (15 in), and likely from those stocked into Sheridan Lake. The May 2009 survey of site 2 only detected longnose dace. A June 1998 survey of site 2 yielded 25 brook trout and 45 longnose dace four rainbow trout <200 mm, 12 mountain suckers, and two fathead minnows.

Palmer Gulch (PAG)

Site 2 on Palmer Gulch was created and surveyed on Sept 10, 2015. Population estimates were 55 brook trout with five ≥200 mm, 15 creek chub, 23 longnose dace, and one rainbow trout ≥200 mm. It is likely that the rainbow trout came from Palmer Gulch KOA's stocked pond downstream.

Site 1, at Willow Creek Horse Camp, was sampled on June 22, 2015. Twelve white sucker and 27 brook trout were estimated in the site with four of the brook trout ≥200 mm. In May 2009, 14 white suckers and 1 longnose dace were captured in a single pass.

Willow Creek (WCP)

Willow Creek, also in the Willow Creek Horse Camp, was surveyed on June 24, 2015. Fifty three brook trout were surveyed in three passes, but depletion was not attained for fish <200 mm, so a population estimate for these is not valid. However, the population estimate for fish ≥200 mm was seven.

China Gulch (CHI)

China Gulch was surveyed for the first time on June 16, 2015 with one brook trout <200 mm captured.

Newton Fork Creek (NFC)

Newton Fork Creek site 2, below Newton Fork Reservoir, was sampled on Aug 13, 2015. Sixty-two brook trout <200 mm, 10 brook trout ≥200 mm, 11 fat head minnow, and 65 longnose dace were estimated in the site. Site 1 was not sampled due to access through private property, but in 2009, brook trout, rainbow trout and longnose dace were captured.

Site 3, above Newton Fork Reservoir, was also surveyed on Aug 13 with 1 fathead minnow and 13 brook trout collected. Six of the brook trout were ≥200 mm.

Marshall Gulch (MAG)

Marshall Gulch was surveyed for the first time in 2015. Site 2, below Marshall Gulch Dam had a population estimate of 217 brook trout with 12 of them ≥200 mm on Aug 24, 2015 (Figure 6). This is 242 per acre, meeting a class 1 fishery.

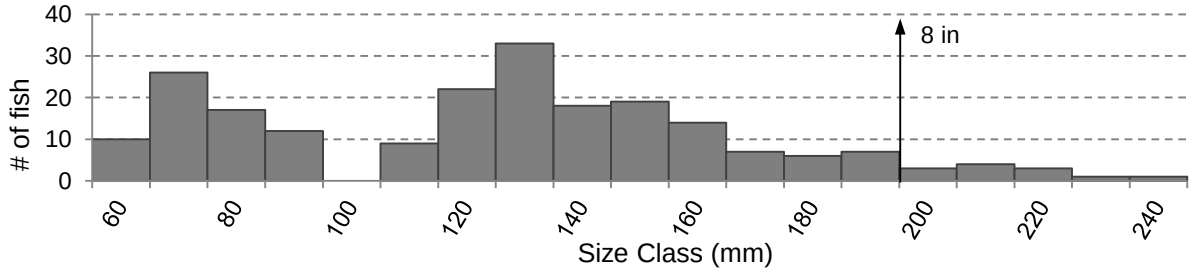

Figure 6. Length frequency histogram of brook trout captured during electrofishing survey of Marshall Gulch site 2 on Aug 24, 2015.

Site 1, above Marshall Gulch Dam, was surveyed June 17, 2015 and had a population estimate of 58 brook trout. Four of these were ≥200 mm with one greater than 14 inches (Figure 7). It is possible that there is a good population of brook trout in the dam below, but it has never been sampled by SDGFP.

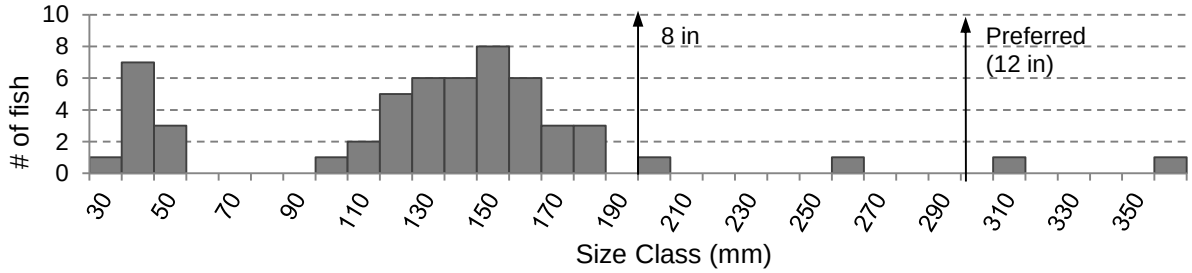

Figure 7. Length frequency histogram of brook trout captured during electrofishing survey of Marshall Gulch site 1 on June 17, 2015.

Patterson Creek (PAT)

Patterson Creek was surveyed for the first time in 2015. Site 2, about 1 mile upstream from Newton Fork Creek, was sampled on Sept 10, 2015. Population estimates were three fathead minnow, two longnose dace and 101 brook trout with 13 ≥200 mm (Figure 8). This meets a class 1 brook trout fishery with 240 ≥200 mm per acre.

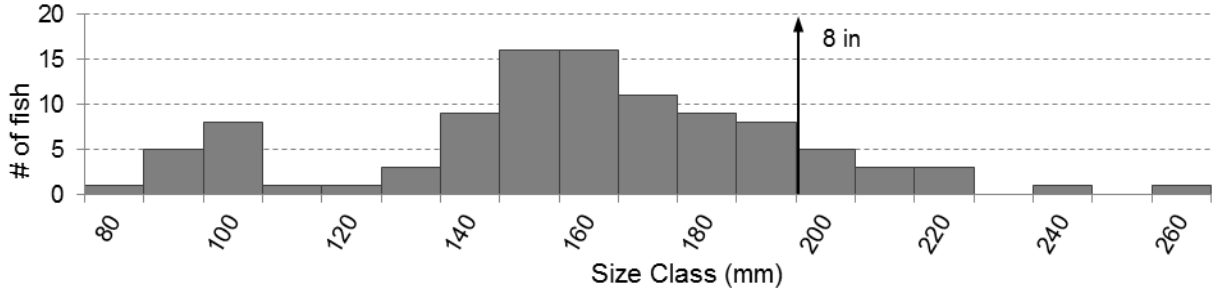

Figure 8. Length frequency histogram of brook trout captured during electrofishing survey of Patterson Gulch site 2 on Sept 10, 2015.

Site 1 on Patterson Creek, west of Hill City about 2.5 miles south of Deerfield Road, was sampled on June 16, 2015 with no fish were captured. This site was visited again in September and was dry.

Reno Gulch (REG)

Reno Gulch was surveyed for the first time on June 1, 2015. No fish were detected.

Sunday Gulch (SUN)

A July 13, 2015 survey of Sunday Gulch site 1 yielded a population estimate of 34 brook trout < 200 mm, 8 ≥200 mm, and 40 longnose dace. This meets the qualification for a class 1 brook trout fishery with 196 ≥200 mm per acre. A May 2009 survey of this site yielded no fish. A June 2004 survey yielded 163 brook trout and three longnose dace and a June 1993 survey yielded 20 brook trout, 13 white sucker, and 11 longnose dace.

Sunday Gulch Site 2, further upstream, was sampled on July 14, 2015. Population estimates for brook trout were 74 less than and two greater than 200 mm.

Tenderfoot Creek (TFC)

At Tenderfoot Creek on Aug 20, 2015, six brook trout were surveyed with two ≥200 mm. No fish were detected in May 2009. A June 1993 survey detected 13 brook trout less than 200 mm.

Vonderlehr Creek (VON)

Vonderlehr Creek site 2, surveyed on July 13, 2015 had a population estimate of 27 brook trout with five ≥200 mm. In June 2009, three brook trout <200 mm were sampled.

Negro (Medicine Mountain) Creek (NEG)

Negro Creek was surveyed for the first time on September 28, 2015 (Table 2). Brook trout were estimated with a population of 147 fish <200 mm and nine fish ≥200 mm. It should be noted that this survey in late September could likely be affected by fall spawning movements. That being said, this site met a class one fishery with 409 brook trout ≥200 mm per acre.

Coon Creek (CNC)

Coon Creek, a tributary of Negro Creek, was surveyed for the first time on September 28, 2015. Population estimates for brook trout were 56 under 200 mm and nine over 200 mm. Similar to Negro Creek, this late September survey could have been affected by fall spawning movements.

Recommendations

5. Manage Spring Creek Watershed's tributaries as a Wild Fish: Natural Yield and Native Fish.

6. Manage Spring Creek below Sheridan Reservoir as Hatchery Supplemented: Seasonal

7. Survey Spring Creek Watershed's tributaries every five to seven years.

8. Perform an intense three-pass survey on Spring Creek within three years and every five years.

Battle Creek Watershed

Counties: Pennington

Fish populations in the Battle Creek Watershed within the BHFMA were surveyed during May through August 2015 to monitor fish populations. The Battle Creek Watershed lies between the Spring Creek and French Creek Watersheds with the headwaters of Battle Creek west of Keystone, with and flows peaking in May (table 11). It runs east through the BHFMA until passing through the south end of Hermosa. The Battle Creek Watershed within the BHFMA is in a pine/spruce forest and managed by the US Forest Service except the southern tributaries which lie in Custer State Park. As with the rest of the Black Hills, many forest service roads cut through the watershed with a few houses and ranches present. The main stem of Battle Creek was last stocked with 100 fingerling brown trout in 2008. Sections of Grace Coolidge Creek as well as Lakota Lake, Horsethief Lake, Center Lake, and Legion Lake are all currently stocked with catchable rainbow trout. Lakota Lake was also stocked with 50 adult black crappie in May 2015 and Center Lake was stocked with fingerling tiger trout in 2008 and 2009, which anglers still sometimes catch. Battle Creek and its tributaries are managed under standard regulations with a daily limit of five trout (in any combination) with one allowed 14 inches or longer. Above average moisture in the spring of 2015 caused record flows in Battle Creek. This made sampling difficult to impossible at times and affected in-stream habitat. Fish communities were likely impacted by this as well, especially where culverts washed out and large influxes of sediment entered the stream.

Table 11. Battle Creek's monthly mean flow at the USGS gauging station near Keystone Jan 2000 to Sept 2015.

	Monthly mean stream flow ($ft^3/2$)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	3	5	5	20	25	11	5	1	0	1	3	2
2001	2	2	7	15	11	16	23	7	2	3	3	2
2002	1	1	1	7	12	4	1	0	1	1	2	1
2003	1	1	6	8	23	8	1	0	0	0	1	1
2004	0	1	3	2	2	2	1	0	1	0	1	0
2005	0	1	1	3	8	6	6	2	0	1	1	0
2006	1	1	3	6	5	6	0	0	1	0	1	0
2007	0	0	2	4	7	2	0	0	0	0	0	0
2008	0	0	1	3	43	26	9	3	1	1	2	2
2009	2	2	5	25	25	24	15	6	3	4	4	2
2010	2	2	4	23	108	50	16	5	2	2	2	2
2011	2	2	5	7	76	44	15	5	2	2	2	2
2012	2	1	3	3	4	3	2	0	0	0	0	0
2013	0	1	1	4	5	2	1	17	4	58	11	4
2014	3	2	5	8	13	44	21	8	11	28	7	4
2015	5	3	2	4	125	167	41	17	9			
Mean	2	2	3	9	31	26	10	5	2	7	3	2

Methods

Please refer above for methods, species abbreviations, and trout stream classifications.

Sample Locations

During this study, efforts were made to check all drainages for presence of water. Reaches were sampled if they had enough flowing water to sample with two reaches attempted per creek. Sampled creeks in the Battle Creek Watershed included: Battle Creek, Grace Coolidge Creek, Spokane Creek, Bear Gulch, Galena Creek, Badger Clark Creek, Foster Gulch, Tepee Gulch, Grizzly Bear Creek, Lafferty Gulch and Pine Creek (Table 12).

Results and Discussion

Six species of fish were captured in the Battle Creek watershed during 2015 sampling (Table 13). The most abundant and widespread species was brook trout. This is a change from in 2009 when the most abundant species were longnose dace and creek chub.

Table 12. Battle Creek Watershed brook trout population estimates and estimated number of fish per acre within each site sampled in 2015. Streams are in order from furthest downstream to upstream. Confidence interval (95%) is reported in parenthesis.

Creek Name/Site #	BKT <200 mm	BKT ≥200 mm	≥200 mm /acre	BKT class
Battle Cr./05	10	5	30	BKT2
Grace Coolidge Cr./02	25	16	132	BKT2
Grace Coolidge Cr./03	78	8	92	BKT2
Spokane Cr./02*				
Spokane Cr./03*	35			BKT3
Bear Gulch/02*	54			BKT3
Galena Cr./01*	96			BKT3
Galena Cr./02*	No fish			
Badger Clark Cr./02	46	6	130	BKT2
Badger Clark Cr./01*	6			BKT3
Foster Gulch/01	No fish			
Tepee Gulch/01	No fish			
Grizzly Bear Cr./02	50 (1)	18	223	BKT1
Grizzly Bear Cr./01	139 (1)	17	171	BKT1
Lafferty Gulch/01	168 (4)	5	145	BKT2
Pine Creek/01		2		BKT2
Pine Creek/02	No fish			

*single pass site, value is total fish captured

Table 13. Battle Creek Watershed population estimates of fish species other than brook trout within each reach site surveyed in 2015. Streams are in order from furthest downstream to upstream. Upper confidence interval (95%) is reported in parenthesis.

	BNT ≥200 mm	RBT <200 mm	RBT ≥200 mm	LND	WHS	CRC
Battle Cr./05	1			69 (1)	85 (6)	174 (9)
Grace Coolidge/02		1 (1)	6 (2)	269 (71)	25 (1)	39 (14)
Grace Coolidge/03		40 (5)				
Spokane Cr./02*				40		
Grizzly Bear/02				71 (5)	68 (1)	59 (2)
Grizzly Bear/01				24		
Lafferty Gulch/01						1 (1)
Pine Creek/01			3			

*single pass site, value is total fish captured

Battle Creek (BAT)

On August 11, 2015 site 5 on Battle Creek was sampled. Population estimates were 15 brook trout with 5 ≥200 mm, one brown trout ≥200 mm, 174 creek chub, 69 longnose dace, and 85 white sucker. A survey of this site in June 2009 yielded one brown trout <200 mm, 194 creek chubs, 34 fathead minnows, 68 longnose dace, and 49 white suckers.

Grace Coolidge Creek (GCC)

Grace Coolidge Creek was sampled at the lower Grace Coolidge Campground (site 2), on July 16, 2015. The population estimate for brook trout was 421 with 16 of them ≥200 mm. Seven rainbow trout were surveyed with six of them ≥200 mm. These are likely from stockings in the walk-in-fishery up stream. Longnose dace, white suckers, and creek chubs were also captured with population estimates of 269, 25, and 39 respectively. During the 2009 survey, 16 brook trout with five ≥200 mm, 65 creek chubs, 93 longnose dace, and 20 white sucker were captured in a single pass.

A survey of site 3 on July 2, 2015 yielded a population estimate of 86 brook trout with eight ≥200 mm, and 40 rainbow trout <200 mm. The rainbow trout indicate natural reproduction that is likely occurring from those stocked into Center Lake below this site. In May 2009, 19 brook trout under 200 mm, and five rainbow trout four of which were over 200 mm were captured in a single pass.

Spokane Creek (SPO)

Forty longnose dace were captured at site 2 of Spokane Creek on July 1, 2015. No fish were surveyed in May 2009 or in June 1994.
Site 3 was created and surveyed on July 8, 2015 with 35 brook trout <200 mm in a single pass.

Bear Gulch (BEG)

The survey of Bear Gulch site 2 on July 16, 2015 yielded 54 brook trout <200 mm. This site had not been surveyed in the past.

Galena Creek (GAC)

Galena Creek site 1 was sampled on July 8, 2015, yielding 96 brook trout <200 mm. A May 2009 survey found nine creek chub, seven brook trout <200 mm and one brook trout ≥200 mm. Site 2 yielded no fish in July 2015 and May 2009. In 1994, 45 brook trout under and seven over 200 mm were detected along with 37 creek chub, 32 white sucker, and 292 longnose dace.

Badger Clark Creek (LSQ)

Sites 1 and 2 of Badger Clark Creek, formerly Little Squaw Creek, were surveyed on June 30, 2015. Site 2 had a population estimate of 46 brook trout <200 mm and six ≥200 mm. This site met a class 2 brook trout fishery with 130 fish ≥200 mm per acre. The survey of site 1 yielded six brook trout <200 mm. The May 2009 and the June 1994 surveys of site 1 both yielded no fish.

Foster Gulch (FOS)

No fish were detected during the June 25, 2015, May 2009 or the July 1994 surveys of Foster Gulch site 1.

Teepee Gulch (TPG)

No fish were detected during the May 20, 2015 or May 14, 2009 surveys of Teepee Gulch site 1. This site was surveyed in June 1994 where 104 brook trout were sampled, with seven over 200 mm.

Grizzly Bear Creek (GBC)

Site 2 was created and surveyed on Grizzly Bear Creek within the city of Keystone on Aug 18, 2015. The population estimate of brook trout was 68 with 18 fish ≥200 mm. Eight of those fish were over 255 mm (10 inches). Creek chub, longnose dace, and white sucker were also surveyed with population estimates of 59, 71, and 68 respectively. This site met a class 1 brook trout designation with 223 fish ≥200 mm per acre.

Site 1, at the Grizzly Bear Campground, was sampled on Aug. 4, 2015 with a population estimate of 139 brook trout <200 mm, 17 brook trout ≥200 mm and 24 longnose dace. This site also met a class 1 brook trout designation with 171 fish ≥200 mm per acre. The survey in May 2009 yielded six brook trout <200 mm, six creek chub, and 16 longnose dace captured.

Lafferty Gulch (LAF)

Lafferty Gulch, west of Keystone, was surveyed for the first time on Jul 6, 2015. Population estimates were 173 brook trout with five fish ≥200 mm and one creek chub

Pine Creek (PIN)

Two sites were surveyed in Pine Creek during the 2015 survey. Site 1, yielded two brook trout ≥200 mm and three rainbow trout ≥300 mm. It is likely that these are a result of the stocked pond of a church camp at this site. In May 2009 no fish were detected.

Site 2, above Horsethief Lake, was surveyed on Aug 4, 2015 with no fish detected. This site is above a series of waterfalls and the creek was mostly dry in 2015 prior to May.

Recommendations

1. Manage Battle Creek Watershed's tributaries as a Wild Fish: Natural Yield and Native Fish.

2. Survey Battle Creek Watershed's tributaries every five to seven years.

Rapid Creek Watershed

Counties: Pennington and Lawrence

Fish populations in Rapid Creek and its tributaries were surveyed during 2015 as a part of a research project studying mountain sucker. Most other tributary creeks were sampled in 2014. The Rapid Creek Watershed begins at the headwaters of the north and south forks of Rapid Creek, northwest of Rochford and at the north and south fork of Castle Creek west of Deerfield Lake (Figure 1). Castle Creek runs through Deerfield Lake and enters Rapid Creek near Mystic. Rapid Creek runs east through Pactola Reservoir and Canyon Lake before entering the Cheyenne River about 13 miles east of Farmingdale. A majority of the Rapid Creek Watershed is located in a pine/spruce forest which is managed by the US Forest Service. This Watershed is also the most populated watershed in the Black Hills and due to its proximity to Rapid City, and serves as the main source of water for this population. Currently, more fish are stocked in the Rapid Creek Watershed than any other watershed. A few sections of Rapid Creek and Castle Creek are stocked with rainbow trout. Additionally, Deerfield Lake, Pactola Reservoir, Canyon Lake, and several small bodies of water within the town of Rapid City are also stocked with rainbow trout.

The majority of Rapid Creek and its tributaries are managed under standard regulations with a daily limit of five trout (in any combination) with one allowed 14 inches or longer. Two sections of Rapid Creek are managed under catch-and-release regulations where the harvest of fish and possession of organic bait within 100 feet of the stream are prohibited. The section of stream from Pactola Dam downstream two miles to the Placerville foot bridge has been managed under catch-and-release regulations since 1991. Also, the section of stream from Park Drive to Jackson Boulevard in the town of Rapid City has been managed under catch-and-release regulations since 2006.

Rapid Creek, itself, was not sampled in 2015 due to very high water flows (90-660 cfs) all summer (USGS 2016). Rapid Creek's 30-year mean flow at the USGS gauging station above Pactola for May and June is 119 and 126 cubic feet per second (cfs) respectively (Table 14). Average flows in May and June 2015 were 311 and 508 cfs respectively. Flows were over 300 cfs until mid-July and didn't get below 70 cfs until mid-September. These flows would cause a hazard to crew members and result in inadequate data collection.

Table 14. Rapid Creek's monthly mean flow at the USGS gauging station above Pactola Reservoir Jan 2000 to Sept 2015.

	Monthly mean in ft3/s											
YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	52	64	63	88	116	77	60	46	38	40	34	36
2001	42	47	52	78	60	47	57	38	30	34	35	27
2002	23	30	32	67	53	38	26	25	30	28	20	19
2003	20	23	45	47	101	74	37	26	25	23	25	21
2004	18	19	32	40	29	22	21	18	20	21	18	15
2005	16	16	20	26	29	26	18	18	16	21	21	19
2006	23	22	34	51	62	41	25	20	21	19	22	19
2007	17	19	26	31	40	55	27	22	20	20	21	25
2008	18	19	23	41	107	126	151	47	33	34	38	27
2009	23	25	60	146	125	70	48	37	34	37	32	31
2010	31	30	45	73	216	178	102	71	44	34	30	38
2011	37	33	42	66	274	282	101	63	50	51	42	41
2012	46	37	48	62	60	40	27	26	26	30	31	30
2013	36	32	40	48	59	62	38	44	39	142	93	63
2014	59	46	67	142	204	140	99	85	69	82	62	56
2015	58	53	63	67	311	508	301	119	68			
Mean	32	32	43	67	115	112	71	44	35	41	35	31

Methods

Please refer above for methods, species abbreviations, and trout stream classifications.

Sample Locations

Five sites in the Rapid Creek Watershed were sampled in 2015 for a research project on mountain sucker populations. Two sites were sampled in Castle Creek, one site each in Rapid Creek North, Slate Creek, and Swede Gulch. One site was also sampled in Skull Creek as a precursor to possible mining operations.

Results and Discussion

Seven species of fish were captured in the Rapid Creek Watershed during 2015 sampling (Table 15, 16 and 17). The most abundant and widespread species surveyed was brook trout.

Table 15. Population estimates of brook trout in 100 meter sample reaches of tributary creeks of the Rapid Creek Watershed during 2015 surveys. Streams are in order from furthest downstream to upstream. Confidence interval (95%) is reported in parenthesis.

Creek Name/Site #	BKT <200 mm	BKT ≥200 mm	≥200 mm /acre	BKT class
Slate\2	201 (5)	21	348	
Skull\1	3	2	83	BKT2
Rapid North\3	20	4	57	BKT2
Swede\3	55 (1)	4	81	BKT2

*single pass site, value is total fish captured

Table 16. Population estimates, density, and stream class of brown trout in 100 meter sample reaches of tributary creeks within the upper portion of the Rapid Creek Watershed during 2015 surveys. Streams are in order from furthest downstream to upstream. Upper confidence interval (95%) is reported in parenthesis.

Creek Name/Site #	BNT <200 mm	BNT ≥200 mm	≥200 mm /acre	BNT class
Castle\153	39 (3)	11 (1)	113	BNT2
Castle\181	21 (4)	5 (1)	36	BNT2
Rapid North\3	37 (1)	8	114	BNT2
Swede\3	19	3 (1)	60	BNT2

*single pass site, value is total fish captured

Table 17. Population estimates of rainbow trout and non-trout species in 100 meter sample reaches of tributary creeks within the Rapid Creek Watershed during 2014 surveys. Streams are in order from furthest downstream to upstream. Upper confidence interval (95%) is reported in parenthesis.

	RBT ≥200 mm	LND	WHS	MTS	LMB
Slate\02	1	23 (2)	10 (5)		
Castle\153		3			
Rapid North\3			1	14 (11)	3[#]
Swede\3		18[#]		3 (2)	

*single pass site, value is total fish captured
[#]high confidence interval. Number is total surveyed

Slate (SLC)

Site two on Slate Creek was sampled on August 4, 2015. The brook trout population estimate was 222 fish with 21 fish ≥200 mm. This meets a class 1 brook trout fishery with 348 fish per acre ≥200 mm. Population estimates for Longnose Dace, White sucker, and Rainbow trout ≥200 mm were 23, 10, and one, respectively.

Skull (SKG)

Skull Creek was not sampled by Game Fish and Parks prior to the Oct. 1, 2015 survey. This site was primarily created to survey an area prior to a minor mining operation. Five brook trout were surveyed in the first of three passes with two of them ≥200 mm.

Castle (CAS)

Reach 153 on Castle Creek was surveyed on Sept 23, 2015. A population estimates for brown trout was 50 with 11 fish ≥200 mm. This meets a class 2 brown trout fishery with 113 per acre ≥200 mm.

Reach 181 was also surveyed on Sept 23, 2015. The population estimate for brown trout was 26 fish with five fish ≥200 mm. This meets a class 2 brown trout fishery with 36 per acre. Three white sucker were also surveyed. Because of the late September timing of both of these surveys, populations were likely effected by fall spawning movements of trout.

Rapid North Fork (RCN)

North Fork Rapid Creek was sampled at site 3, below the confluence with Buskala Creek, on Sept 8, 2015. The population estimate for brook trout was 24 fish with four fish ≥200 mm.

Brown trout population estimate was 45 with eight fish ≥200 mm. This meets a class 2 fishery for both brook and brown trout. Population estimates for longnose dace, mountain sucker and white sucker were 56, 14 and one, respectively. Three largemouth bass were also surveyed.

Swede Gulch (SWD)

Site three on Swede Gulch was sampled on Sept 18, 2015. Population estimates were 59 brook trout with four fish ≥200 mm, 22 brown trout with three fish ≥200 mmm and three mountain sucker. Eighteen longnose dace were also surveyed. Because of the late September timing of this survey, populations were likely effected by fall spawning movements of trout.

Recommendations

1. Manage Rapid Creek Watershed's tributaries as Wild Fish: Natural Yield and Native Fish.

2. Survey Rapid Creek Watershed tributaries every five to seven years.

3. Perform an intense three-pass survey on Rapid Creek within 3 years or when water flows allow.

French Creek Watershed

County: Custer

Fish populations in the French Creek Watershed within the Black Hills Fish Management Area (BHFMA) were surveyed during 2009 to monitor fish populations. The French Creek Watershed lies south of the Battle Creek Watershed and includes part of Custer State Park (CSP). The headwaters of French Creek lie about seven miles west of the city of Custer and the creek flows southeast through CSP. The drainage experiences a loss zone (where flow is lost to underlying geologic units) near the CSP east primitive campground 2 miles west of the park boundary and only has water in very wet years. The drainage crosses Hwy 79 near Fairburn. Water typically re-surfaces east of Fairburn and drains into the Cheyenne River about 14 miles east near Red Shirt. The French Creek Watershed within the BHFMA is in a pine/spruce forest managed by the US Forest Service and the State of South Dakota. As with the rest of the Black Hills, many forest service roads cut through the watershed with a few houses and ranches present. French Creek is stocked with catchable rainbow trout from just downstream of Stockade Lake to the Horse Camp by Bluebell in CSP. French Creek and its tributaries are managed under standard BHFMA regulations with a daily limit of five trout (in any combination) with one allowed 14 inches or longer.

French Creek's average flow at the USGS gauging station near Fairburn for May and June is 25 and 22 cfs respectively, but the monthly averages in 2015 were 85 and 107 (USGS 2016) (Table 18).

Table 18. French Creek's monthly mean flow at the USGS gauging station near Fairburn, South Dakota, January 2000 to September 2015.

	Monthly mean in ft^3/s											
YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	8	10	15	34	25	9	6	3	2	3	4	4
2001	4	3	9	14	14	24	17	7	4	5	4	2
2002	5	3	2	13	13	6	2	1	2	2	3	3
2003	3	2	11	11	16	11	3	2	1	2	2	3
2004	2	3	6	4	2	2	1	1	1	1	2	1
2005	1	1	2	3	4	5	2	3	1	2	2	1
2006	2	2	4	6	4	4	1	0	0	1	1	1
2007	1	1	2	3	5	2	0	5	2	2	1	1
2008	1	1	3	5	23	26	18	5	3	3	4	2
2009	2	3	5	18	18	16	12	5	3	6	5	3
2010	2	3	8	25	81	55	26	10	7	6	6	5
2011	4	6	13	17	68	46	17	13	8	7	7	6
2012	5	4	8	7	7	6	2	0	1	1	1	1
2013	1	1	2	5	6	3	2	5	2	32	10	3
2014	3	3	11	16	21	37	20	11	9	30	9	7
2015	6	6	7	8	85	107	47	19	7			
Mean	3.1	3.2	6.7	12	25	22	11	5.7	3.3	6.8	4	2

Methods

Sample Methods

Please refer above for methods, species abbreviations, and trout stream classifications.

Sample Locations

One reach each in Meeker West Fork, Meeker East Fork and Hazelrodt Creeks were surveyed in July and August 2015 (Table 19). French Creek itself was surveyed intensively in 2012, however, two reaches were surveyed as a part of a separate research project.

Results and Discussion

Eleven species of fish were captured in the French Creek watershed during 2015 sampling. The most abundant species were longnose dace, creek chub, and white sucker (Table 20).

Table 19. Population estimates trout species in 100 meter sample reaches of creeks within the French Creek Watershed during 2015 surveys. Streams are in order from furthest downstream to upstream. Upper confidence interval (95%) is reported in parenthesis.

	BKT <200 mm	BNT <200 mm	BNT ≥200 mm	RBT ≥200 mm
French Cr\741*		19	16	2
French Cr\979	3	49(2)	10(0)	3
Hazelrodt Springs\01	No fish			

*single pass site, value is total fish captured

Table 20. Population estimates non-trout species in 100 meter sample reaches of creeks within the French Creek Watershed during 2015 surveys. Streams are in order from furthest downstream to upstream. Upper confidence interval (95%) is reported in parenthesis.

	LND	WHS	BSB	MTS	CRC	FHM	LMB	YEP
French Cr\741*	21	2			12			
French Cr\979	112[#]	117 (9)		3	94 (13)		1	1
Hazelrodt Springs\01								
Meeker East\01*			4		1	3		
Meeker West\01			10					

*single pass site, values are total fish captured

[#]very high confidence interval, value is total fish captured

French Creek (FRC)

Two sites were surveyed on French Creek in 2015. Site 741 near the CSP East Primitive Campground was sampled on Sept 11 with one pass. Thirty five brown trout were surveyed with 16 fish ≥ 200 mm along with two rainbow trout, 12 creek chub, 21 longnose dace and two white sucker. In May 2009, this site had 14 brown trout with two ≥200 mm, one rainbow trout ≥200 mm, one smallmouth bass, and two white sucker.

Hazelrodt Springs Creek (HSC)

No fish were surveyed at Hazelrodt Springs Creek on July 9, 2015. This stream had never been sampled previously.

Meeker Creek East Fork (MEF)

Site 1 on Meeker East Creek was sampled on Aug 20, 2015 and had four brook stickleback, one creek chub, and three fathead minnow. In May 2009, 15 brook stickleback and one creek chub were surveyed.

Meeker Creek West Fork (MWF)

Meeker West Fork was also sampled on Aug 20, 2015 with ten brook stickleback detected. During a May 2009 survey, two creek chub and three brook stickleback were captured.

Recommendations

1. Manage French Creek Watershed's tributaries as a Wild Fish: Natural Yield and Native Fish.
2. Manage sections of French Creek as Hatchery Supplemented: Seasonal
3. Survey French Creek Watershed's tributaries every five to seven years.
4. Perform an intense three-pass survey on French Creek every five to seven years.

Lame Johnny Creek Watershed

County: Custer

Fish populations in the Lame Johnny Creek, Watershed within the BHFMA were surveyed during June through August 2015 to monitor fish populations. The creeks within these watersheds are managed under standard fishing regulations with a daily limit of five trout (in any combination) with one allowed 14 inches or longer. Most of the watershed within the BHFMA is located in Custer State Park in a mixed prairie and pine/spruce forest. The headwaters of Flynn Creek are roughly 9 km (5.5 mi) south of the city of Custer. Flynn Creek converges into South Fork Lame Johnny Creek which joins North Lame Johnny Creek to make Lame Johnny Creek near the southeast end of Custer State Park. The drainage below this point is on private ground and mostly dry. Lame Johnny Creek continues southeast until it enters the Cheyenne River about 17 km (10.6 mi) east of Buffalo Gap.

Methods

Please refer above for methods, species abbreviations, and trout stream classifications.

Sample Locations

During this study, efforts were made to check all drainages for presence of water. Reaches were sampled if they had enough flowing water to sample with two reaches attempted per

creek. Sampled creeks in the Lame Johnny Creek Watershed included: Lame Johnny North, Lame Johnny South, and Flynn Creek.

Results and Discussion

Flynn Creek was the only place fish were detected in during the Lame Johnny Creek Watershed survey. Four species were captured with longnose dace being the most abundant.

Flynn Creek (FLN)

Flynn Creek site 3 was created and surveyed on August 6, 2015. Population estimates were 22 brook trout with three fish ≥200 mm, 15 creek chub, 93 longnose dace, and 16 mountain sucker. This site meets a class 2 brook trout fishery with 77 fish ≥200 mm per acre. Site 1 surveyed on Aug 6, 2015 had a population estimate of 49 longnose dace and 8 mountain sucker. The single pass survey of this site in May 2009 yielded three longnose dace. A survey in June 1993 detected one brook trout at 201 mm, 24 longnose dace, 21 mountain suckers, and one fathead minnow.

Lame Johnny Creek-North Fork (LJN)

No fish were captured at either site 1 or 2 of Lame Johnny Creek North Fork on June 24, 2015. Site 1 was not sampled in 2009 since the water was less than one inch deep and it was dry in September 1994.

Lame Johnny Creek-South Fork (LJS)

No fish were captured at either site 1 or 3 on Lame Johnny Creek South Fork on June 29, 2015. No fish were captured at site 1 in May 2009 either and in September 1994 it was dry.

Recommendations

1. Manage Lame Johnny Creek Watershed's tributaries as a Wild Fish: Natural Yield and Native Fish.

2. Survey Lame Johnny Creek Watershed's tributaries every five to seven years.

Beaver Creek Watershed

County: Custer

The Beaver Creek headwaters lie approximately 4 km (2.5 mi) south of Custer and display low flows year round (table 21). The creek runs southwest through Wind Cave NP and enters the Cheyenne River about 8 km (5 mi) southeast of Buffalo Gap. The northwestern two-thirds of the Beaver Creek Watershed are in a pine/spruce forest and mixed grass prairie managed by the US Forest Service and the National Park Service. Southeastern portions of this watershed within the BHFMA lie primarily on private ranch land in a short to mid-grass prairie with almost no public access.

Table 21. Beaver Creek's monthly mean flow at the USGS gauging station near Pringle, South Dakota, January 2000 to September 2015.

	Monthly mean stream flow (ft^3/s)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	2	2	3	6	7	3	2	2	1	1	1	1
2001	1	1	2	2	1	1	3	1	1	1	1	1
2002	1	1	1	1	1	1	0	0	1	1	1	1
2003	1	1	1	1	1	1	0	1	0	1	1	1
2004	1	1	1	1	1	0	0	0	0	0	1	0
2005	0	0	1	1	1	1	0	0	0	0	1	0
2006	0	0	0	1	0	0	0	0	0	0	0	0
2007	0	0	1	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	1	0	1	1	0	0	0	0
2009	0	0	0	0	1	0	0	0	0	0	0	0
2010	0	0	1	1	4	7	6	3	2	2	2	2
2011	2	2	3	3	6	6	4	3	2	2	2	2
2012	2	1	2	2	2	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	3	2	2	4	5	3	3	4	3	2
2015	2	2	2	2	6	16	23	11	6			
Mean	1	1	1	1	2	3	3	2	1	1	1	1

Methods

Please refer above for methods, species abbreviations, and trout stream classifications.

Sample Locations

During this study, efforts were made to check all drainages for presence of water. Two reaches in Beaver Creek, three in Highland Creek and one in Cold Springs Creek were surveyed in July - Sept 2015.

Results and Discussion

Beaver Creek (BV1)

Beaver Creek site 7 was created and surveyed on July 23, 2015 within Wind Cave National Park. Six brook stickleback, three creek chub and seven fathead minnow were captured. Site 4, slightly downstream of site 7, was sampled in June 2009 with 56 creek chub and 51 fathead minnow captured. A previous survey of this site in June 1997 yielded a different species composition with three brook trout, 76 longnose dace, and two white sucker.

Site 8 was created and surveyed on Sept. 28, 2015. Three longnose dace and 28 brook stickleback were captured in a single pass. Site 6, just downstream on the other side of the road could not be sampled due to overgrown willows, but when it was surveyed in June 2009, three fathead minnow were captured.

Highland Creek (HGL)

Highland Creek site 2, near the Wind Cave Buffalo Corrals, was surveyed on Aug 5th, with no fish captured; although a fish of substantial size was visually observed in three passes, but not captured. Water was warm (21°C), slow flowing and turbid at the time of the survey.

Site 3 was created and surveyed below the boundary fence between Custer State Park and Wind Cave National Park. Population of brook trout was estimated at 13 with all but one greater than 200 mm.

Highland Creek site 1 was sampled on June 29, 2015 with a population estimate of 25 brook trout with 11 fish ≥200 mm. This was 160 fish ≥200 mm per acre, meeting a class 1 brook trout fishery classification. When sampled in June 2008, no fish were detected. The June 2004 survey yielded four brook trout under and one over 200 mm while the June 1995 survey yielded 28 brook trout under and four over 200 mm.

Cold Spring Creek (CCR)

Site 1 of Cold Spring Creek, within Wind Cave NP, was sampled on July 23, 2015. In a single pass, 19 brook stickleback, 16 fathead minnow, and one creek chub. A June 2009 survey had no fish captured. A survey of this site in June 1997 yielded four brook trout less than and 13 greater than 200 mm, 23 longnose dace, 50 white sucker, 11 fathead minnow, and one mountain sucker.

Recommendations

1. Manage Beaver Creek Watershed's tributaries as a Wild Fish: Natural Yield and Native Fish.

2. Survey Beaver Creek Watershed's tributaries every five to seven years.

Southern Hills Minor Watersheds:
Pass Creek, Red Canyon, Fall River, Cheyenne River

Counties: Custer, Fall River

Fish populations in the Pass Creek, Red Canyon Creek, and Fall River Watersheds (Figure 9) within the BHFMA were surveyed during May through August 2015 to monitor fish populations. Additionally, Cascade Creek, south of Hot Springs in the Cheyenne River Watershed, was also surveyed. These watersheds were combined in this report because they have few flowing streams. The creeks within these watersheds are managed under standard fishing regulations with a daily limit of five trout (in any combination) with one allowed 14 inches or longer. These watersheds within the BHFMA are in a pine/spruce forest. A large portion of them, especially the southern end of the Red Canyon and Pass Creek Watersheds lie on private property.

The headwaters of the Fall River Watershed begin with Cold Brook Creek approximately 9 km (5.6 mi) north-northwest of Pringle. Cold Brook and Hot Brook Creeks converge on Fall River at the north side of Hot Springs. Fall River enters the Cheyenne River downstream of Angostura Reservoir about 8.5 km (5.2 mi) south of Hot Springs.

The Pass Creek Watershed's headwaters begin with Hell Canyon approximately 16 km (9.9 mi) southwest of Hill City. The canyon runs south and enters Pass Creek before converging with Beaver Creek and entering the Cheyenne River 19 km (11.8mi) northwest of Edgemont. Almost all of the drainages within the watershed carry water only in a large precipitation event.

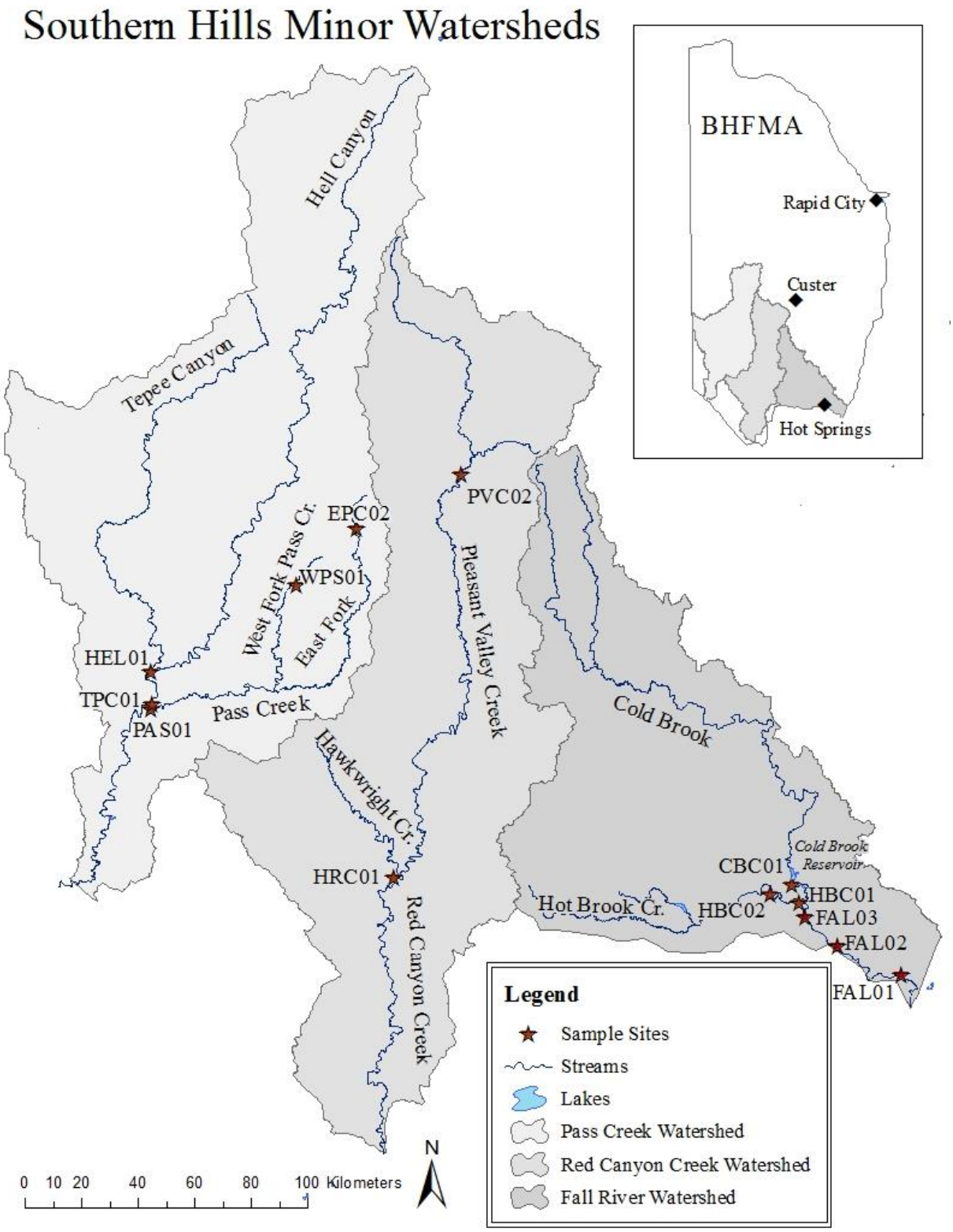

Figure 9. Pass Creek, Red Canyon Creek, and Fall River Watersheds in the Black Hills Fish Management Area (BHFMA) with 2015 sample sites depicted.

Fall River Watershed

Fall River (FAL)

Fall River site 1 was surveyed on May 20, 2015. Population estimates were 36 creek chub, 2 green sunfish, 43 longnose dace, two mountain sucker, four plains topminnow, six sand shiner, and 17 white sucker. In Aug 1998, this site had 239 longnose dace, 24 plains top minnow, 545 sand shiner and 95 white sucker.

Site 2 was surveyed on May 19, 2015. Population estimates were 26 creek chub, 23 Jack Dempsey cichlid, 38 longnose dace, four mountain sucker, 70 plains top minnow, five sand shiner and eight white sucker.

Site 3 was also surveyed May 19, 2015 with population estimates of nine creek chub, one green sunfish, 19 longnose dace, 13 plains topminnow and three sand shiner. One-hundred and seventy Jack Dempsey cichlid were also surveyed, but subsequent pass depletion was not achieved so the population estimate of 699 fish had a confidence interval of 1,209. During an Aug 1998 survey this site had a population estimate of one fathead minnow, seven goldfish, 49 green sunfish, 1 mountain sucker and 35 plains topminnow. Longnose dace and sand shiner were detected with 570 and 56 individuals respectively, but confidence intervals were too high to accurately estimate population. It should be noted that due to high conductivity, creeks in the Fall River watershed are difficult to sample and fish are likely missed. It has also been discovered that Jack Dempsey cichlids can also be difficult to sample as they evade the shocker before electrotaxis occurs.

Hot Brook Creek (HBC)

Two sites were sampled within Hot Brook Creek (Figure 9) in August 2015. Site 1 was sampled with a single pass and yielded 23 creek chub, 63 longnose dace, 12 sand shiner, one white sucker and five Jack Dempsey cichlid. In June 2009, this site yielded 11 creek chub, four green sunfish, 72 longnose dace, 19 sand shiner, two plains top-minnow, and five white sucker.

A survey of site 2 yielded 33 creek chub, 35 green sunfish, 1 Jack Dempsey, 76 longnose dace and four sand shiner. In June 2009 the survey resulted in one creek chub, one fathead minnow, 19 green sunfish, 95 longnose dace, and six plains top minnow.

Cold Brook Creek (CBC)

Cold Brook Creek site 1 was dry in Aug 2015, June 2009 and June 1995.

Recommendations

1. Manage Fall River Watershed's tributaries as a Wild Fish: Natural Yield and Native Fish.

2. Survey Fall River and its tributaries every five to seven years.

Cascade Creek

Cascade Creek (CCC)

Cascade Creek is a cold water spring fed creek that runs for about 5 km before entering the Cheyenne River above Angostura Reservoir. It is stocked with catchable rainbow trout. Site 2 on Cascade Creek was sampled on May 20, 2015. Population estimates were five longnose dace, two rainbow trout ≥200 mm and nine white sucker.

Recommendations

1. Monitor the Cascade Creek on a seven to ten year basis.

Red Canyon Creek Watershed

County: Custer

Pleasant Valley Creek (PVC)

Pleasant Valley site 2 was checked on July 30, 2015 and had small pools of stagnant water. When surveyed in June 1993, it had a population estimate of 321 fathead minnow.

Hawkright Creek (HRC)

Hawkright Creek site 1 was dry on July 30, 2015.

Recommendations

1. Monitor the Red Canyon Watershed on a seven to ten year basis.

Pass Creek Watershed

County: Custer

Pass Creek (PAS)

Pass Creek site 1 was dry on May 20, 2015, April 13, 2009 in Aug 1994.

Tepee Canyon Creek (TPC)

Tepee Canyon Creek sites 1 and 2 were dry on May 20, 2015, April 13, 2009 and in Aug 1994.

Hell Canyon Creek (HEL)

Hell Canyon Creek site 1 was dry on May 20, 2015, April 13, 2009 and in Aug 1994.

West Fork Pass Creek (WPS)

West Fork Pass Creek site 1 was not checked for water in 2015, but was dry on May 26, 2009 and in Aug 1994. It is assumed that is was dry in 2015 also.

East Pass Creek (EPC)

East Fork Pass Creek site 2 was dry on May 20, 2015, April 13, 2009 and in Aug 1994.

Recommendations

2. Monitor the Pass Creek watershed on a seven to ten year basis.

Cold Springs Creek Watershed

County: Lawrence, SD; Weston, WY; Crook, WY

One site on Cold Creek within the Cold Springs Creek Watershed was sampled in 2015 as a part of a mountain sucker research project and to monitor fish populations. The Cold Spring Creek Watershed lies mainly in Wyoming with Cold Springs Creek and Cold Creek being the only perennial streams in the watershed. The headwaters are about 3-4 km from the state border west of the town of Rochford. Cold Creek and Cold Springs Creek converge near the headwaters. The watershed is in a pine/spruce forest on the South Dakota side and is managed by the US Forest Service. This is one of the most remote areas of the Black Hills with few roads.

Results and Discussion

Cold Creek (CLC)

Site 1 was surveyed on October 8, 2015. The population estimate for brook trout was 38 with two ≥200 mm. During a single pass of this site in June 2010 24 brook trout were surveyed with two ≥200 mm. In June 1996 six brook trout <200 mm were sampled.

Recommendations

1. Manage Cold Springs Creek tributaries as a Wild Fish: Natural Yield and Native Fish.

2. Monitor the Cold Springs Creek Watershed on a seven to ten year basis.

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Appendix I. GPS locations of stream sites sampled during the 2014 survey. GPS is reported in UTM Zone 13T.

Watershed	Stream	Site	X(easting)	Y(northing)
Crow Creek	Crow Creek	CRW05	658129	4936223
Crow Creek	Beaver Creek	BV302	579101	4914408
Crow Creek	Beaver Creek	BV303	577907	4911409
Crow Creek	Potato Gulch Creek	PGS01	578509	4914634
Crow Creek	Potato Gulch Creek	PGS03	577795	4914315
Spearfish Creek	Spearfish Creek	SFC354	588008	4917112
Spearfish Creek	Higgins Gulch	HIG03	583648	4923980
Spearfish Creek	Iron Creek North	ICN04	584344	4914535
Spearfish Creek	Iron Creek North	ICN03	580650	4913443
Spearfish Creek	Deer Creek	DRK01	620851	4883716
Whitewood Creek	Whitewood Creek	WWC20	621292	4942044
Whitewood Creek	Whitewood Creek	WWC19	610635	4930294
Whitewood Creek	Whitewood Creek	WWC27	609044	4921900
Whitewood Creek	Whitewood Creek	WWC28	609401	4925245
Whitewood Creek	Whitewood Creek	WWC24	595150	4908312
Whitewood Creek	Deadwood Creek	DWC05	599933	4913822
Bear Butte Creek	Bear Butte Creek	BBC810	609609	4909933
Bear Butte Creek	Bear Butte Creek	BBC813	633011	4859463
Bear Butte Creek	Bear Butte Creek	BBC833	608106	4909220
Bear Butte Creek	Bear Butte Creek	BBC904	605569	4905868
Bear Butte Creek	Bear Butte Creek	BBC16	604278	4904690
Bear Butte Creek	Strawberry Creek	STB02	607496	4908686
Bear Butte Creek	Strawberry Creek	STB03	607071	4908723
Boxelder Creek	Boxelder Creek South	BXS02	612149	4893922
Boxelder Creek	Hay Creek	HAY01	613741	4898456
Spring Creek	Spring Creek	SPR10	627683	4871996
Spring Creek	Spring Creek	SPR07	619725	4843970
Spring Creek	Spring Creek	SPR04	610326	4857610
Spring Creek	Horse Creek	HOC01	618485	4873143
Spring Creek	Horse Creek	HOC02	621450	4871112
Spring Creek	Palmer Gulch	PAG02	618960	4863499
Spring Creek	Palmer Gulch	PAG01	617571	4861638
Spring Creek	Willow Creek	WCP01	617616	4861239
Spring Creek	China Gulch	CHI01	616152	4866540
Spring Creek	Newton Fork Creek	NFC02	611784	4868662
Spring Creek	Newton Fork Creek	NFC03	608987	4868991
Spring Creek	Marshall Gulch	MAG02	614747	4868937
Spring Creek	Marshall Gulch	MAG01	614949	4869539
Spring Creek	Patterson Creek	PAT02	612294	4867081
Spring Creek	Patterson Creek	PAT01	609708	4865434
Spring Creek	Reno Gulch	REG01	610012	4863023
Spring Creek	Sunday Gulch	SUN01	614092	4858581
Spring Creek	Sunday Gulch	SUN02	614041	4857550
Spring Creek	Tenderfoot Creek	TFC01	610021	4856783
Spring Creek	Vonderlehr Creek	VON02	604795	4857477
Spring Creek	Negro Creek	NEG01	604377	4862000
Spring Creek	Coon Creek	CNC01	605826	4861514
Battle Creek	Battle Creek	BAT05	630862	4861639
Battle Creek	Grace Coolidge Creek	GCC02	628874	4848262
Battle Creek	Grace Coolidge Creek	GCC 03	625001	4850864

Watershed	Stream	Site	X(easting)	Y(northing)
Battle Creek	Spokane Creek	SPO02	631655	4853570
Battle Creek	Spokane Creek	SPO03	629054	4854432
Battle Creek	Bear Gulch	BEG02	632546	4850109
Battle Creek	Galena Creek	GAC01	627451	4845733
Battle Creek	Galena Creek	GAC02	622979	4846561
Battle Creek	Badger Clark Creek	LSQ02	626915	4848060
Battle Creek	Badger Clark Creek	LSQ01	624185	4848543
Battle Creek	Foster Gulch	FOS01	632264	4862843
Battle Creek	Teepee Gulch	TPG01	630092	4863607
Battle Creek	Grizzly Bear Creek	GBC02	626548	4860704
Battle Creek	Grizzly Bear Creek	GBC01	625372	4859386
Battle Creek	Lafferty Gulch	LAF01	625214	4861219
Battle Creek	Pine Creek	PIN01	623226	4862206
Battle Creek	Pine Creek	PIN02	621343	4860741
Rapid Creek	Slate Creek	SLC02	608018	4874735
Rapid Creek	Skull Creek	SKG01	611049	4875702
Rapid Creek	Castle Creek	CAS153	603588	4880183
Rapid Creek	Castle Creek	CAS181	602665	4881322
Rapid Creek	Rapid Creek North	RCN03	598982	4894551
Rapid Creek	Swede Gulch	SWD03	622004	4884403
French Creek	French Creek	FRC741	631512	4841834
French Creek	French Creek	FRC979	621723	4841626
French Creek	Hazelrodt Springs Creek	HSC01	619379	4840561
French Creek	Meeker Creek East Fork	MEF01	616164	4851061
French Creek	Meeker Creek West Fork	MWF01	616091	4851062
Lame Johnny Creek	Flynn Creek	FLN03	623863	4836223
Lame Johnny Creek	N.Fork Lame Johnny Creek	LJN01	627714	4839077
Lame Johnny Creek	N.Fork Lame Johnny Creek	LJN02	630372	4836041
Lame Johnny Creek	S. Fork Lame Johnny Creek	LJS01	625579	4837184
Lame Johnny Creek	S. Fork Lame Johnny Creek	LJS03	626468	4835707
Beaver Creek	Beaver Creek	BV107	623018	4826527
Beaver Creek	Beaver Creek	BV108	620239	4829648
Beaver Creek	Highland Creek	HGL02	625993	4831263
Beaver Creek	Highland Creek	HGL03	626589	4830198
Beaver Creek	Cold Spring Creek	CCR01	622612	4825836
Fall River	Fall River	FAL01	628587	4806774
Fall River	Fall River	FAL02	624862	4808490
Fall River	Fall River	FAL03	622912	4810176
Fall River	Hot Brook Creek	HBC01	622663	4811071
Fall River	Hot Brook Creek	HBC02	620984	4811503
Fall River	Cold Brook Creek	CBC01	622246	4812066
Cascade Creek	Cascade Creek	CCC01	616257	4796672
Red Canyon Creek	Pleasant Valley Creek	PVC02	602926	4836014
Red Canyon Creek	Hawkright Creek	HRC01	598983	4812519
Pass Creek	Pass Creek	PAS01	584799	4822362
Pass Creek	Tepee Canyon Creek	TPC01	584880	4822597
Pass Creek	Tepee Canyon Creek	TPC02	583815	4829076
Pass Creek	Hell Canyon Creek	HEL01	584800	4824495
Pass Creek	West Fork Pass Creek	WPS01	593294	4829614
Cold Springs Creek	Cold Creek	CLC01	578502	4889043