Horse Creek Watershed Fisheries Investigations

2008

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1.0 Introduction

The Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*), a Montana native, has declined in abundance and distribution throughout its historic range. Seeking to reverse this trend on private lands, the Landowner Incentive Program/Yellowstone cutthroat trout project assists private landowners seeking to improve habitat for Yellowstone cutthroat trout on their property. This report documents ongoing evaluations for a potential project to restore fish passage through an impassable culvert on South Fork Horse Creek (Figure 1-1). This reports builds on an initial project assessment that identified this perched, steep, and long culvert as a probable barrier to upstream movement by fish (Endicott 2007). The objective of this report is to document results of fisheries investigations conducted to guide decision-making regarding providing passage through this road crossing.

Figure 1-1: Perched, steep, and long culvert on South Fork Horse Creek.

A second objective of this report is to generate general recommendations for conserving Yellowstone cutthroat trout in the Horse Creek watershed. Fish population assessments and evaluations of habitat in assessed streams provide an opportunity to identify factors limiting Yellowstone cutthroat trout. Using the results of these assessments, FWP will

seek opportunities to work with private landowners on implementation of projects designed to protect Yellowstone cutthroat trout within watershed.

2.0 Project Area

The Horse Creek watershed lies on the east side of the Shields River basin, and Horse Creek joins the Shields River just downstream of Wilsall, Montana (Figure 2-1). Coniferous forest dominates higher elevations within the watershed, and streams enter rangeland in valley portions. Land uses in the Horse Creek watershed are primarily agricultural, with livestock grazing and irrigated forage production being dominant activities.

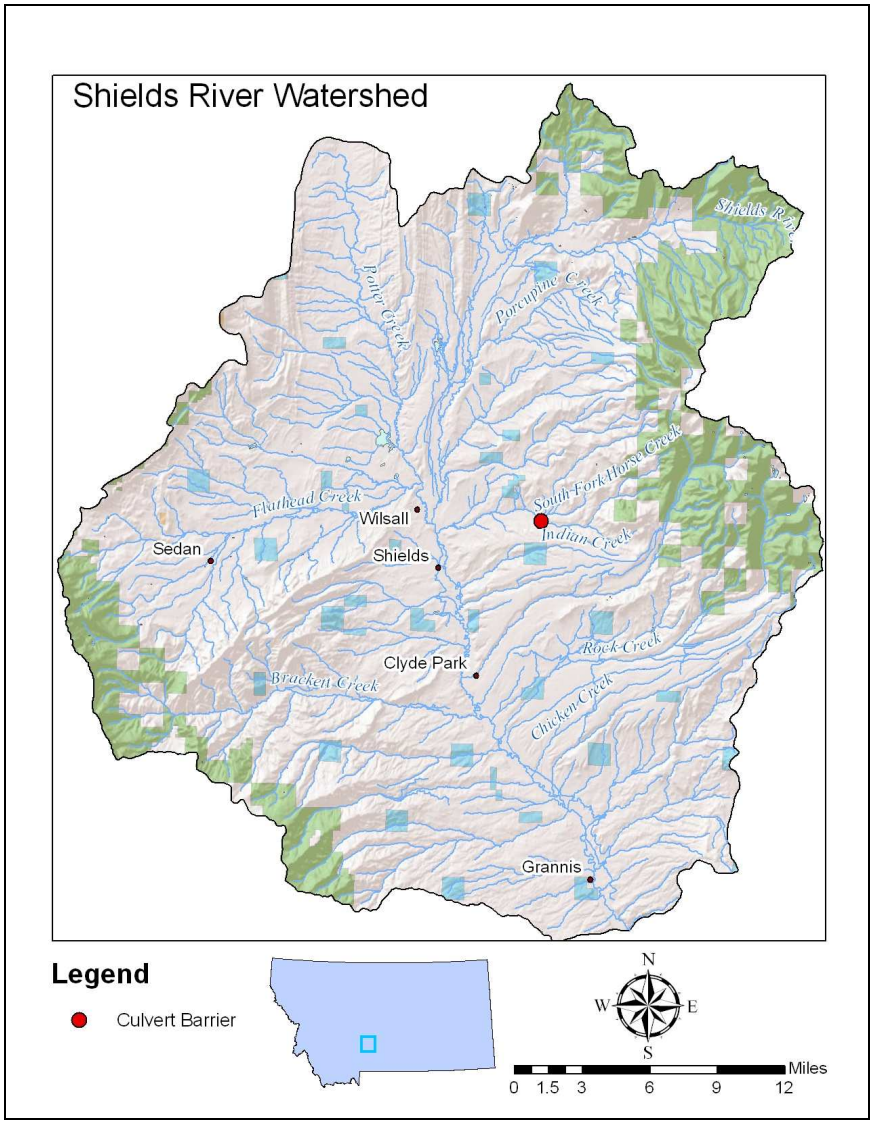

Figure 2-1: Shields River watershed, and location of Horse Creek.

3.0 Methods

This investigation involved office, field, and laboratory components. Review of existing fisheries information housed in FWP's database provided information on species composition, genetic status, and distribution in the Horse Creek watershed, and allowed some evaluation of temporal and seasonal trends. Where possible, FWP seeks to manage Yellowstone cutthroat trout on a watershed scale, which acknowledges the potential for seasonal migrations within a basin. Therefore, this literature review encompasses the entire Horse Creek watershed

The field component entailed sampling fish upstream and downstream of the perched, steep culvert under Horse Creek Road on September 29, 2008 (Figure 3-1). The downstream reach was 1000 feet in length, and corresponded with fisheries investigations in 1999 (Tohtz 1999). Sampling involved a 2-pass depletion using a Smith-Root backpack electrofisher. All salmonids were netted, weighed, measured, and released. Presence and relative abundance of other species was recorded. Fin clips were collected from 25 Yellowstone cutthroat trout to evaluate genetic status. The upstream reach was on South Fork Horse Creek, and measured 650 feet in length. The goal was to capture 25 putative Yellowstone cutthroat trout for genetic testing; however, available daylight limited this effort, and afforded time for only one pass.

The two pass depletion conducted on the Horse Creek reach allowed calculation of a population estimate. Data were entered into FWP's Fisheries Analysis + software, which generates population estimates and associated measures of variability.

Field observations of habitat condition occurred concomitant with fish sampling. These qualitative assessments of riparian health and function, and in-stream habitat quality for fish provide additional insight into factors shaping fish populations.

Fin clips were sent to Dr. Stephen Kalinowski at Montana State University for analysis. For each sample, twelve single nucleotide polymorphisms (SNPs) having diagnostic alleles for rainbow trout, westslope cutthroat trout, and Yellowstone cutthroat trout were genotyped (Kalinowski 2009). Analysis of SNPs allows estimation of the proportion of the genes in each population derived from these three taxa.

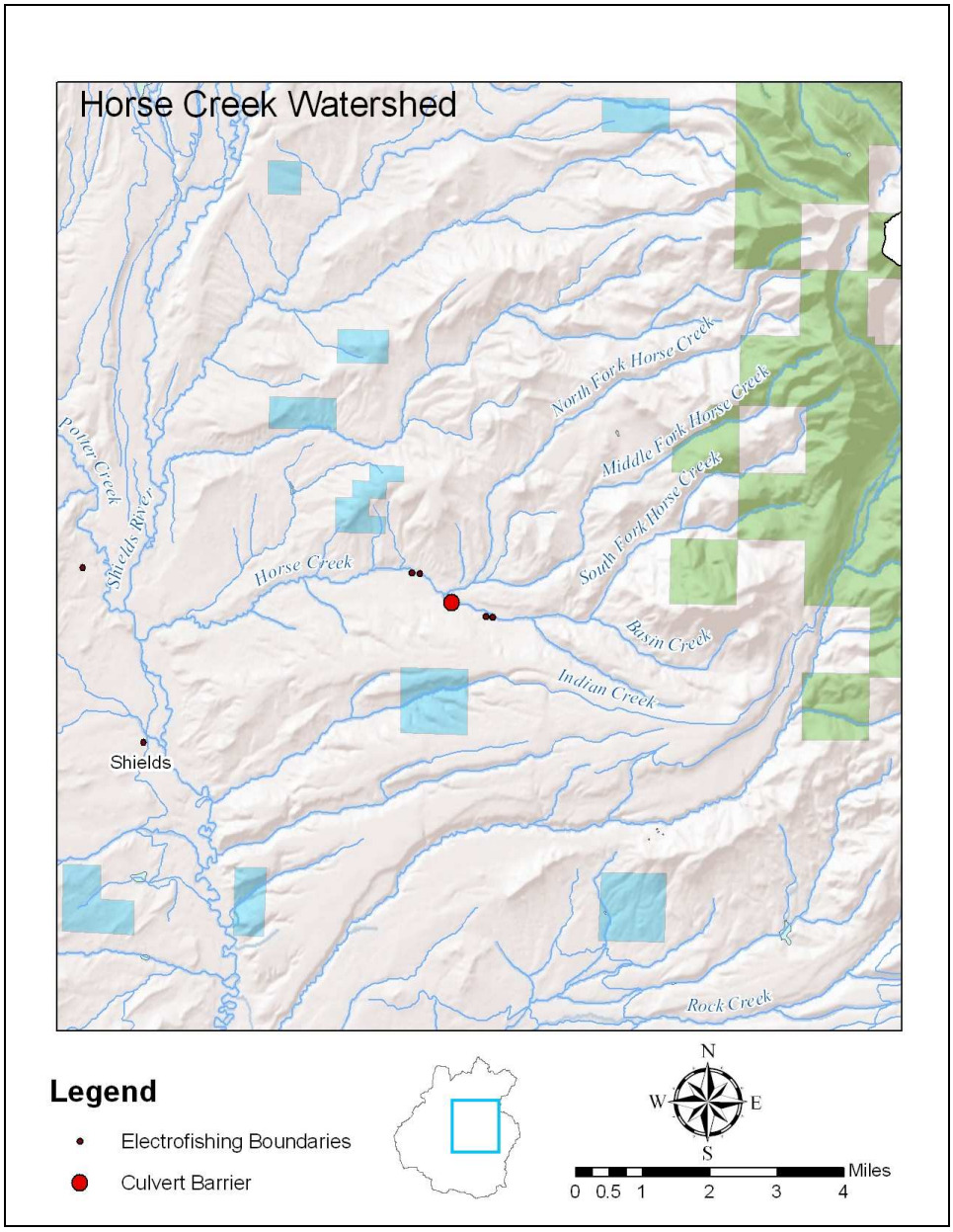

Figure 3-1: Map of Horse Creek watershed showing fish sampling locations.

4.0 Results and Discussion

4.1 Literature Review

Fisheries investigations in the Horse Creek drainage began in the early 1970s, and have continued through 2009. The first effort occurred in August of 1974, and involved electrofishing a 500-foot long section of Horse Creek, located about 2.6 miles from its confluence with the Shields River (Berg 1975). This report refers to Horse Creek as

"Horsefly Creek", and reported capture of 30 Yellowstone cutthroat trout, and no other species.

In 1991, FWP conducted genetic testing of Yellowstone cutthroat trout captured in tributaries of Horse Creek. Electrophoretic analysis of 5 fish from Middle Fork Horse Creek, and 7 fish from South Fork Horse Creek found alleles characteristic of only Yellowstone cutthroat trout (Leary 1992). The apparent absence of rainbow trout genes suggested these streams supported pure populations of Yellowstone cutthroat trout; however, the small sample size limited certainty in the results. Leary (1992) recommended managing these streams as pure Yellowstone cutthroat trout unless further testing demonstrated otherwise.

The next fisheries investigation in the Horse Creek drainage occurred in 1999. On October 13, 1999, FWP biologists conducted a 3-pass depletion estimate in a 750-foot long reach of Horse Creek, located about 1.5 miles downstream of the confluence of the north and south forks of Horse Creek (Tohtz 1999). Yellowstone cutthroat trout were "surprisingly abundant", yielding a population estimate of over 870 fish per mile (Table 4-1). Likewise, the size class structure indicated a well-established, self-sustaining population (Figure 4-1). Genetic analysis of tissue collected from 30 fish found only alleles characteristic of Yellowstone cutthroat trout (Leary 2001), making this a core population in Yellowstone cutthroat trout conservation efforts. Other species reported present were mottled sculpin (*Cottus bairdi*), longnose dace (*Rhinichthys cataractae*), and an unidentified species of sucker. All these species are native to the Shields River watershed.

Table 4-1: Yellowstone cutthroat trout population estimates for Horse Creek in 1999 (from Tohtz 1999)

Stream Name: (section)	***Number of fish (pass 1, 2, 3)***	***Probability of capture***	***Estimated fish/mile***	***Standard error***
Horse (Goffena)	105, 16, 3	0.85	873	2.04

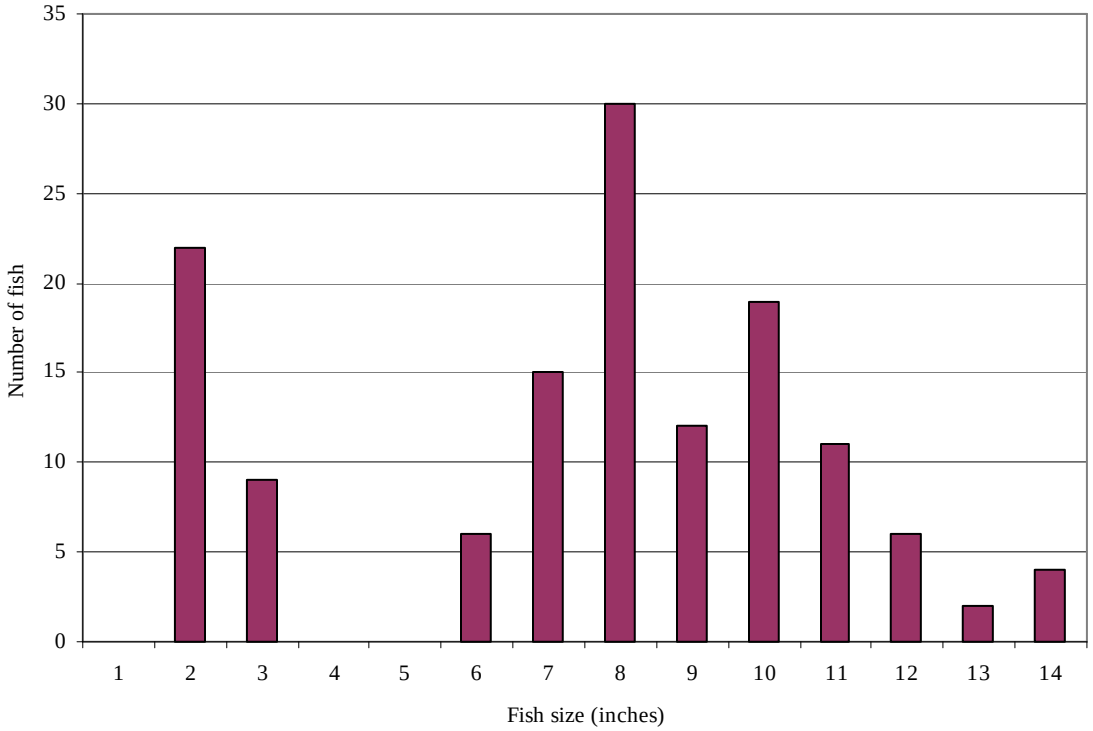

Figure 4-1: Length frequency distributions of Yellowstone cutthroat trout in Horse Creek in 1999 (Tohtz 1999).

In late June of 2003, biologists sampled fish in a reach of Horse Creek extending from 2.5 to 2.7 miles from Horse Creek's confluence with the Shields River (Shepard 2004). This reach likely overlapped, at least in part, with the reach sampled by Berg (1975). No Yellowstone cutthroat trout were captured in this effort, nor were other species of trout present in the catch. The species reported were longnose dace, mottled sculpin, and an unidentified species of sucker.

Seasonal factors may have been involved in the absence of Yellowstone cutthroat trout from the catch. Late June corresponds with the Yellowstone cutthroat trout's spawning period, and fish may have been occupying spawning areas elsewhere in the basin. Identifying spawning areas within the Horse Creek watershed would aid in conserving this species by maintaining connectivity to spawning grounds, and promoting habitat and water quality in these reaches.

In the mid-2000s, FWP worked with a private landowner on several projects aimed at conserving Yellowstone cutthroat trout in North Fork Horse Creek. Actions included installation of riparian fencing and off-channel water tanks to control livestock use of the stream, replacement of an old, and decadent irrigation diversion with a turbulent fountain fish screen, and improvements to the irrigation system to increase efficiency.

Coinciding with these conservation activities, FWP sampled fish in 500-foot reaches above and below the replaced diversion structure using the two-pass depletion approach. Yellowstone cutthroat trout were the only species reported, and these were abundant, reaching densities similar to those found in Horse Creek in 1999 (Tohtz 1999).

Table 4-2: Yellowstone cutthroat trout population estimates for North Fork Horse Creek in 2003.

Section Name	*Size Class (in.)*	*Number of fish (pass 1, 2, 3)*	*Probability of capture*	*Estimated fish/500 ft*	*Standard error*
Crutcher	1.5-2.9	29, 6	0.854	35	1.175
Diversion (lower)	4.0-7.0	16, 5	0.750	22	0.138
Crutcher	1.2-2.9	41,12	0.746	56	0.087
Diversion (upper)	3.0-9.9	26, 4	0.882	30	0.070

Evaluation of sizes of fish captured in the North Fork Horse Creek in 2003 suggests this area is an important rearing, and perhaps spawning area for Yellowstone cutthroat trout. Relatively small fish dominated the population, with fish in the 3-inch size class greatly outnumbering other sizes.

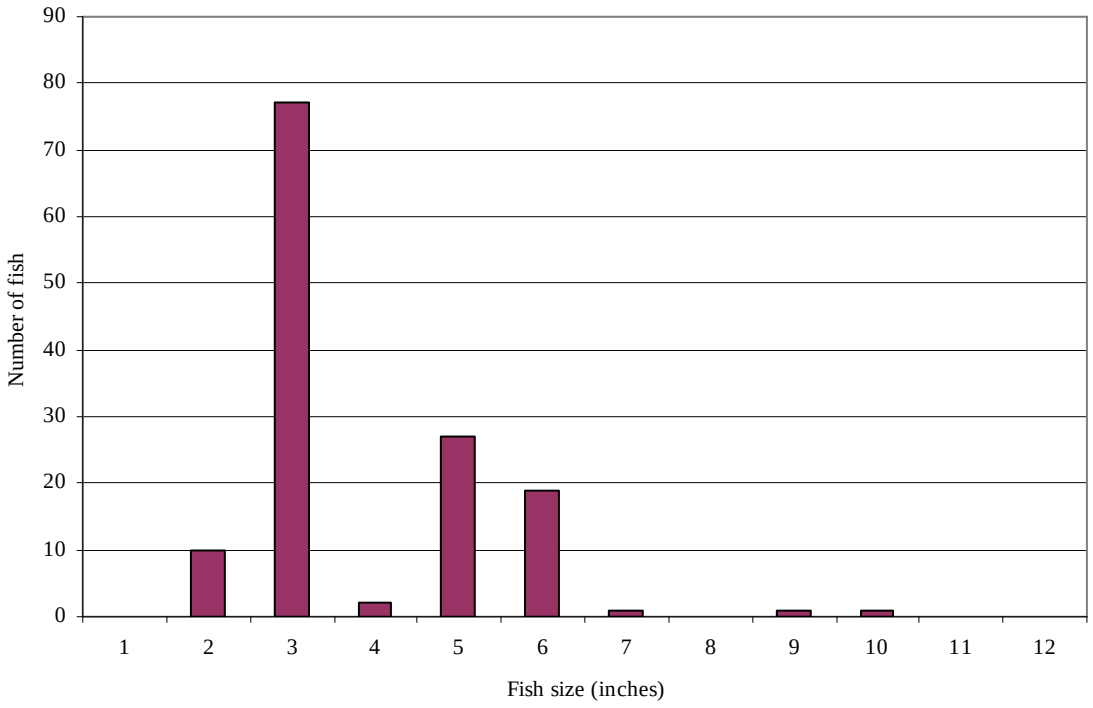

Figure 4-2: Size class distribution in North Fork Horse Creek in 2003 (data from both sites pooled).

In 2009, the middle and south forks of Horse Creek were part of a fish survey project on the east side of the Shields River watershed, involving sampling of randomly selected

sites (Brad Shepard, FWP, personal communication). Formal analysis is pending, but preliminary results reported here address species composition. No fish were found on the Middle Fork Horse Creek site, which was high in the watershed, and within the Gallatin National Forest. Only brook trout were found at site within the montane portions of the South Fork Horse Creek. A downstream reach on South Fork Horse Creek yielded brook trout and Yellowstone cutthroat trout, with brook trout being the dominant species.

4.2 Fish Sampling 2008

4.2.1 Horse Creek

Six species of fish were captured in the Horse Creek sampling reach (Table 4-3). Native Yellowstone cutthroat trout, mottled sculpin, and white sucker ranked as abundant. Nonnative brown trout and brook trout were rare, with 2 brown trout, and 1 brook trout captured.

Table 4-3: Fishes captured in the Horse Creek sampling reach

Family	***Common Name***	***Scientific Name***	***Origin***	***Number Captured/Relative Abundance***
Catostomidae (sucker family)	White sucker	*Catostomus commersoni*	Native	Abundant
Cyprinidae (minnow family)	Longnose dace	*Rhinichthys cataractae*	Native	1/rare
Salmonidae (trout, grayling, whitefish, and salmon)	Yellowstone cutthroat trout	*O. clarki bouvieri*	Native	29/abundant
	Brown trout	*Salmo trutta*	Introduced	2/rare
	Brook trout	*Salvelinus fontinalis*	Introduced	1/rare
Cottidae (sculpin)	Mottled sculpin	*Cottus bairdi*	Native	Abundant

The removal pattern resulted in a population estimate of 158 cutthroat trout per mile (Table 4-4, a figure considerably lower than the 873 fish/mile estimated in 1999 (Tohtz 1999, Table 4-1). Extended drought through the 2000s may be responsible for these apparently depressed numbers. Alternatively, seasonality may be a factor. Although these efforts coincided with early fall (October 13, 1999 and September 28, 2008), fish may have been congregating in overwintering habitat during the 1999 effort. The excellent habitat present in this reach is highly suitable for overwintering. Determining seasonal fish movement patterns and cues would be a useful adjunct in interpreting these data.

Table 4-4: Yellowstone cutthroat trout abundance in Horse Creek on September 28, 2009.

Stream Name: (section)	***Number of fish (pass 1, 2)***	***Probability of capture***	***Estimated fish/mile***	***Standard error***
Horse (Goffena)	27, 3	0.91	158	3.17

Examination of length-frequency data indicates dominance of older fish, and a lack of juvenile Yellowstone cutthroat trout in 2008 (Figure 4-3). This unbalanced population structure differs markedly from the 1999 effort, in which juvenile fish comprised a

substantial proportion of the catch (Figure 4-1). As with the apparently depressed fish density estimate, this lack of juveniles may be related to reduced reproductive success in recent years because of extended drought. The previous year, 2007, was an exceptionally hot summer, which was compounded by low water supply. The resulting elevated water temperatures, and a lack of water, can limit reproductive success of cold-water fishes such as Yellowstone cutthroat trout.

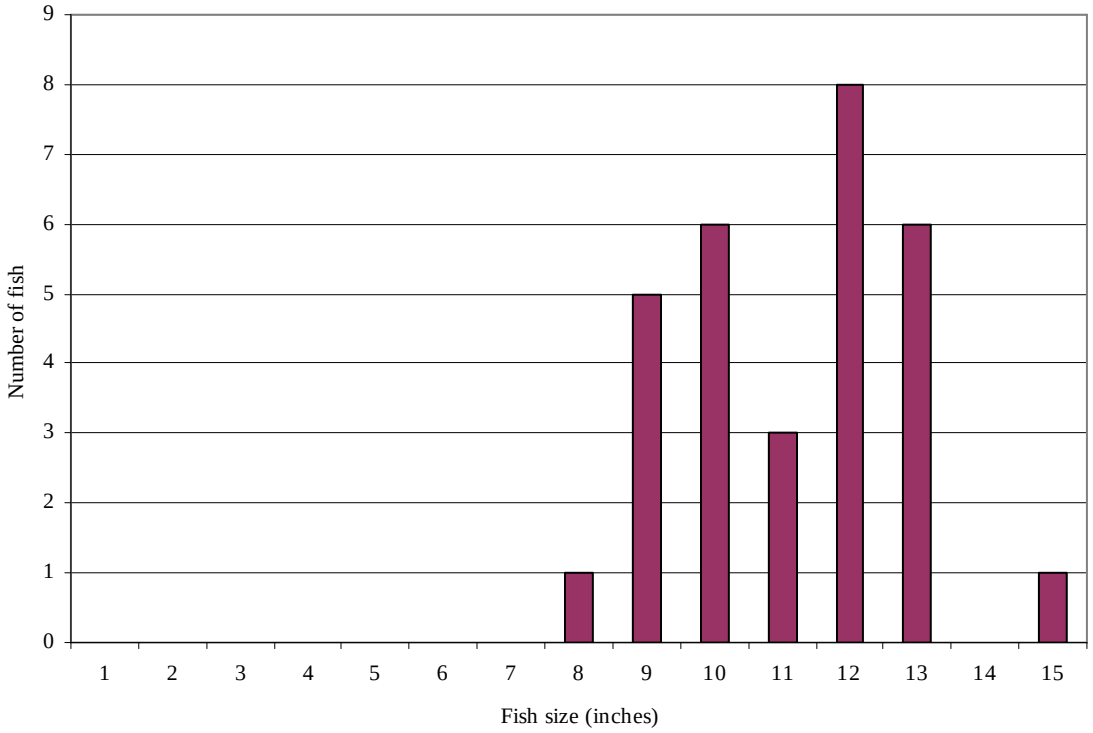

Figure 4-3: Length frequency distribution of Yellowstone cutthroat trout in Horse Creek in 1999 (Tohtz 1999).

4.2.2 South Fork Horse Creek

Three species of fish were captured or observed in the sampling reach on South Fork Horse Creek (Table 4-5). The nonnative brook trout substantially outnumbered Yellowstone cutthroat trout, with twice as many brook trout captured as cutthroat trout. Similar to the reach on Horse Creek, mottled sculpin were abundant, although suckers and minnows were not found. No brown trout were captured in this reach.

Table 4-5: Fishes captured in the South Fork Horse Creek sampling reach.

Family	***Common Name***	***Scientific Name***	***Origin***	***Number Captured/Relative Abundance***
Salmonidae (trout, grayling, whitefish, and salmon)	Yellowstone cutthroat trout	*O. clarki bouvieri*	Native	18/common
	Brook trout	*Salvelinus fontinalis*	Introduced	36/abundant
Cottidae (sculpin)	Mottled sculpin	*Cottus bairdi*	Native	Abundant

Size class composition showed more balance for Yellowstone cutthroat trout in South Fork Horse Creek (Figure 4-4). Two 3-inch cutthroat were captured, indicating some successful reproduction in recent years. Yellowstone cutthroat trout captured in this reach ranged up to 13 inches in length.

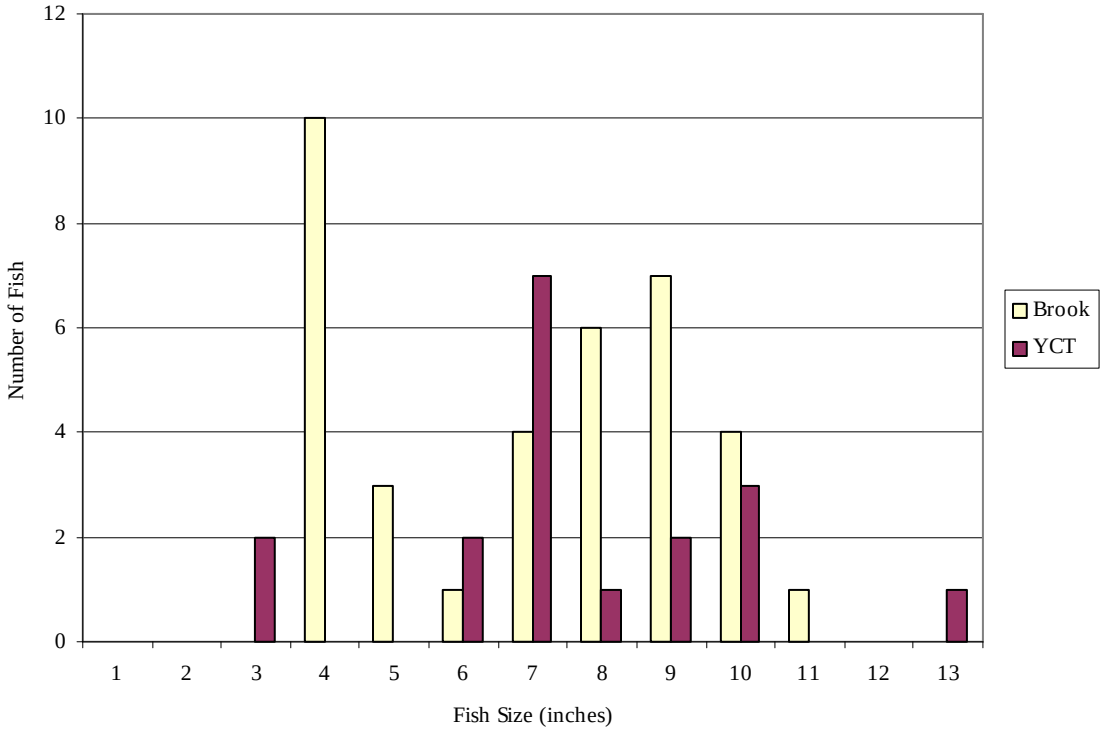

Figure 4-4: Length-frequency distribution of Yellowstone cutthroat trout and brook trout in the sampled reach on South Fork Horse Creek.

4.3 Habitat Observations

4.3.1 Horse Creek

The sampled reach on Horse Creek provided exceptional habitat. The riparian area consisted of a mixed age stand of riparian shrubs, with dense cover of grasses (Figure 4-5 and Figure 4-6). This functioning riparian corridor resulted in a relatively narrow and deep stream channel. High quality pools were frequent features. Banks were mostly stable, and the limited bank erosion occurring in this reach did not appear to be the result of trampling or vegetation removal by cattle (Figure 4-7).

Figure 4-5: Representative view of riparian and stream channel conditions in the assessed reach of Horse Creek.

Figure 4-6: Representative view of riparian and stream channel conditions in the assessed reach of Horse Creek.

Figure 4-7: Example of limited bank erosion in the Horse Creek reach attributable to natural variation.

This reach of Horse Creek is part of a working cattle ranch, and livestock had access to the stream during sampling. Stocking rates, and duration and timing of grazing are compatible with riparian function and stream morphology in this reach, which supports the excellent habitat available to Yellowstone cutthroat trout.

4.3.2 South Fork Horse Creek

Riparian health and function were reduced in the assessed reach on South Fork Horse Creek. Vegetation removal and bank trampling by cattle were the primary causes of degradation in this section. These perturbations resulted in an overly wide and shallow stream channel, reduced frequency and quality of pools, warmer summer temperatures, and increased sedimentation.

Figure 4-8: Example of reduced riparian vegetative cover and in-stream habitat quality in South Fork Horse Creek.

4.4 Genetic Analyses

Of the 25 samples collected in Horse Creek, 24 appeared to be pure Yellowstone cutthroat trout (Kalinowski 2009). The remaining sample had characteristics consistent with a first generation hybrid between Yellowstone cutthroat trout and rainbow trout. To eliminate laboratory error as the cause of this anomalous result, the laboratory re-extracted DNA, and repeated the analysis, finding the same results the second time.

Of the 18 samples collected from apparent Yellowstone cutthroat trout in the South Fork Horse Creek, all samples demonstrated alleles of only Yellowstone cutthroat trout (Kalinowski 2009). A sample size of less than 25 provides less than 99% certainty in the ability to detect rainbow trout or westslope cutthroat trout genes; however, until further sampling shows otherwise, this population will be treated as a pure or core population.

5.0 Conclusions and Recommendations

The Horse Creek watershed has high conservation value for native Yellowstone cutthroat trout. As genetically pure Yellowstone cutthroat trout are distributed throughout the basin, these streams rate as a core population, and protecting these populations is the highest conservation priority (MCTSC 2007). Although Yellowstone cutthroat trout remain abundant in most waters, nonnative fishes and habitat degradation present threats to the security of the Yellowstone cutthroat trout population in the Horse Creek drainage.

5.1.1 Barrier Determinations

The presence of a first generation hybrid downstream of the culvert under Horse Creek Road means replacing this culvert with a passable crossing is not desirable. Providing

connectivity between South Fork Horse Creek and the main stem would jeopardize the genetic integrity of the potentially pure population above the culvert. This decision is consistent with conservation planning for Yellowstone cutthroat trout lists protection of pure population as the highest conservation priority for Yellowstone cutthroat trout (MCTSC 2007)

Although providing passage through the culvert under Horse Creek road is contraindicated, opportunities to collaborate with the Park County Road Department and adjacent landowners still exist. In addition to being a passage barrier, this road crossing frequently floods during high flows. Flooding impedes public travel, threatens neighboring property, and delivers fine sediment from this unpaved road to South Fork Horse Creek. FWP will work with the Park County to develop solutions to flooding and erosion that retain the impassability of this road crossing.

5.1.2 Nonnative Fishes

The Yellowstone cutthroat trout in the Horse Creek drainage face substantial threats from nonnative fishes. Dominance of brook trout in South Fork Horse Creek is a major concern for native Yellowstone cutthroat trout. The pattern of displacement of cutthroat trout by brook trout is common throughout the Intermountain West, and is one of the greatest threats to native cutthroat (Dunham et al. 2002). This trend has been observed in other portions of the Shields River watershed, resulting in implementation of fish distribution mapping efforts and mechanical removal of brook trout in the northern portion of the basin (FWP 2009).

Brook trout pose an imminent threat to the persistence of the core Yellowstone cutthroat trout population in South Fork Horse Creek, which obliges FWP and its conservation partners to act under the current conservation agreement (MCTSC 2007). Removal or suppression of brook trout are among the potential actions for this stream. Restoring habitat and water quality presents another approach to conserving Yellowstone cutthroat trout in presence of brook trout. In a study of the closely related westslope cutthroat trout, habitat degradation and sedimentation were found to favor displacement of native cutthroat by brook trout (Shepard et al.1999). Therefore, efforts to improve riparian health and function, and in-stream habitat quality should be priority efforts for South Fork Horse Creek.

Although pure Yellowstone cutthroat trout have dominated the fishery in the main stem of Horse Creek since the first surveys in the early 1970s, sampling in 2008 found reasons for concern. Notably, the presence of a first generation Yellowstone cutthroat trout x rainbow trout hybrid was alarming, as hybridization presents an irreversible threat to pure populations. The presence of brown trout and brook trout, although at low numbers, is also disturbing, as this is the first time since the 1970s that biologists have captured these species in Horse Creek. Horse Creek is apparently in the early stages of invasion by these nonnatives, which will require action to prevent displacement of this core Yellowstone cutthroat trout population.

5.1.3 Habitat Restoration

Riparian health and function, and in-stream habitat are variable within the Horse Creek watershed. The 1000-foot reach sampled on the main stem of Horse Creek in 2008 was in excellent condition, and the abundance of Yellowstone cutthroat trout in this reach provides anecdotal evidence for the role of habitat quality in supporting native cutthroat trout. In contrast, in assessed portions of South Fork Horse Creek, reduced riparian health and function, combined with bank trampling, had resulted substantial bank erosion and associated lateral channel adjustments. Although brook trout can displace cutthroat trout in non-impaired habitat, this type of degradation may give a competitive advantage to brook trout, which are more tolerant of fine sediment and warm water temperatures.

Several programmatic opportunities exist to address habitat degradation. FWP's Landowner Incentive Program biologist provides technical and financial assistance to private landowners seeking to implement conservation actions on their property. Likewise, the Natural Resources Conservation Service assists landowners with implementing land and water conservation practices that will benefit fisheries. FWP and NRCS often work in concert, which capitalizes on the NRCS's agricultural expertise and FWP's knowledge of fisheries management.

Water planning efforts being undertaken by the Shields Valley Watershed Group present another avenue for planning and implementing projects aimed at decreasing sediment loading to streams. The watershed group will be developing a watershed restoration plan in 2010, with assistance from Montana Department of Environmental Quality and a yet to be determined environmental consulting firm. This is the next phase of total maximum daily load (TMDL) planning effort for the watershed (DEQ 2009), which identified the Horse Creek watershed as being among the moderate contributors of sediment. This plan will identify and prioritize specific projects to benefit water quality by reducing sediment loading. Financial assistance will be available for projects identified in the watershed restoration plan, which presents another avenue for funding projects to benefit Yellowstone cutthroat trout in the Shields River watershed.

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