Fisheries and Aquatic Resources Adaptive Management System

2020-2024

Black Hills Fish Management Area

South Dakota Game, Fish and Parks Wildlife Division

Formally adopted by GFP Commission: March 6, 2020

Department Mission

We provide sustainable outdoor recreational opportunities through responsible management of our state's parks, fisheries, and wildlife by fostering partnerships, cultivating stewardship and safely connecting people with the outdoors

Department Vision

We will conserve our state's outdoor heritage to enhance the quality of life for current and future generations

Introduction

The purpose of this strategic plan is to guide fisheries management based on the missions of the South Dakota Department of Game, Fish and Parks (SDGFP). This plan is a dynamic tool addressing the issues, challenges, and opportunities in managing the Black Hills Fisheries Management Area (BHFMA). The components of this plan include an **Inventory** Section, which describes the resources present in this management area, and reviews both historical and current management activities. This section is subdivided into three categories: **People**, **Fish**, and **Habitat**. Following the Inventory Section is the **Issues** Section, listing the current issues involving fisheries for this management area. Lastly, measurable and time-bound **Objectives**, along with specific **Strategies,** are listed. Progress towards meeting these objectives will be evaluated prior to developing subsequent plans.

Priorities for annual work plans related to accomplishment of Black Hills Management Area objectives for the 2020-2024 period include:

- Acquiring adequate (>40 cfs) winter flows below Pactola Reservoir.
- Evaluating effectiveness of fish stocking strategies at meeting management objectives.
- Submitting large-scale habitat and access project proposals for the Rapid and Spearfish Creek watersheds, for funding consideration.
- Improving angler access to Black Hills fisheries.
- Gathering angler use information on small impoundments to evaluate management strategies.

Due to brushfires, unforeseen obstacles, and development of new management issues, plan priorities may change during the period of implementation.

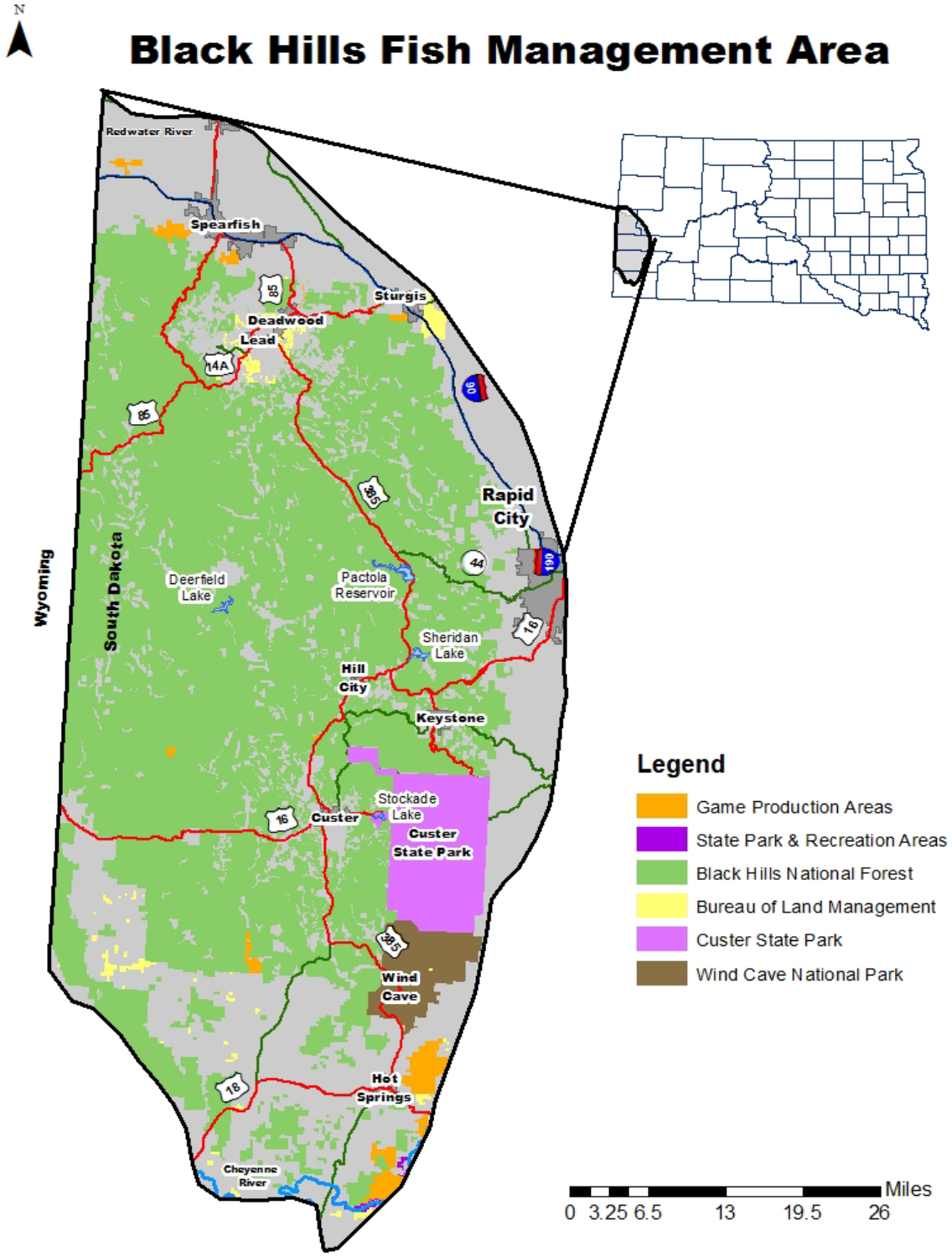

Figure 1. Black Hills Fish Management Area.

Inventory

People

Demographics:

While the Black Hills is a popular tourist destination, there is a strong contingent of local anglers. In fact, a recent estimate showed 57% of the anglers interviewed had a permanent residence within the Black Hills and of those, approximately 39% only fished within the Black Hills Fish Management Area (BHFMA; Figure 1; Longmire 2015). On average, resident anglers traveled 60 miles one-way, while non-residents traveled 575 miles one-way to fish in the BHFMA.

Regulations:

Regulations are the primary method for ensuring the equitable use of fisheries resources and protecting fisheries from over-harvest. Black Hills trout fisheries are managed with a variety of regulations. Currently, the BHFMA streams daily limit for trout is five, with only one trout over 14-inches. Special regulations include a 24-inch minimum length limit on lake trout and splake, with a daily limit of one fish of either species within the BHFMA. In addition, Yates Ponds, Pactola Basin, and a section of Rapid Creek are catch and release for all trout species, while a section of Spearfish Creek is catch and release only for rainbow trout. The most recent comprehensive survey of anglers indicated that 80% of anglers felt that BHFMA fishing regulations were generally in the best interest of the average angler, but 61% also agreed that unique waters should have their own set of regulations that suit the fishery best (Longmire 2015).

Angler preferences and satisfaction:

In 1993, a management plan for Black Hills streams was produced (Erickson et al. 1993). In the following years, an extensive angler use and preference survey was conducted (Erickson and Galinat 2005). As a result of this survey, several management changes were made, including a reduction in the daily trout limit and an increase in the size of trout stocked. Since that survey, other methods have been used to obtain angler information. In 2004, 2007, and 2010, a statewide angler survey was conducted with licensed anglers in South Dakota (Gigliotti 2004, 2007 and 2011). As part of these surveys, anglers were classified with respect to their motivations for fishing in the Black Hills and their likelihood for accepting regulation changes. Angler preference and satisfaction information from Black Hills anglers has also been gathered through water-specific creel surveys (Simpson et al. 2007; Simpson 2007a, 2007b, 2007c, 2008, 2009, 2010a, 2010b, 2011a, 2011b, 2012). Angler satisfaction, the focus of these water-specific surveys (Simpson 2007a), exceeded the statewide goal of 66% (Gigliotti 2004) in

all instances. In Black Hills streams, satisfaction ranged from 67% to 88% (Simpson 2009). Satisfaction in small lakes and ponds ranged from 73% to 86%, and in large reservoirs overall satisfaction ranged from 69% to 86%. These values are only slightly different from the 1994 mail survey, which noted that 80% of Black Hills anglers were satisfied with their overall experience (Erickson and Galinat 2005). The most recent comprehensive survey was conducted in 2014 (Longmire 2015). During this effort, a mixed mode survey was administered to 2,576 anglers identified through a BHFMA-wide angler use and harvest survey. Of the contacted anglers, 1,056 provided responses. Of the anglers that responded, 77% fished at least one of the four large reservoirs (Deerfield, Pactola, Sheridan and Stockade) with rainbow trout being the preferred species. Fifty-six percent also fished smaller reservoirs, with rainbow trout being the preferred species again. Additionally, 49% of those anglers also fished streams with brown trout being the most preferred species. On average, anglers were satisfied with the fishing experience provided within the BHFMA, regardless of what type of water they were fishing.

Angler access:

Public access and fishing opportunities exist in many locations throughout the BHFMA. Most lands are in public ownership as part of the United State Forest Service (USFS) Black Hills National Forest (BHNF), Custer State Park, Bureau of Land Management (BLM) or National Park System (NPS). Private landholdings are scattered throughout these large public land blocks. However, private land can be crossed to access water for fishing unless posted as “no trespassing” within the Black Hills Fire Protection District (BHFPD). The boundary of the BHFPD generally follows the boundary of the BHFMA, with the only exception being the small portion in the northwest corner that lies north of Interstate 90, which is not included in the BHFPD. South Dakota Game, Fish and Parks provides several resources for anglers to identify where public land provides access to public waters (e.g. Public Fishing Access Map; Guide to Fishing the Black Hills).

Other management entities:

Within the BHFMA, several other government entities have land holdings and conduct management activities. Additionally, many of these areas have aquatic resources that are managed by SDGFP. As such, coordination often occurs on an annual basis prior to many management activities, such as sampling or habitat projects. The majority of the BHFMA lies within the boundaries of the USFS BHNF. Additionally, the BLM and the NPS manage certain areas within the BHFMA. While some of these entities may conduct limited aquatic sampling, the vast majority is conducted by SDGFP and data transfer occurs annually. In addition to sampling by other government organizations, bio-monitoring occurs annually as part of the requirement for certain mining activities that have or are currently occurring within the BHFMA. This information is shared with SDGFP annually.

Fish

Species:

Historic fish assemblages in the BHFMA were simple, consisting of suckers, chubs and dace (Bailey and Allum 1962). Trout were first stocked in the late 1800s and are now numerous throughout many stream sections (Barnes 2007). Currently, seven species of trout (brown, brook, rainbow, cutthroat, lake, tiger and splake) exist in the streams and reservoirs in the BHFMA. The BHFMA also supports four species listed by the South Dakota Natural Heritage Program (SDNHP) as threatened, endangered or species of greatest conservation need (SGCN) in South Dakota (Table 1). One of the species listed is mountain sucker, which are native to the Black Hills. While their numbers remain stable in much of their native range, there has been some decline in the BHFMA (Schultz and Bertrand 2012). Within South Dakota, mountain sucker habitat is restricted to the BHFMA, and as a result, the species is listed as an S3 species by the SDNHP. An S3 species is defined as "either very rare and local throughout its range or found locally (possibly in abundance at some locations) in a restricted range, or vulnerable to extinction throughout its range because of other factors". Similarly, lake chub are listed as an S1 species by the SDNHP, indicating that they are "critically imperiled because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction." Historically, lake chub occurred in streams across the Black Hills, but recent surveys indicate the only remaining lake population is in Deerfield Reservoir. This localized population has been in decline since 1994 (Isaak et al. 2003). In 2019, lake chub were detected in a section of Box Elder Creek (SDGFP data). Both mountain sucker and lake chub are listed as SGCN within South Dakota's State Wildlife Action Plan (SDGFP 2006). The BHFMA area also supports multiple warm-water species in both large reservoirs and small impoundments, including smallmouth and largemouth bass (Miller et al. 2010). Additional game-fish species providing angling opportunities include walleye, black crappie, bluegill, yellow perch, and northern pike.

Stocking:

From a historical context, all sport fisheries in the Black Hills are a product of stocking. The stocking of hatchery-raised trout is one of the primary tools available to fisheries managers, and catchable trout fisheries comprise a large portion of the recreational fisheries in small lakes, ponds and larger reservoirs in the Black Hills (Erickson et al. 1993). The stocking of catchable-sized trout to create put-and-take fisheries is a standard management practice for lakes in the BHFMA where natural recruitment is low to non-existent (Davis 2012). On average, the three largest reservoirs: Sheridan, Pactola and Deerfield, receive approximately 25% of the catchable sized rainbow trout stocked in the BHFMA (Miller et al. 2010). Stocking numbers in smaller impoundments range from a few hundred to a few thousand

depending on size, location, and angler use. Additional species have been stocked by SDGFP to increase angler opportunity such as smallmouth bass in Sheridan Reservoir (Miller et al. 2010). The stocking of streams within the BHFMA is dependent on individual stream management classifications. Streams are classified by the number of wild adult trout (eight inches) per acre of water (Table 2; Erickson et al. 1993). Supplemental stocking is done on stream reaches where environmental variables reduce the opportunity for a self-sustaining wild trout population. For example, sections of Castle and Rapid Creek are supplemented with catchable-sized rainbow trout annually as natural production does not meet angler desires (Bucholz and Wilhite 2009). Furthermore, the stocking of hatchery trout can occur in streams where high angler use leads to low angling catch rates or where hatchery stockings are needed to achieve a specific management objective (Erickson et al.1993). Urban fisheries often receive high angler use and require frequent catchable rainbow trout stockings in order to meet angler expectations.

Fisheries surveys:

Fisheries work began in the Black Hills as early as 1890, however the report titled Stream and Lake Inventory and Classification in the Black Hills of South Dakota (Stewart and Thilenius 1964) was the first comprehensive, Black Hills–wide, inventory of fish populations. Extensive monitoring followed in the 1970s. Biologists initiated studies to investigate fish population dynamics, regulation effectiveness, and habitat influences. In the 1980s, an extensive survey of Black Hills stream fish populations was conducted. Follow-up stream surveys were also completed in the 1990s and in 2010-11. These stream surveys documented the negative impact of drought through increased summer water temperatures, reductions in winter habitat, and low water levels. Annually, numerous streams are surveyed, but the frequency depends on recreational importance and environmental conditions. Large reservoirs in the BHFMA are surveyed annually, but most small impoundments are surveyed on a 5-year rotation. Data from these surveys is available on the SDGFP website.

Fisheries research:

Research within the BHFMA is designed to address management issues such as declines in fish populations, changing conditions within a system or ways to optimize hatchery production. These projects have management-based objectives and are intended to generate new management strategies. Examples include research projects to evaluate populations of brown trout in Rapid Creek (Erickson et al. 2005; James et al. 2007) and to examine the movement patterns of a unique population of rainbow trout in Spearfish Creek (James 2011). In cases where the scope of the project requires additional assistance, partnerships with academic institutions, such as South Dakota State University, University of South Dakota and South Dakota School of Mines and Technology, are undertaken. These projects

are often financially supported with Sport Fish Restoration Funding or State Wildlife Grants. Projects involving the status of native fish (Schultz 2011; Fopma in prep.) and unique trout populations (Davis 2012; Kientz 2016) have provided managers with essential information. Additionally, factors such as predation by both aquatic (Scheibel 2015) and terrestrial (Davis et al. 2016; Galinat in prep.) predators, density dependence (Rehm 2019) and water availability (Kenney 2018) have been evaluated in recent years.

Undesirable fish introductions:

Fish species not stocked by SDGFP, such as northern pike, yellow perch and rock bass, have established naturally-reproducing populations in many locations throughout the BHFMA (Scheibel 2015). The introduction of these species complicates management and may lead to costly removal efforts (Miller et al. 2010). Continued outreach and education efforts occur in an attempt to educate the public on the possible negative consequences of these introductions. Additionally, specific management actions (e.g. mechanical removal, stocking adjustments) are performed annually to mitigate the negative impacts of these introductions.

Fish removals and chemical renovations:

Population manipulation is one of the management tools used by fisheries managers in the BHFMA. Removal of undesired species has been attempted in specific waters to try and improve the overall fishery. For example, white sucker were removed in 2006 after fish population surveys and anecdotal information from anglers indicated might have been negatively influencing trout populations in Deerfield Reservoir and its tributaries (Miller et al. 2010). In cases where removal efforts were likely to have little effect, chemical renovations have been conducted to completely remove all fish from a water body. Deerfield Reservoir has been chemically treated twice in the past in an attempt to restore the trout fishery (Miller et al. 2010). These chemical renovations occurred in conjunction with dam repairs and are unlikely to be an option in the future and were only effective until additional unauthorized introductions occurred shortly after completion.

Aquatic Invasive Species (AIS):

Any species not native to an area that threaten the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquaculture, or recreational activities dependent on such waters are classified as Aquatic Invasive Species (NANPCA 1990). Currently, several AIS species exist within the BHFMA, including Didymosphenia geminata (didymo) and curlyleaf pondweed. In 2002, didymo was discovered in Rapid Creek and has since regularly bloomed from the tailrace below Pactola Reservoir dam downstream to the City of Rapid City (~39 km). Occasional blooms are observed

in Rapid Creek above Pactola Reservoir and in a small, isolated section of Castle Creek. Although these blooms raised concerns with anglers and managers and were blamed for the decline of the Rapid Creek brown trout fishery, research showed that didymo was not the source of the decline of trout populations (James et al. 2010). Red-rimmed melania is a non-native snail common in the aquarium trade. It is currently present in Cascade Springs (Fall River County) south of Hot Springs, SD and in Fall River in the City of Hot Springs. Jack Dempsey, a common aquarium fish, has also been sampled in Fall River adjacent to the town of Hot Springs. These two species thrive in the warmer waters of these southern Black Hills streams. Additional AIS species within the BHFMA include European rudd found in Sheridan and Pactola Reservoirs (Miller and Galinat 2009). In 2019, New Zealand mudsnail were found in Beaver Creek, west of Buffalo Gap, SD. This was the first time they had been confirmed in the state of South Dakota.

Habitat

Large Reservoirs/Small Lakes and Pond/Streams:

Large Reservoirs:

For management purposes, large reservoirs are classified as water bodies greater than 130 surface acres in size. Only four water bodies in the BHFMA meet this classification: Pactola, Deerfield, Stockade and Sheridan Reservoirs. Except for Stockade, all these reservoirs have a beneficial use classification of “Cold Water Permanent Fisheries”, which is defined as “surface waters of the state which are capable of supporting aquatic life and are suitable for supporting a permanent population of coldwater fish from natural reproduction or fingerling stocking” (Lorenzen 2005). Stockade Lake is classified as “Coldwater Marginal” and as such, does not support and is not managed for coldwater species. In addition to various trout species, warm and cool-water fish are also present in each of the reservoirs.

The Bureau of Reclamation (BOR) operates Pactola and Deerfield Reservoirs in accordance with downstream water demands such as irrigation, domestic water supply, and minimum flows maintenance in Rapid Creek below Pactola. The USFS holds the water rights to Sheridan Lake and currently operates Sheridan Dam to maintain a stable lake level to maximize benefits to recreational uses on and around the reservoir.

Small Lakes and Ponds:

Small lakes (reservoirs) and ponds are scattered throughout the Black Hills region. These waters range in size from less than an acre to 130 acres. Currently, 47 small lakes and ponds are managed with catchable (11-inch) trout stockings, although other cool and warmwater fish species are present. During warm, dry

periods in the summer, elevated surface temperatures in some of these waters precludes trout stocking.

Streams:

There are approximately 800 miles of streams in the Black Hills, which account for nearly all the coldwater streams in the entire state. Not all these streams are perennial fisheries, but many are still important for nurseries of young and refuge areas for native fishes. Within the Black Hills there are several primary trout streams including Rapid, Castle, Spearfish, Whitewood, Spring and Crow Creeks. These streams provide 240 miles of fishable trout waters during most years, but distribution and abundance of trout may decline during prolonged drought periods. These streams are noted as being perennial, based on stream classifications stated within the 1993 Black Hills Trout Stream Plan (Erickson et al. 1993). Rapid Creek (including Castle Creek) and Spearfish Creek watersheds are considered "Primary Watersheds", with the rest considered "Secondary Watersheds".

Water sources for these streams come from underground springs and surface runoff from the central core of the Black Hills radiating outwards. Few streams flow westward from the Black Hills, but many flow north, east and southeast. Stream flows are highly influenced by geological conditions and spring flows originate from fractures of the Madison and Minnelusa aquifers in higher elevations. Multiple loss zones (Table 3) occur within the Black Hills in areas where streams cross outcrops of Madison Limestone and Minnelusa formations (Carter et al. 2002) and are important recharge locations for the Madison and Minnelusa aquifers. Stream sections below these loss zones often become dry stream beds unless inflows exceed the amount of loss (Hortness and Driscoll 1998). Precipitation patterns coupled with the geology of the Black Hills set the baseline conditions for stream water resources and fisheries.

Changes in the Black Hills Fish Management Area:

With the exception of Cox Lake, Mud Lake, and both Mirror lakes, natural lakes and ponds do not exist in the BHFMA. Many of the small reservoirs present today were constructed by the Work Projects Administration (WPA) during the 1930s. Reservoirs such as Sheridan Lake (originally Lake of the Pines), Horsethief Lake, Stockade Lake, Center Lake, and Bismarck Lake were created by the construction of dams built during this era collaboratively by the WPA and Civilian Conservation Corp (CCC).

Water quality:

The majority of land within the BHFMA is part of the BHNF which is managed for multiple-uses including outdoor recreation, cattle grazing, timber harvesting, and wildlife. Pockets of private land are dispersed throughout the management area. The Black Hills region traditionally has some of the best water quality in the state

(South Dakota Department of Environment and Natural Resources 2012). Historically, Black Hills waters were described as “clear, cool, and pure” by US Army Lt. Col. Dodge back in 1876 (Kime 1996). There is little doubt that water quality conditions have declined since these early explorations. Urban runoff, grazing practices, water withdrawals, fires, mining, logging, and recreational uses have reshaped the Black Hills. Sedimentation, as a natural process, typically occurs gradually. However, with human intervention, the speed of sedimentation has greatly increased (Waters 1995). Runoff from roads, parking lots, and other impervious surfaces during rain events is transported through storm water lines and deposited directly to creeks and streams at high velocities causing bank erosion. Roads, highways, logging and recreational trails, can also increase sedimentation into streams. Placer, surface, underground, and sand and gravel, mining have caused sediment loading through direct intrusion in the stream bed or from erosion of tailings deposited near creeks (Hill 1975). In addition to impacts by increased sediment loads, stream flow has also been influenced by irrigation demands, domestic use, dam construction, and non-consumptive uses for mining or electrical power on Rapid Creek, Elk and Spearfish Creeks (Carter et al. 2002). Instream barriers, (i.e. culverts and small dams) have the potential to reduce stream connectivity and negatively influence fish passage.

Habitat projects:

Increased angling demand combined with habitat degradation prompted agencies to start conducting habitat improvement projects in the 1960s. Grazing enclosures, willow plantings along creeks, and other lake and stream improvement projects have been completed, along with habitat related research. An intensive habitat study of the Black Hills in 1964 resulted in the publication of the Stream and Lake Inventory and Classification in the Black Hills of South Dakota (Stewart and Thilenius 1964). In 1984 and 1985, a comprehensive stream and riparian habitat inventory was completed for the Black Hills with the goal of developing a system to classify streams based on morphology, trout biomass, and habitat. A total of 220 stations on 65 streams were sampled (Ford 1988). Continued efforts to identify factors limiting habitat as well as utilization of existing information are required to implement innovative projects to maximize the potential of stream and lake fisheries in the BHFMA.

Black Hills Small Reservoirs Management Issues

1. Shore fishing opportunities are limited due to siltation and vegetation.
2. Angler use and harvest information is lacking on many waters and is needed to evaluate fisheries management actions, particularly in relation to stocking strategies.

3. Return rates of hatchery-reared rainbow trout are unquantified in many small reservoirs, complicating assessment of hatchery product effectiveness.
4. Many small reservoirs are over 80 years old, degraded, and are now unable to provide quality fisheries.
5. Unauthorized introductions continue to negatively impact other native species and sport fish through competition and predation.

Pactola Reservoir Management Issues

1. High use during summer by various user groups leads to conflict, impaired access, and the potential for lower overall angler satisfaction.
2. Access to ice fishing areas can be difficult due to accumulation of snow and ice at access points.
3. Return rates of hatchery fish may fall below goals for put-and-take fisheries.
4. The effectiveness of stocking larger rainbow trout to reduce mortality due to northern pike predation has not been evaluated.

Deerfield Reservoir Management Issues

1. Abundant rock bass compete with other sportfish for food as well as presenting a nuisance for anglers targeting other species.
2. Existing information on the lake trout population is insufficient to evaluate stocking success, reproduction, and the effectiveness of current regulations.
3. Post-stocking survival, angler harvest, and satisfaction with stockings of large rainbow trout has not been evaluated.

Sheridan Reservoir Management Issues

1. High use during summer by various user groups leads to conflict, impaired access, and the potential for lower overall angler satisfaction.
2. Walleye population dynamics and their impact on other sport fish populations are unknown.
3. Bluegill population dynamics and their impact on other sport fish populations are unknown.
4. Yellow grub prevalence rates are not monitored, but anecdotal information suggests fish are less desirable for harvest by anglers when present.

Stockade Reservoir Management Issues

1. Yellow grub prevalence rates are not monitored, but anecdotal information suggests fish are less desirable for harvest by anglers when present.

2. Poor water quality promotes algae blooms which negatively impact the fishery and recreational use.
3. Periods of low oxygen levels in the water reduce habitat available to fish.
4. Walleye population dynamics and their impact on other sport fish populations are unknown.

Black Hills Streams (Secondary Watersheds) Management Issues

1. The lack of relationships with private landowners are a factor in the low implementation of Best Management Practices along sensitive stream areas.
2. Current fish population surveys are limited to short stretches of stream (100 m) and their results may not adequately describe trout populations on many streams.
3. Native fish populations in the Black Hills have been negatively impacted by habitat loss and sportfish introductions.
4. Sedimentation from forestry practices, grazing, road construction, and mining likely have a negative impact on habitat quality and fish populations.
5. Instream flows are often insufficient to maintain sport fish populations in many smaller Black Hills streams.
6. Elevated summer water temperatures limit cold-water habitat and negatively impact trout populations in some waters.
7. User information is lacking on most stream fisheries making management decisions difficult.
8. Growth rates of trout in many streams are unknown limiting our ability to accurately assess populations.

Rapid Creek Watershed Management Issues

1. Low stream productivity in some sections of Rapid and Castle Creeks reduces fisheries potential.
2. Extremely high and low water releases from Pactola and Deerfield Dams negatively impact downstream trout populations making management difficult.
3. High summer stream temperatures within the Rapid City stretch can negatively impact trout populations.
4. Brown trout growth potential has not been quantified in many stretches of Rapid Creek.
5. Up-to-date user information is needed to better address angler needs.

Spearfish Creek Watershed Management Issues

1. High trout density appears to negatively affect trout growth.

2. The impact of enteric redmouth on the trout population is unknown.
3. Adult trout habitat may be limited in certain areas, possibly limiting the quality of fish populations.

Goals, Objectives, Strategies

Goal:

Manage fisheries and aquatic resources in the Black Hills of South Dakota for long-term sustainable use and enjoyment.

Objectives and Strategies

Not all objectives will be met due to brushfires, unforeseen obstacles, and changes in needs or priorities as a part of the adaptive management process.

1. ***Objective:***

   Improve shore fishing access on a minimum of two small impoundments by 2023.

   Strategies:

   a) Identify, prioritize, and select fisheries in need of access improvements.

   b) Select appropriate management action(s) for selected fisheries (e.g. vegetation removal, fishing piers, dredging).

   c) Initiate and complete projects on locations including, but not limited to: Iron Creek Lake, Strawberry Hill Pond and Reausaw Lake.

   d) Evaluate angler use of selected access areas following completion of projects.

2. ***Objective:***

Estimate angler use and satisfaction on a minimum of five small impoundments by 2023.

Strategies:

a) Develop appropriate study designs (i.e. in-person or remote surveys) in consultation with other Department staff and academic researchers.

b) Involve other interested parties (e.g. USFS, municipalities)

c) Initiate and complete surveys at Sunday Gulch Pond, Grace Coolidge Ponds, Reausaw Lake, Silver City walk-in fishery, Kinney Canyon walk-in fishery and Sturgis Reservoirs.

d) Disseminate survey results internally and externally.

e) Implement management strategies to address issues identified for specific waters.

3. ***Objective:***

Determine return rates of hatchery-reared rainbow trout on a minimum of five small impoundments by 2023.

Strategies:

a) Consult Department and university staff to develop and propose a study to address research questions and management issues.

b) Initiate and complete projects on locations including, but not limited to: Bismarck Lake, Horsetheif Lake, Iron Creek Lake, and Dalton Lake.

c) Disseminate study findings internally and externally.

d) Implement management strategies to address issues identified for specific waters.

4. Objective:

Determine success of larger (~15 inch) rainbow trout stockings on aspects of the fishery including predation and angler satisfaction on Pactola and Deerfield Reservoirs by 2023.

Strategies:

a) Generate hypotheses on potential factors limiting fish abundance or interfering with preferred size structure in identified fisheries

b) Develop appropriate study design in consultation with other department staff and academic researchers.

c) In consultation with administrative staff, determine if research can be conducted internally or through funding a university study.

d) Write proposals and obtain the required funding.

e) Initiate, complete and disseminate research study and implement any management recommendations.

5. ***Objective:***

Complete lake-habitat renovation of Stockade Lake by 2024.

Strategies:

a) Identify areas where sediment could be removed to increase depth.

b) Identify areas where in-lake structure (e.g. gravel bars, woody debris) could be added to improve fish habitat.

c) Determine the feasibility of implementing various lake improvement strategies including dredging, draw downs and aeration, etc. based on cost and available resources.

d) Implement selected strategies and evaluate their impact on water quality and the fish community.

6. ***Objective:***

Complete at least one in-stream habitat project on a secondary watershed (i.e. non-Rapid and Spearfish Creek watersheds) by 2024.

Strategies:

a) Identify, prioritize, and select areas in need of habitat improvements.

b) Select appropriate management action(s) for selected area.

c) Communicate area fishing access needs to habitat staff and fisheries administrators to develop proposal.

d) Submit project in accordance with budget timelines.

e) Initiate and compete project.

7. Objective:

Improve instream habitat and flow conditions in at least two sections of Rapid or Castle Creeks by 2024.

Strategies:

a) Engage Rapid Creek water users and management authorities in discussions about maintaining adequate (>40 cfs) winter flows for trout below Pactola Reservoir.

b) Identify, prioritize, and select areas in need of instream, physical habitat improvements or repair.

c) Select appropriate management action(s) for selected areas.

d) Submit project proposals in accordance with budget timelines.

e) Initiate and complete projects.

8. Objective:

Determine brown trout growth throughout Rapid and Castle Creeks and, if needed, work to implement strategies to improve growth by 2023.

Strategies:

a) Identify where brown trout growth information is lacking.

b) Generate hypotheses on potential factors limiting fish abundance or interfering with preferred size structure in identified fisheries.

c) Develop appropriate study designs in consultation with other department staff and academic researchers

d) In consultation with administrative staff, determine if research can be conducted internally or through funding a university study.

e) Write proposals and obtain the required funding.

f) Initiate, complete and disseminate research studies and implement any management recommendations.

9. Objective:

Complete at least one additional habitat project in Spearfish Creek by 2023.

Strategies:

a) Identify, prioritize, and select areas in need of habitat improvements within Spearfish Canyon near Hydro Plant #2.

b) Select appropriate management action(s) for selected area.

c) Communicate area fishing access needs to habitat staff and fisheries administrators to develop proposal.

d) Submit project proposals in accordance with budget timelines.

e) Initiate and complete project.

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Appendices

Appendix 1

2014-2018 Issues

1. Possible negative impacts of introduced species on recreational fisheries.
2. Current angler demographics are unknown.
3. Conflicting angler preferences require multiple management strategies.
4. Habitat degradation, such as sedimentation, is negatively impacting fisheries.
5. Readily available Black Hills access information for anglers is over 15 years old and needs to be updated.
6. Human dimensions data from the non-angling public in the Black Hills concerning fisheries management activities is lacking.
7. Angler compliance with existing regulations in the Black Hills is unknown.
8. Relationships with private landowners are lacking, preventing the implementation of Best Management Practices along sensitive stream areas.
9. Fish species not stocked by Game, Fish and Parks appear in new Black Hills waters.
10. Anglers may be confused by different bait regulations for different Black Hills waters.
11. Native fish populations in the Black Hills have been negatively impacted by habitat loss.
12. Native fish populations in the Black Hills have been negatively impacted by fish introductions.
13. Stream flows are impacted by human development, which will likely increase in the future.
14. Management to produce maximum angler satisfaction in the Black Hills likely requires complex and possible water-specific regulations.
15. Sunfish and perch in many Black Hills waters may not meet angler expectations.
16. Hatchery rearing influences on post-stocking performance and angler satisfaction are not always considered when making trout stocking decisions.
17. The long-term impacts of invasive or introduced species in Black Hills waters are not well understood.
18. Hatchery production of trout is limited, with hatcheries currently operating at capacity.
19. The extended time frame for requesting changes in coldwater hatchery production requires long-term planning by fisheries managers.
20. Sampling protocols and management strategies for non-game and native fish populations are lacking.
21. Sampling protocols for aquatic invertebrates and amphibians are not established.

22. Trout stocking criteria and prioritization are not well-defined.
23. Shore fishing opportunities are limited due to siltation and vegetation.
24. Long-term planning is required to implement habitat and access projects on federal lands.
25. Water quality data, such as dissolved oxygen, nutrient levels, and temperature, have not been recently collected from most Black Hills waters.
26. Population genetics information, including genetic health, source strains, and contribution to the fishery, is unknown for nearly all naturally-reproducing trout populations.
27. Data pertinent to Black Hills fisheries management collected and stored by other state and federal resource agencies is not readily available.
28. Factors affecting trout reproduction and recruitment are unknown for many streams.
29. Current information on riparian zones is lacking.
30. Many Black Hills small ponds and lakes are aging and filling with sediment, with some dams experiencing structural deterioration.
31. Habitat restoration and access projects are often not evaluated upon completion, and cost-benefit analysis is not conducted.
32. Sedimentation from forestry practices, grazing, road construction, and mining may be negatively impacting habitat quality and fish populations.
33. Overhead cover along streams may be impacted by grazing practices.
34. Instream flows are often insufficient to maintain game fish populations in many Black Hills streams.
35. Elevated summer water temperatures limit coldwater habitat in some waters.
36. Existing habitat may be limiting over-winter survival in selected creeks.
37. Sampling protocols to measure instream habitat have not been established.

2014-2018 Objectives and Completion Status:

1. ***Objective:***

   Develop an operational plan to manage the presence of undesirable introduced fish species in Black Hills waters by 2016.

   Status:

   Completed: Black Hills Fish Management Area Unauthorized Introductions Strategic and Operational Plan was created and implemented in 2016.

2. ***Objective:***

   Prevent unplanned and undesirable fish introductions by increasing angler awareness and influencing angler behavior by 2018.

   Status:

   Ongoing: Conservation Digest article was published in 2016 and continued public outreach and education occurs annually.

3. ***Objective:***

   Determine current angler demographics and preferences for Black Hills lakes and streams by June 2015.

   Status:

   Completed: Black Hills Fisheries Management: 2014 Angler Opinion Survey Results final report

4. ***Objective:***

   Develop a database that contains pertinent habitat information from Black Hills watersheds to identify and prioritize degraded waters by 2018.

   Status:

   Ongoing: An Excel spreadsheet database contains standardized habitat information on stream sites included in both cooperative research projects (e.g. Fopma in prep.) and internal surveys.

5. ***Objective:***

   Develop a procedural manual to direct the selection of habitat improvement projects and evaluation procedures by 2018.

Status:

Completed: Black Hills Fish Management Area Stream Habitat Conservation and Restoration Planning and Implementation manual created and implemented in 2017.

6. ***Objective:***

Complete existing and currently identified habitat improvement projects.

Status:

Ongoing: three identified projects completed (Pactola Basin Phase I; USFS Scenic Byway Project [Bismark, Lakota and Horse Thief Lakes] and Gimlet Creek) with the last project (Grace Coolidge Creek) to be completed winter 2019/2020.

7. ***Objective:***

Refine existing trout stocking criteria and evaluation criteria for implementation by 2018.

Status:

Completed: trout stocking criteria evaluated by management and hatchery staff and changes implemented.

8. ***Objective:***

Determine factors that may be limiting the quality of Black Hills fisheries by 2017.

Status:

Ongoing: multiple limiting factors have been identified through specific research projects such as density dependence (Rehm 2018), competition (Kientz 2016), water availability (Kenney 2018) aquatic predation (Scheibel 2015) and terrestrial predation (Galinat in prep.). However, fisheries are dynamic and limiting factors continue to be identified.

9. ***Objective:***

Generate sub-plans for the BHFMA plan by June 2015 using information from the Angler Use and Preference survey and fish population and habitat surveys.

Status:

Completed: Black Hills Reservoirs and Streams plans created, adopted and implemented in 2015.

10. Objective:

Investigate and identify streams and refuge areas which can be managed for non-game and native fish populations by 2018.

Status:

Completed: multiple research projects (e.g. Schultz 2012 and Fopma in prep.) helped identify areas for native fish management and those have been included into the Stream Management Index.

Appendix 2. Peer-reviewed publications and theses published involving SDGFP staff within the BHFMA or involving a project within the BHFMA since the last BHFMA plan was adopted in 2014.

2019

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Voorhees, J. M., M. E. Barnes, S. R. Chipps, and M. L. Brown. 2019. Effects of exercise and bioprocessed soybean meal during rainbow trout rearing. Open Biology Journal 7:1-13.

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Blain, T., G. Simpson, and M. E. Barnes. 2018. A survey of brown trout redd locations in Crow Creek, Lawrence County, South Dakota, USA. International Journal of Pure and Applied Biology 6:9-14.

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Table 1. South Dakota Natural Heritage Program listed fish species for the Black Hills Fisheries Management Area. Status abbreviations: SE = state endangered; ST = state threatened; SGCN = Species of Greatest Conservation Need.

Common Name	Scientific Name	State Status
Finescale Dace	*Chrosomus neogaeus*	SE, SGCN
Lake Chub	*Couesius plumbeus*	SGCN
Longnose Sucker	*Catostomus catostomus*	ST, SGCN
Mountain Sucker	*Catostomus platyrhynchus*	SGCN

Table 2. Current classifications for BHFMA streams.

Based on number of trout in excess of eight inches	
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
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
Class RB1	Number of wild Rainbow Trout exceeds 25 per acre
Class RB2	Number of wild Rainbow Trout is less than 25 per acre

Table 3. Major flow loss zones in the BHFMA.

Stream name	Flow loss (cubic feet per second)
Box Elder Creek	50
Spring Creek	28
Spearfish Creek	23
Grace Coolidge Creek	21
Elk Creek	19
False Bottom Creek	15
Highland Creek	10
Rapid Creek	10