YELLOWSTONE CUTTHROAT TROUT CONSERVATION STRATEGY FOR THE SHIELDS RIVER WATERSHED ABOVE CHADBOURNE DIVERSION

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Prepared by:

Carol Endicott, Scott Opitz, Brad Shepard[1], Patrick Byorth[2]
Montana Fish, Wildlife & Parks

Scot Shuler, Scott Barndt, Bruce Roberts
Gallatin National Forest

Leanne Roulson[3]
Garcia and Associates

[1] Current affiliation Wildlife Conservation Society - Yellowstone Rockies Program 320 North Willson Avenue, Bozeman, MT 59715
[2] Current affiliation, Trout Unlimited Montana Water Project. 321 East Main Street, Bozeman, Montana 59715
[3] Current affiliation HydroSolutions, 1500 Poly Drive, Suite 103, Billings, MT 59102

Table of Contents

List of Figures

List of Tables

List of Abbreviations

BLM	Bureau of Land Management
BMP	Best management practice
DEQ	Department of Environmental Quality
DNRC	Department of Natural Resources and Conservation
EPA	Environmental Protection Agency
FWP	Montana Fish, Wildlife & Parks
GIS	Geographical information system
GNF	Gallatin National Forest
GPS	Global positioning system
GWIC	Groundwater Information Center
HUC	Hydrologic unit code
LIP	Landowner Incentive Program
MCA	Montana Code Annotated
MEPA	Montana Environmental Policy Act
MFISH	Montana Fisheries Information System
MNHP	Montana Natural Heritage Program
Agreement	Memorandum of understanding and conservation agreement
NEPA	National Environmental Policy Act
NHD	National Hydrological Data
Park CD	Park Conservation District
RBT	Rainbow trout
SNTEMP	Stream network temperature model
SSTEMP	Stream segment temperature model
SVWG	Shields Valley Watershed Group
TMDL	Total maximum daily load
UILT	Upper incipient lethal temperature
Forest Service	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Service
USWA	Upper Shields Watershed Association
WRCC	Western Regional Climate Center
YCT	Yellowstone cutthroat trout
YCTCC	Yellowstone Cutthroat Trout Coordinating Committee
YNP	Yellowstone National Park

Executive Summary

The Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*), a Montana native fish, has declined markedly in abundance and distribution throughout its historic range. Factors contributing to this decline include hybridization with the closely related rainbow trout (*O. mykiss*), competition with nonnative brown (*Salmo trutta*) and brook trout (*Salvelinus fontanalis*), dewatering, and habitat degradation and fragmentation. In Montana, concerns for the persistence of Yellowstone cutthroat trout resulted in development of a cooperative agreement (the Agreement) aiming to conserve, protect, and enhance Yellowstone and westslope cutthroat trout (*O. c. lewisii*) within their historic range in the state. Signatories include a diverse group of state and federal agencies, tribes, and various stakeholder groups. The Agreement called for development of conservation strategies outlining an approach to achieve conservation objectives (FWP 2000 and FWP 2007a).

This document presents the conservation strategy required under the Agreement intended to conserve Yellowstone cutthroat trout in the Shields River watershed above the Chadbourne diversion, an irrigation diversion located in the lower reach of the Shields River (Figure 1-1). The rationale for addressing only this portion of the subbasin within this document is that the diversion presents a partial fish barrier that limits invasion of rainbow trout from Yellowstone River. This barrier to upstream invasion has contributed substantially to preservation of the widespread distribution of nonhybridized or slightly hybridized Yellowstone cutthroat trout remaining in the Shields River drainage, and provides a logical boundary for watershed level conservation efforts. A separate conservation strategy will address Yellowstone cutthroat trout in the Montana portions of its historic range, including the remaining streams in the Shields River watershed.

Although this conservation strategy is the product of collaboration among state and federal agencies, it acknowledges the need for involvement of private landowners in the drainage, and development of strategies that are compatible with the economic and social setting of this agricultural basin. The Park Conservation District (Park CD) and Shields Valley Watershed Group (SVWG), along with numerous private landowners, have already established an impressive list of conservation projects to benefit Yellowstone cutthroat trout. The conservation strategy will build on the existing relationships among agencies, Park CD, the SVWG, and private landowners.

The relatively intact distribution of Yellowstone cutthroat trout in the Shields River watershed gives the drainage high conservation value, and no other watershed in Montana has retained this spatial extent of Yellowstone cutthroat trout occupancy. Nonetheless, the remaining Yellowstone cutthroat trout face several threats. Nonnative fishes present the biggest near-term challenge to Yellowstone cutthroat trout persistence in numerous streams. Notably, brook trout continue to

invade streams in the upper watershed, resulting in rapid displacement of Yellowstone cutthroat trout in some areas. In addition, competition with, and predation by, brown trout possibly limit Yellowstone cutthroat trout abundance. Rainbow trout occur in several streams in the watershed, and present genetic threats to the pure Yellowstone cutthroat trout. Dewatering and habitat degradation limit the suitability of some streams to support Yellowstone cutthroat trout. Passage barriers in the form of road crossings or irrigation structures limit connectivity within the basin.

The proportion of streams in the basin occupied by nonnative trout is substantial. Over half of surveyed streams support at least one nonnative species. Fourteen out of 61 surveyed streams have 2 nonnative fishes, and 3 streams have all 3 introduced trout. Addressing the threats posed by these nonnative fishes will be a considerable component of Yellowstone cutthroat trout conservation in the Shields River watershed.

The conservation strategy includes general categories of actions to address the host of issues relating to Yellowstone cutthroat trout conservation in the Shields River Subbasin. These general categories are as follows:

- Reducing threats posed by nonnative fishes by limiting their expansion, removing them from some waters, and prohibiting their introduction into private ponds;
- Promoting in-stream flows through voluntary, cooperative agreements with water rights holders that emphasize sound data collection, potential compensation for contributed flows, and incorporation of agricultural producers' water rights and agricultural needs;
- Identifying barriers to fish movement throughout the basin, and modifying, removing, or maintaining these as warranted;
- Chemical or mechanical removal of nonnative fishes, coinciding with barrier construction as necessary;
- Restoring stream habitat and riparian health and function using agricultural best management practices (BMPs), riparian plantings, and stream restoration practices as warranted;
- Improving water quality with respect to nutrients and warm water temperatures by encouraging development and implementation of science-based water quality restoration plans to address these pollutants;
- Reducing sediment loading to streams by assisting the SVWG in implementing their watershed restoration plan (WRP; Confluence 2012);
- Identifying ditches entraining Yellowstone cutthroat trout, and developing solutions to reduce or prevent entrainment.

In addition to the general categories of conservation strategies, this document provides available characterizations of stream habitat and riparian health and function, which permits development of conceptual conservation approaches for many individual streams. These narratives include

brief descriptions of potential actions integrated with available information on distribution and status of Yellowstone cutthroat trout. Detailed restoration planning for these streams will follow specific site characterizations, which will also incorporate the landowner's objectives for agricultural productivity, residential use, or associated interests. All actions entailing public funds or agency personnel will be the subject of environmental review, as required under the Montana Environmental Policy Act (MEPA), the National Environmental Policy Act (NEPA), or both. A strong monitoring component will accompany restoration projects to promote the adaptive management of the basin's Yellowstone cutthroat trout.

Numerous data gaps exist that limit the ability to develop a comprehensive restoration strategy for the Yellowstone cutthroat trout in the Shields River watershed. This conservation strategy also includes provisions for studies and monitoring to fill information gaps. In general, this strategy emphasizes the value of sound science and stakeholder participation in promoting the conservation of this important natural resource.

A note on hydrologic nomenclature may be useful in reading this document. The Natural Resources Conservation Service (NRCS) classification system designates hydrologic units hierarchically, according to a numeric coding system, which assigns a hydrologic unit code (HUC) and an associated term[4]. For example, the area draining into the Shields River to its confluence with the Yellowstone River comprises a 4th code HUC, and under this system its narrative descriptor is "subbasin"; therefore, the Shields River 4th code HUC is technically referred to as the Shields River Subbasin. The next smaller hydrologic division is a 5th code HUC, which this system denotes as a watershed. Potter Creek and its tributaries are a designated 5th code HUC, and the technical name for this hydrological unit is the Potter Creek Watershed. In common use, the terms watershed, basin, and drainage are used interchangeably and typically without regard to stream order or size of the watershed. Moreover, this terminology is not consistent with terms used by area residents or members of the SVWG. This document uses the NRCS nomenclature when specifically referring to designated HUCs. Otherwise, terms like watershed and drainage will be used generically. Notably, the portion of the Shields River Subbasin treated under this plan will be referred to as the Shields River watershed.

[4] http://www.nrcs.usda.gov/programs/rwa/Watershed_HU_HUC_WatershedApproach_defined_6-18-07.pdf

1.0 Introduction

Yellowstone cutthroat trout were once widely distributed in portions of the Yellowstone River drainage of south central Montana. A variety of factors have contributed to a significant decline in the distribution and abundance of Yellowstone cutthroat trout across their range, including introduction of nonnative salmonids, hybridization with rainbow trout, construction of migration barriers, dewatering, and habitat and water quality degradation. The Shields River Subbasin is rare among watersheds supporting Yellowstone cutthroat trout in Montana, as this fish occurs nearly throughout the basin, rather than being relegated to headwater reaches. Because of its importance to Yellowstone cutthroat trout, the Shields River Subbasin is a core area for conservation and restoration of the subspecies. This conservation strategy will guide the efforts of Montana Fish, Wildlife, & Parks (FWP) and its partners to protect and restore Yellowstone cutthroat trout in the Shields River watershed, upstream of the Chadbourne diversion.

FWP developed this strategy in accordance with the *Cooperative Conservation Agreement for Yellowstone Cutthroat Trout in Montana* (YCTCC 2000). The cooperative conservation agreement was originally developed with input from the Crow Tribe, FWP, DEQ, Montana Department of Natural Resources and Conservation (DNRC), U.S. Forest Service (Forest Service), U.S. Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (USFWS), and Yellowstone National Park (YNP). This group of cooperating entities came together in 1998 to facilitate effective conservation of Yellowstone cutthroat trout by protecting, enhancing, and restoring the species within its historic range in Montana (YCTCC 2000)**.** Although the conservation agreement expired in September 2005, an updated agreement entitled *Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana* (FWP 2007a) has been developed to foster continued progress toward the conservation of cutthroat trout in Montana. This Agreement includes a commitment to develop conservation strategies for each subspecies of cutthroat trout, and to develop conservation plans for discrete regions of the range of cutthroat trout across Montana. This document is an extension of the Agreement and the conservation plan to guide Yellowstone cutthroat trout management in the Shields River watershed upstream of the Chadbourne diversion.

Although governmental agencies developed the Agreement and conservation plan, the plan acknowledges that local communities are essential partners in native species conservation. The Park CD will be a collaborator, as this strategy is consistent with their mission to serve as leaders, facilitators, and educators in the conservation of natural resources. In addition, the SVWG will be a valuable partner in Yellowstone cutthroat trout conservation. This group has completed numerous projects benefitting native fish, and has begun a basin-wide restoration planning effort to guide future efforts.

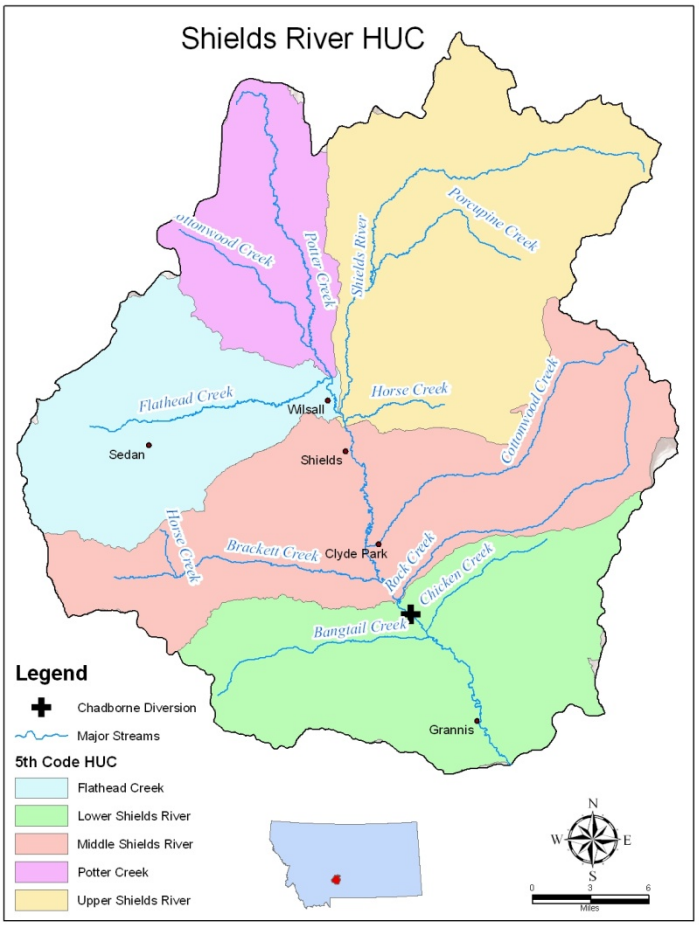

Figure 1-1: The Shields River Subbasin (4th Code HUC 10070003), major tributaries, and watersheds (5th code HUCs).

The spatial focus of this Yellowstone cutthroat trout restoration strategy is the Shields River watershed upstream of the Chadbourne diversion (Figure 1-1). The Chadbourne diversion was built in 1908, and was likely an impediment to fish passage historically, although rainbow trout probably can pass over the structure when flows are within a specific range (OASIS 2006). The Chadbourne diversion makes a logical management divider, because it has functionally isolated the Yellowstone cutthroat trout population from potential genetic introgression with rainbow trout. Yellowstone cutthroat trout above the Chadbourne diversion in the Shields River are only slightly hybridized, and many populations within tributaries show no evidence of introgression (Shepard 2004).

Conservation of native fishes in Montana's waters is a priority of the State of Montana and signatory federal agencies, including the U.S. Forest Service, which has a considerable amount

of administered land in the subbasin. To that end, the conservation goal for Yellowstone cutthroat trout in the Shields River watershed is as follows:

> To ensure the long-term, self-sustaining persistence of Yellowstone cutthroat trout by maintaining the genetic diversity and life history strategies represented by the remaining local populations, and protecting their ecological, recreational, and economic values. To the extent practical and feasible, the drainage above Chadbourne diversion will be managed as one metapopulation.

To meet the goal of long-term conservation of Yellowstone cutthroat trout in the Shields River watershed, these objectives, adopted from the Agreement (FWP 2007a), will guide conservation efforts:

Objective 1. Maintain, secure, and/or enhance all cutthroat trout populations designated as core or conservation populations.

Objective 2. Continue to survey waters to locate additional cutthroat trout populations and determine their distribution, abundance, and genetic status.

Objective 3. Seek collaborative opportunities to restore and/or expand Yellowstone cutthroat trout into selected suitable habitats within its historical ranges.

Objective 4. Continue to monitor cutthroat trout distributions, genetic status, and abundance using a robust, range-wide, statistically sound monitoring design.

Objective 5. Provide public outreach, technical information, inter-agency coordination, administrative assistance, and financial resources to meet the listed objectives and encourage conservation of Yellowstone cutthroat trout.

Metapopulation theory provides a framework for watershed scale management of salmonids, which will guide conservation activities in the Shields River watershed. A metapopulation consists of a group of spatially separated populations of the same species that interact on some level (Levins 1969). Each of these subpopulations faces an extinction risk relating to disturbance events or disease. Maintaining connectivity among subpopulations allows recolonization following disturbance, and allows for gene flow; thereby reducing threats of inbreeding in isolated populations. Managing the Shields River watershed above Chadbourne diversion as a metapopulation will involve promoting connectivity throughout the basin to promote dispersal of Yellowstone cutthroat trout, and other native fishes, which will increase the potential for recolonization and promote genetic diversity. This approach will increase the probability of persistence of Yellowstone cutthroat trout in the watershed as a whole. Moreover, the emphasis on promoting genetic diversity is consistent with conservation objectives established in the Agreement.

Although maintaining connectivity is a key component of the strategy in the Shields River watershed, effective conservation must also acknowledge the role of nonnative species in displacement of Yellowstone cutthroat trout. Brown trout and brook trout have wide distribution in the watershed, and these species displace Yellowstone cutthroat trout through competition, predation, or both. Rainbow trout have a more restricted distribution; however, invasion of this fish into new portions of the watershed puts the genetic integrity of the basin's Yellowstone cutthroat trout at risk. Specific actions to conserve Yellowstone cutthroat trout in the Shields River watershed will require balancing the threats associated with isolation with those posed by sympatry with nonnatives. In some cases, construction of a barrier to prevent upstream movement of nonnative trout may be the best alternative, even it if results in a loss of connectivity among Yellowstone cutthroat trout metapopulations.

2.0 Status of Yellowstone Cutthroat Trout

2.1 Range-Wide Population Assessment

Information on distribution and status of Yellowstone cutthroat trout across its historic range comes from a 2006 status review (May et al. 2007). This document is the second iteration in evaluating the range-wide status of Yellowstone cutthroat trout, and updates and refines the previous status review (May et al. 2003). Both reviews employed a replicable, quantitative approach within a project geographical information system (GIS). The 2006 effort expanded the protocol to include additional attribute information in four categories: 1) presence of nonnative fishes; 2) evaluation of habitat quality; 3) incorporation of stocking records at the stream or segment level; and 4) describing life history behaviors for each population (May and Shepard 2007).

During the assessments, biologists classified each cutthroat trout population as follows:

1) *core conservation populations,* which are genetically unaltered (< 1% genetic contribution from other species);
2) *conservation populations* that may be either genetically unaltered or slightly introgressed, but have attributes worthy of conservation (<10% genetic contribution from other species); and
3) *sport fish populations* that are managed primarily for their recreational fishery value (May et al. 2003).

Core conservation populations have important genetic value and could serve as donor sources for developing either captive brood or for refounding additional populations. Management will emphasize conservation, including potential expansion, of both core and conservation populations.

The Yellowstone cutthroat trout is native to waters in the upper portions of the Yellowstone River drainage in Montana and Wyoming, and the upper Snake River watershed in Idaho, Wyoming, Nevada, and Utah; however, distribution and abundance has changed substantially from the historic condition (Figure 2-1; May et al. 2007). The 2006 status review estimated Yellowstone cutthroat trout historically occupied over 17,700 stream miles range-wide, with about 43% of stream miles still occupied by core, conservation, and sport fishing populations (May et al. 2007). Genetically unaltered Yellowstone cutthroat trout were estimated to occupy a sizeable proportion of the current range, with 41% of miles still supporting fish tested as unaltered, and another 25% of stream miles with fish suspected to be unaltered (Table 2-1). Formal genetic testing of the populations within the suspected to be unaltered category is a significant research need that will allow generation of specific conclusions on the status Yellowstone cutthroat trout occupying these 1,854 stream miles.

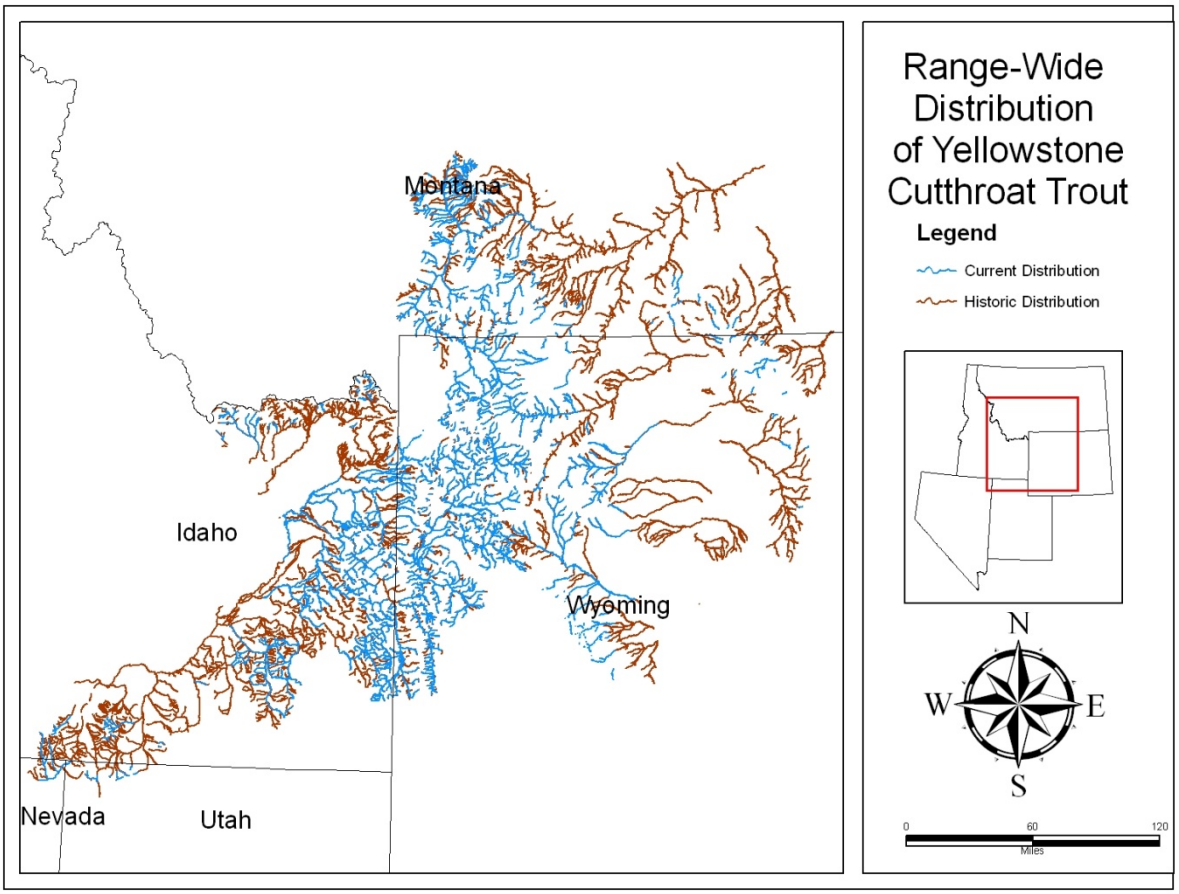

Figure 2-1: Historic and current distribution of Yellowstone cutthroat trout across its native range (FWP fisheries database).

Table 2-1: Genetic status for Yellowstone cutthroat trout by stream length (miles) within its current multi-state range as of 2006 (from May et al. 2007).

Genetic Status	*Stream Miles*	*% of Occupied*
Tested unaltered	3,112	41%
Tested; ≥ 1% to ≤ 10% introgression	612	8%
Tested; > 10% to ≤ 25% introgression	103	1%
Tested; > 25% introgression	56	1%
Suspected unaltered	1,854	25%
Potentially altered	1,614	21%
Mixed stock, altered and unaltered	169	2%
Not applicable	7	0%
Total	**7,527**	**100%**

Although distribution in streams has decreased, Yellowstone cutthroat trout have increased substantially in the number of lakes occupied, owing to introductions into previously fishless lakes. An estimated 205 lakes currently support Yellowstone cutthroat trout populations, compared to 61 historically occupied lakes (May et al. 2007).

In Montana, Yellowstone cutthroat trout historically occurred in nearly 4,300 miles of stream, which accounted for 24% of the fish's total historic distribution (May et al. 2007). Core, conservation and sport populations still reside in 32% of the fish's historic range in Montana (May et al. 2007). Analysis of the most recent genetic and distribution data finds genetically unaltered populations remain in 35% of the currently occupied stream habitat, and another 28% of stream miles potentially support unaltered populations (Table 2-2). Genetic analyses indicate 15% of currently occupied habitat support slightly hybridized fish, with less than 10% of genetic contributions from rainbow trout or westslope cutthroat trout. Another 28% of stream miles potentially support hybridized fish; however, testing is required to verify genetic status of these populations.

Table 2-2: Current genetic status for Yellowstone cutthroat trout by stream length (miles) within Montana (FWP database).

Genetic Status	*Stream Miles*	*% of occupied*
Tested unaltered	568	35%
Tested; ≥ 1% to ≤ 10% introgression	235	15%
Tested; unknown % introgressed	2	0%
Suspected unaltered	202	13%
Potentially altered	450	28%
Mixed stock, altered and unaltered	58	4%
Not Applicable	3	0%
Unknown	89	6%
Total	**1,607**	**100%**

Distribution of the remaining Yellowstone cutthroat trout populations is uneven across the fish's historic range. The western parts of its historic range, particularly in the Upper Yellowstone and Shields River subbasins, support the greatest extent of the remaining Yellowstone cutthroat trout populations (Figure 2-2). Proceeding east, fewer Yellowstone cutthroat trout populations exist, and these remaining populations are rarely connected with others.

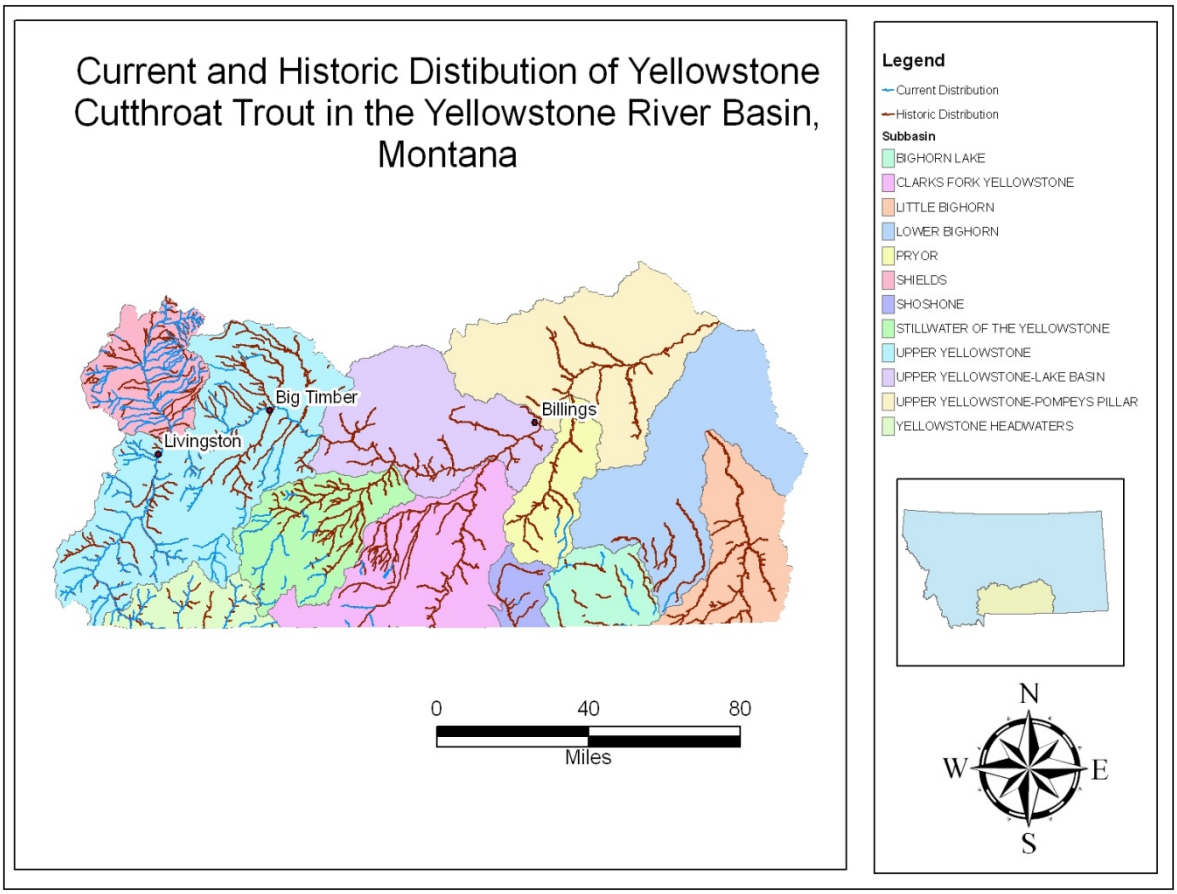

Figure 2-2: Current and historic distribution of Yellowstone cutthroat trout in streams in Montana.

Examination of the percent of historically occupied stream miles still supporting Yellowstone cutthroat trout further illustrates the trend for greater fragmentation and reduced distribution in the eastern extent of its range (Table 2-3). The Yellowstone Headwaters Subbasin, which lies mostly in Wyoming, supports a nearly intact extent of Yellowstone cutthroat trout, with 96% of historically occupied waters still containing this fish. The Shields River and Upper Yellowstone subbasins supported the second and third greatest extent of habitat still occupied, respectively. In other subbasins, Yellowstone cutthroat trout still reside in as little as 2% of their historic range, or have been extirpated.

Table 2-3: Comparison of historically and currently occupied stream miles for subbasins (4th Code HUCs) with water in Montana (from May et al. 2007).

Name	*HUC*	*Historically Occupied Miles*	*Currently Occupied Miles*	*Percent of Historic Still Occupied*
Yellowstone Headwaters	10070001	952	914	96%
Upper Yellowstone	10070002	1,116	560	50%
Shields	10070003	682	452	66%
Upper Yellowstone-Lake Basin	10070004	288		0%
Stillwater	10070005	416	103	25%
Clarks Fork Yellowstone	10070006	524	81	15%
Upper Yellowstone-Pompey's Pillar	10070007	273		0%
Pryor	10070008	225	26	12%
Bighorn Lake	10080010	277	65	23%
Shoshone	10080014	172	4	2%
Lower Bighorn	10080015	422	7	2%
Little Bighorn	10080016	224	20	9%

2.2 Distribution and Genetic Status of Yellowstone Cutthroat Trout in the Shields River Watershed

Investigations spanning the late 1980s through 2004 mapped Yellowstone cutthroat trout distribution and genetic purity throughout the basin (Tohtz 1999a; Jones and Shuler 2004; and Shepard 2004). Yellowstone cutthroat trout still occur throughout much of the watershed, including most of the main stem and a majority of tributaries, although they have been extirpated from some streams (Figure 2-3).

Genetic analyses of fish indicated pure Yellowstone cutthroat trout occupy a substantial number of stream miles (Figure 2-4). Moreover, no populations tested exhibited more than 8% hybridization with rainbow trout (Table 2-4). Of the 645 miles classified as historically occupied by Yellowstone cutthroat trout, core and conservation populations remain in 66% of this habitat (May et al. 2007). Analysis of current genetic and distributional data indicates 36% of occupied habitat supports pure Yellowstone cutthroat trout as indicated by genetic analyses, and another 25% of stream miles are likely to support unaltered fish (Table 2-5). Similar to May et al.'s findings, the most recent data indicate hybridized fish with less than 10% rainbow trout genes occupy 7% of the currently occupied stream miles, although another 20% of the presumed distribution may have some level of hybridization.

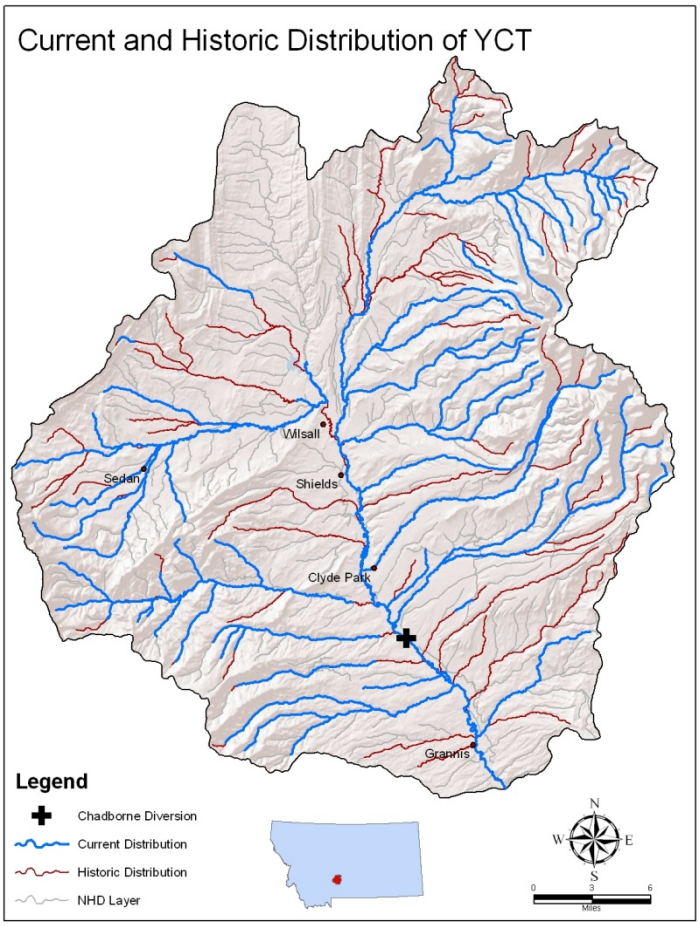

Figure 2-3: Current and historic distribution of Yellowstone cutthroat trout (YCT) in the Shields River Subbasin (MFISH database, January 2012).

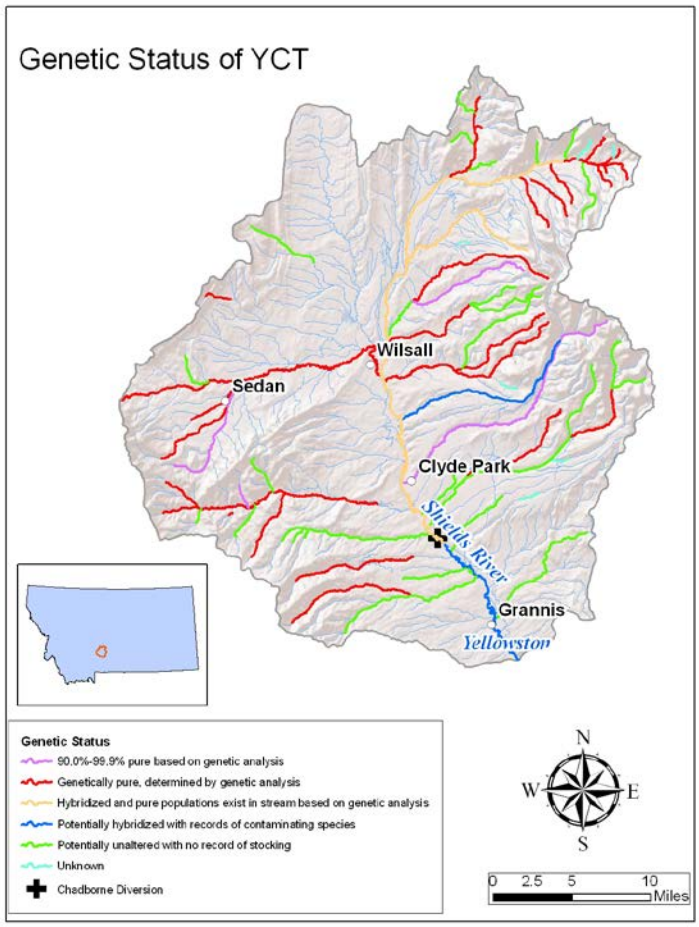

Figure 2-4: Genetic status of Yellowstone cutthroat trout (YCT) in the Shields River watershed (MFISH database, January 2012).

Table 2-4: Summary of genetically tested populations of stream dwelling Yellowstone cutthroat trout in Shields River watershed (MFISH database). (YCT = Yellowstone cutthroat trout, RBT = rainbow trout)

Stream	*Tributary To*	*Year*	*Species*	*Number of Fish*	*Percent YCT Genes*	*Count*
Bangtail Creek	Shields River	2010	YCT	10	100%	0
Bangtail Creek	Shields River	1999	YCT	22	100%	0
Bangtail Creek	Shields River	1990	YCT	12	100%	0
Bennett Creek	Shields River	1990	YCT	10	100%	0
Brackett Creek	Shields River	2002	YCT	19	0%	18
Brackett Creek	Shields River	2002	YCT x RBT	19	0%	1
Brackett Creek	Shields River	1987	YCT	20	100%	0
Cache Creek	Fairy Creek	2001	YCT	22	97.33%	0
Carrol Creek	Fairy Creek	2001	YCT	2	0%	2
Carrol Creek	Fairy Creek	1990	YCT	19	100%	0
Cottonwood Creek	Shields River	1999	YCT	32	99.10%	0
Cottonwood Creek	Shields River	1999	RBT	32	0.90%	0
Daisy Dean Creek	Shields River	1999	YCT	25	100%	0
Deep Creek	Shields River	1990	YCT	10	100%	0
Dugout Creek	Shields River	1992	YCT	5	100%	0
East Fork Smith Creek	Smith Creek	1988	YCT	9	100%	0
Fairy Creek	Cache Creek	2002	YCT	10	100%	0
Fairy Creek	Cache Creek	1990	YCT	3	100%	0
Flathead Creek	Shields River	1990	YCT	9	100%	0
Hammond Creek	Rock Creek	2010	YCT	14	100%	0
Hammond Creek	Rock Creek	2010	YCT	16	100%	0
Horse Creek	Brackett Creek	1993	YCT	9	92.80%	0
Horse Creek	Brackett Creek	1993	RBT	9	7.20%	0
Horse Creek	Shields River	1999	YCT	30	100%	0
Lodgepole Creek	Shields River	1986	YCT	4	100%	0
Middle Fork Brackett Creek	Brackett Creek	1987	YCT	21	100%	0
Middle Fork Horse Creek	Horse Creek	1991	YCT	5	100%	0
Middle Fork Muddy Creek	North Fork Muddy Creek	2010	YCT	26	100%	0
Miles Creek	Brackett Creek	2002	YCT	26	100%	0
Mill Creek	Shields River	1990	YCT	11	100%	0
North Fork Brackett Creek	Brackett Creek	1987	YCT	21	100%	0
North Fork Elk Creek	Elk Creek	1999	YCT	44	100%	0
North Fork Elk Creek	Elk Creek	1993	YCT	13	100%	0
North Fork Willow Creek	Willow Creek	2010	YCT	16	100%	0
North Fork Willow Creek	Willow Creek	2002	YCT	19	100%	0
North Fork Willow Creek	Willow Creek	1993	YCT	17	100%	0
Porcupine Creek	Shields River	1999	YCT	34	0%	33
Porcupine Creek	Shields River	1999	YCT x RBT	34	0%	1
Rock Creek	Shields River	1988	YCT	20	100%	0
Scofield Creek	Shields River	1990	YCT	10	100%	0

Stream	*Tributary To*	*Year*	*Species*	*Number of Fish*	*Percent YCT Genes*	*Count*
Table 2-4 continued						
Shields River	Yellowstone River	1999	YCT	23	0%	20
Shields River	Yellowstone River	1999	YCT x RBT	23	0%	3
Shields River	Yellowstone River	1989	YCT	25	100%	0
Shields River	Yellowstone River	1989	YCT	25	100%	0
Shields River	Yellowstone River	1988	YCT	22	100%	0
Smith Creek	Shields River	1992	YCT	1	100%	0
Smith Creek	Shields River	1988	YCT	23	100%	0
South Fork Carrol Creek	Carrol Creek	1990	YCT	11	100%	0
South Fork Elk Creek	Elk Creek	1999	YCT	29	99.10%	0
South Fork Elk Creek	Elk Creek	1999	RBT	29	0.90%	0
South Fork Flathead Creek	Flathead Creek	1990	YCT	7	100%	0
South Fork Horse Creek	Horse Creek	1991	YCT	7	100%	0
South Fork Shields River	Shields River	1992	YCT	10	100%	0
Turkey Creek	Shields River	1986	YCT	13	100%	0
Unnamed Trib to Weasel Cr RM 0.4	Weasel Creek	2001	YCT	1	100%	0

Table 2-5: Summary of genetic status for stream dwelling Yellowstone cutthroat trout (FWP database, January 2012).

Genetic Status	*Stream Miles*	*% of Occupied*
Tested unaltered	162	39%
Tested; ≥ 1% to ≤ 10% introgression	40	10%
Suspected unaltered	123	29%
Potentially altered	27	6%
Mixed stock, altered and unaltered	59	14%
Unknown	7	2%
Total	417	100%

In summary, the wide distribution of Yellowstone cutthroat trout in the Shields River Subbasin, combined with the high degree of genetic purity, makes the subbasin one of the few remaining basin level strongholds for Yellowstone cutthroat trout in Montana. The conservation objectives established under the cutthroat trout Agreement (FWP 2007a) provide the framework for conserving existing populations, and restoring pure Yellowstone cutthroat trout within the Shields River watershed.

2.3 Distribution of Other Fish Species in the Shields River Subbasin

The Shields River Subbasin supports a fish assemblage composed of native and nonnative species (Table 2-6). Of the eleven species present, most are native, and include Yellowstone

cutthroat trout, mountain whitefish, three suckers, two members of the minnow family, and mottled sculpin. Nonnatives include rainbow trout, brown trout, and brook trout.

Table 2-6: Fishes present in the Shields River Subasin.

Family	***Common Name***	***Scientific Name***	***Origin***
Sucker (Catostomidae)	Mountain sucker	*Catostomus platyrhynchus*	Native
	White sucker	*Catostomus commersoni*	Native
	Longnose sucker	*Catostomus catostomus*	Native
Minnow (Cyprinidae)	Lake chub	*Couesius plumbeus*	Native
	Longnose dace	*Rhinichthys cataractae*	Native
Trout (Salmonidae)	Rainbow trout	*Oncorhynchus mykiss*	Nonnative
	Yellowstone cutthroat trout	*O. clarkii bouvieri*	Native
	Brown trout	*Salmo trutta*	Nonnative
	Brook trout	*Salvelinus fontanalis*	Nonnative
	Mountain whitefish	*Prosopium williamsoni*	Native
Sculpin (Cottidae)	Mottled sculpin	*Cottus bairdi*	Native

Rainbow trout are a considerable threat to Yellowstone cutthroat trout persistence because of the risk of hybridization and genetic introgression between the species. Rainbow trout are mainly restricted to the lower portions of the Shields River and Cottonwood and Brackett creeks (Figure 2-5). Rainbow trout were stocked into Brackett, Cottonwood, and Daisy Dean creeks, and the Shields River until the early 1970s (Shepard 2004). In addition, rainbow trout can probably access the Shields River from lower source populations, particularly from the Yellowstone River, but the Chadbourne irrigation diversion has likely limited the ability of rainbow trout to invade the Shields River watershed. This diversion was believed to function as a near total barrier to upstream fish movement until relatively recently; however, hydraulic modeling suggests the diversion may be passable at some flows (OASIS 2006). Moreover, apparently fluvial rainbow trout are present in spring sampling efforts upstream of the Chadbourne diversion, and these fish are likely migrants from Yellowstone or lower Shields rivers (S.T. Opitz, FWP, personal communication). Genetic testing of fish collected from the Shields River near Clyde Park, Montana in 1999 found several fish that were first-generation hybrids between rainbow and Yellowstone cutthroat trout (Shepard 2004), which suggests a recent invasion event.

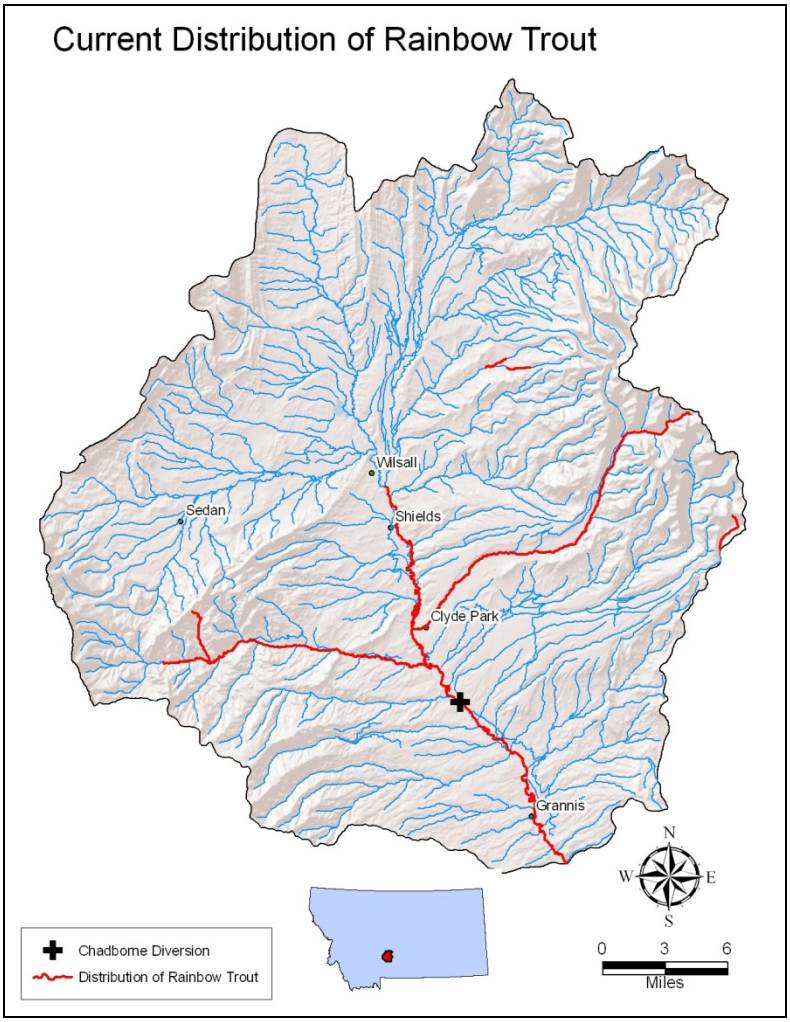

Figure 2-5: Distribution of rainbow trout in the Shields River watershed (FWP database, January 2012).

Brook trout occur throughout much of the basin (Figure 2-6), and are currently expanding into waters that previously supported Yellowstone cutthroat trout as the only salmonid (Shepard 2004; FWP, Livingston office files). Brook trout are likely to eventually invade all accessible habitat in the Shields River Subbasin (Shepard 2004). This rapid invasion is of extreme concern from a Yellowstone cutthroat trout conservation standpoint, as brook trout invasion often coincides with extirpation of Yellowstone cutthroat trout. Shepard (2004) found several streams where brook trout had likely eliminated Yellowstone cutthroat trout since the mid-1970s and a rapid invasion is underway in the headwaters of the Shields River (FWP, Livingston Office files). The threat brook trout pose to Yellowstone cutthroat trout, especially in headwaters streams, cannot be overstated.

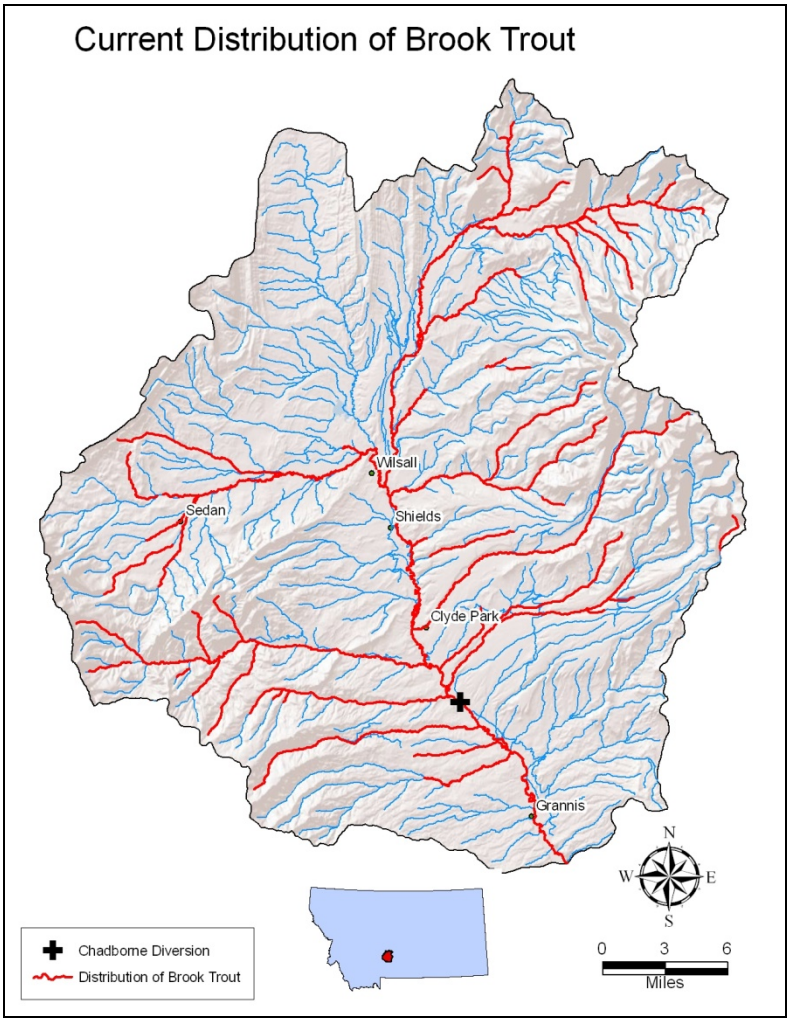

Figure 2-6: Distribution of brook trout in the Shields River watershed (FWP database, January 2012).

Brown trout are also present in the Shields River watershed and have wide distribution throughout the Shields River and the lower portions of most of its tributaries (Figure 2-7). Brown trout pose a threat through competition and perhaps predation. Overall, brown trout pose less of a risk to Yellowstone cutthroat trout than rainbow trout and brook trout, although brown trout tend to displace native fish in lower elevation streams (Behnke 1992; de la Hoz Franco and Budy 2005; Wood and Budy 2009) and this tendency appears to hold true for brown trout and Yellowstone cutthroat trout. Their abundance in the main stem of the Shields River and lower reaches of several tributaries may be among the reasons Yellowstone cutthroat trout are relatively rare in these areas, although other factors such as habitat condition, water temperature, and summer flow regime may be contributing factors.

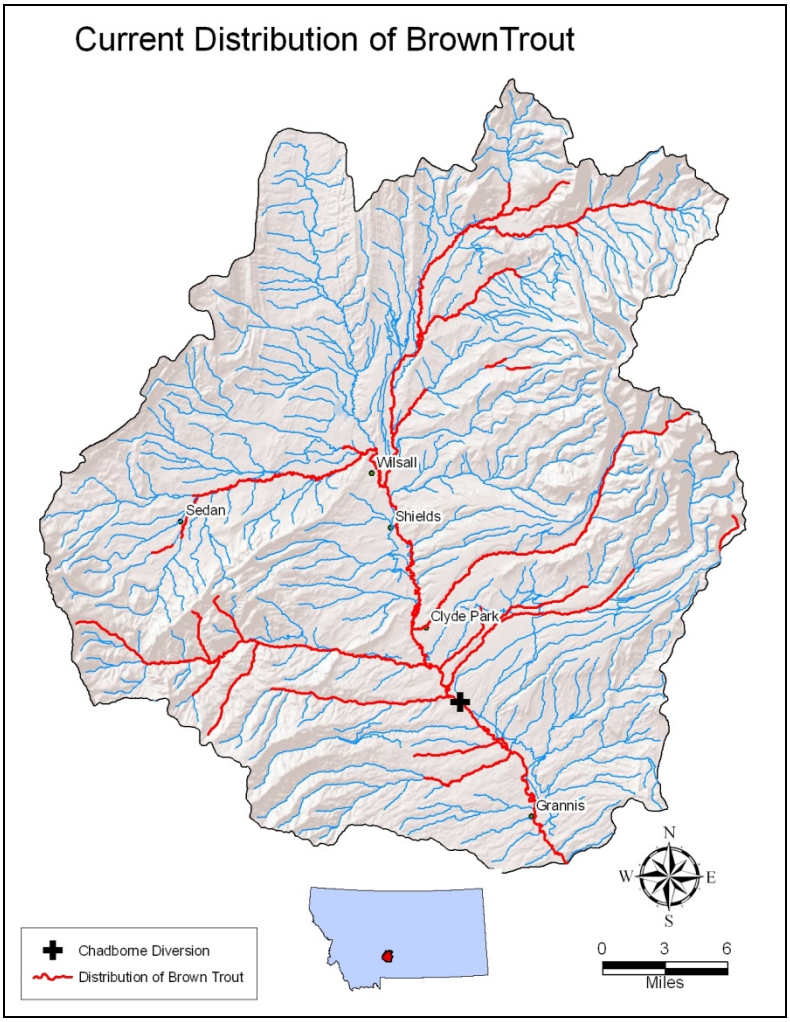

Figure 2-7: Distribution of brown trout in the Shields River watershed (FWP database, January 2012).

Although brown trout pose some risk to Yellowstone cutthroat trout, especially in lower elevation reaches, Yellowstone cutthroat trout are able to persist in sympatry in with brown trout in some higher elevation streams. For example, Yellowstone cutthroat trout coexisted with brown trout in Lower Deer Creek, a tributary of the Yellowstone River downstream of Big Timber, for decades, although brown trout were the more abundant species and appeared to be increasing relative to Yellowstone cutthroat trout in recent years (MFISH database). In contrast, fisheries investigations in East Fork Duck Creek, a stream draining the south end of the Crazy Mountains found a marked reversal in Yellowstone cutthroat trout abundance compared to brown trout between the early 1980s and 2007. In the 1980s, Yellowstone cutthroat trout outnumbered brown trout by up to sevenfold (White 1984; R.J. White, Trout Habitat Specialists, personal communication). In 2007, brown trout were three times as abundant as Yellowstone cutthroat trout, suggesting the possibility for future extirpation. Recent electrofishing surveys

indicate brown trout are increasing their range into the upper Shields River watershed, which is a cause for concern and requires further study (B.B. Shepard, WCS, personal communication).

Continued invasion of brown trout into headwater strongholds for Yellowstone cutthroat trout is possible, but the extent of the threat remains unknown. Timing of spawning and associated abiotic factors may limit, but not prevent, the invasion of brown trout into higher elevation reaches (Wood and Budy 2009). Current and future research into species invasions in the Upper Shields River Watershed may shed light on the potential for brown trout to invade headwaters. Moreover, conservation efforts such as fish removal and barrier construction may protect the headwaters populations of Yellowstone cutthroat trout in the Shields River watershed from brook trout and brown trout.

Although brown trout are not entirely compatible with Yellowstone cutthroat trout, conservation of Yellowstone cutthroat trout will not entail suppression or eradication of this popular sport fish in most of the Shields River and its tributaries. Brown trout will continue to provide sportfishing opportunities in a considerable portion of the Shields River Subbasin. Any potential brown trout removal would likely be limited headwater streams. Therefore, the vast majority of the main stem of the Shields River and the lower elevation reaches of its tributaries would continue to be managed as a recreational fishery for brown trout, with catch-and-release regulations applying to Yellowstone cutthroat trout.

2.4 Recent Yellowstone Cutthroat Trout Population Trends in the Shields River Subbasin

Fisheries investigations in the 2000s examined distribution and abundance of Yellowstone cutthroat trout, genetic status, and presence of competing species in a number of tributary streams in the Shields River watershed. The results of these studies allow inference on population trends and shed light on the relative security of subpopulations.

From 2000 through 2003, Shepard (2004) sampled over 30 tributary streams in the Shields River watershed. This study involved a systematic sampling scheme to estimate the relative abundance and distribution of fishes, and to quantify stream habitat characteristics. Fish population estimates occurred at 2-mile intervals along assessed streams. In addition, sections sampled in the 1970s (Berg 1975) were resampled to evaluate temporal trends.

This effort confirmed the continued wide distribution of Yellowstone cutthroat trout in the Shields River watershed, as nearly all trout-bearing sites yielded Yellowstone cutthroat trout (Shepard 2004). Nonetheless, findings pertaining to brook trout provided cause for concern. Brook trout had expanded their range in the Shields River watershed, and were displacing

Yellowstone cutthroat trout at several locations. In addition, brook trout made up an increasing proportion of trout communities throughout much of the drainage. Shepard (2004) speculated that brook trout would ultimately invade all streams where they have physical access, which places Yellowstone cutthroat trout in the basin at risk of extirpation.

Fisheries investigations conducted by the U.S. Forest Service also demonstrate displacement of Yellowstone cutthroat trout by nonnative brook trout. These population surveys occurred on forestlands, primarily in the headwater reaches of Smith and Rock creeks, and the South Fork of the Shields River (Jones and Shuler 2004, Forest Service 2006 file data). Forest Service biologists have documented an expansion in the distribution of brook trout and declines, and potential extirpation, of Yellowstone cutthroat trout, especially where brook trout co-occur.

In 2009, FWP, the Gallatin National Forest (GNF), and YNP collaborated on an intensive survey of streams in the upper Shields River watershed, with streams upstream of the confluence with Smith Creek being the focus of the investigation. This effort found continued invasion of brook trout into these streams, and apparent displacement of Yellowstone cutthroat trout in some streams. On the positive side, all genetic samples collected in this effort showed no evidence of hybridization with rainbow trout.

The recent fisheries investigations provide cause for concern about the security of Yellowstone cutthroat trout in the Shields River watershed. Shrinking distribution following recent invasions of brook trout indicate intervention is consistent with conservation goals and objectives for Yellowstone cutthroat trout conservation. Likewise, increased distribution of brown trout is some headwaters streams presents a potential threat to Yellowstone cutthroat trout and warrants continued monitoring, with intervention occurring as warranted.

2.5 State and Federal Status

Declines in abundance and range of Yellowstone cutthroat trout have prompted state and federal agencies to assign special status to this species. The State of Montana considers the Yellowstone cutthroat trout a species of special concern, and Region 1 of the Forest Service classifies Yellowstone cutthroat trout as a sensitive species. The Montana Natural Heritage Program (MNHP) ranks Yellowstone cutthroat trout as a “G4, T2, S2 species”, which means cutthroat trout are secure globally, but Yellowstone cutthroat trout are imperiled over their range and within Montana (MNHP and FWP 2008).

Concerned about the potential for extinction of Yellowstone cutthroat trout, environmental advocacy groups petitioned the USFWS to list Yellowstone cutthroat trout as a threatened species under the Endangered Species Act (ESA) on August 18, 1998 (Smith 1998). Following review of the petition, and all available scientific and commercial information pertaining to

Yellowstone cutthroat trout, the USFWS found that the petition did not present sufficient information indicating listing the Yellowstone cutthroat trout was warranted (66 FR 11244). In January 2004, a civil suit filed in Colorado (Civil Action number 04-F-0108[OEs]) challenged this finding. The basis of this lawsuit was a decline in Yellowstone cutthroat trout abundance associated with habitat degradation or loss. The examples listed included livestock grazing, logging, mining, other human activities, and dewatering of streams. A settlement of the lawsuit initiated a status review under ESA, which affirmed the finding that listing Yellowstone cutthroat trout as a threatened species was "not warranted" (71 FR 8819). In May of 2006, petitioners issued a 60-day notice of intent to sue, indicating challenges to these findings are probable.

3.0 Shields River Subbasin Characterization

The Shields River Subbasin encompasses approximately 289,000 acres and flows into the Yellowstone River, east of Livingston, Montana (Figure 3-1). The Shields River valley is primarily agricultural land, and production of cattle, hay, and small grains is the foundation of the local economy. Rangeland makes up the majority of the land use at 59% (USWA 2001). Major towns in the region include Wilsall and Clyde Park, and agriculture provides the major economic base for these small communities. Private land ownership in the watershed constitutes 81% of the area, while the Forest Service administers 16% of land base, primarily in the headwater reaches on the east and west sides of the watershed (USWA 2001). BLM (0.4%) and state lands (2.5%) are typically small parcels (≤ 1 section) and are scattered throughout the watershed.

Most streams have headwaters in the mountains that form the eastern and western extents of the watershed and many of these streams flow through the GNF. The Crazy Mountains bound the watershed on the east, and the Bridger and Bangtail ranges form the western boundary. Elevations range from 4,300 feet at the mouth of the Shields River to 11,000 feet at the summit of Crazy Peak in the Crazy Mountains. The Bridger Range rises to an elevation of 9,500 feet. As most streams originate at high elevations, snowmelt is the primary driver of the hydrology resulting in a spring rise, followed by a decline to base flows by fall, although irrigation activities have altered the hydrograph from the natural regime. A few streams originate at lower elevations and function like warm-water prairie streams with lower gradients, finer bed material, and a less pronounced spring runoff.

Precipitation in the Shields River valley generally falls between 13 to 15 inches per year; however, the weather station at Wilsall reports a mean of just over 20 inches for the period of record from 1957 to 2004 (WRCC 2005). The Bridger Range in the west has an annual precipitation of over 50 inches, and the Crazy Mountains in the east average around 60 inches of annual precipitation. About 68% of the annual precipitation falls from April through September,