UPPER CLARK FORK RIVER BASIN

BULL TROUT STATUS REPORT

June, 1995

prepared for:

The Montana Bull Trout Restoration Team

by:

The Montana Bull Trout Scientific Group

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EXECUTIVE SUMMARY

Bull trout were one of three salmonids native to the Clark Fork River. It is believed bull trout were once widely distributed in the mainstem and tributary streams. The present distribution of bull trout is much reduced from historic levels in this drainage.

The migratory bull trout life form in the Upper Clark Fork River above Milltown Dam has disappeared. At present, bull trout populations in the upper Clark Fork River drainage, except for Rock Creek, are composed of small sized, resident fish inhabiting tributary streams. These populations are isolated from one another as a result of a variety of human created barriers to fish movement. The migratory bull trout life form persists in the Rock Creek drainage.

The over-riding high risk factor is mining, including historical and current. Water pollution occurring prior to the turn of the century essentially eliminated fluvial bull trout from most of the drainage except Rock Creek. Dewatering from agriculture and interactions with introduced species also ranked as high concerns in the basin. Other major risk factors include habitat degradation from grazing in riparian areas and roads associated with forestry and mining. Warm water temperatures in the river and the Milltown Dam are major factors affecting distribution and fragmentation.

Core and nodal habitats

Core watersheds (those which currently support the strongest remaining populations of bull trout) are Rock Creek and its tributaries, Boulder Creek drainage, Warm Springs Creek drainage, Harvey Creek drainage, and the Racetrack Creek drainage. The Little Blackfoot River drainage is also identified as a core

watershed at this time but the population is small and likely declining.

The nodal habitat (waters containing migratory corridors and overwintering areas) is the Clark Fork River from Warm Springs Creek downstream to Milltown Dam.

Threats

The most serious threat to restoration of bull trout in this drainage is fragmentation of bull trout populations into isolated units. Because most of the remaining bull trout populations are fragmented, they are at a high risk of extinction and the effects of other risk factors such as mining, grazing, agricultural impacts on water quantity and quality and introduced species are locally exacerbated. When isolated populations become extinct, the probability of recolonization is low. In addition, the high number of risk factors and the interactions between risk factors complicate restoration efforts.

The restoration goal

The restoration goal for bull trout in the Upper Clark Fork drainage is to establish a self-reproducing migratory population in the Clark Fork River which spawns in tributary streams. Specifically, a preliminary goal is to have at least 100 redds or 2000 total individuals in the migratory population over a period of 15 years (3 generations), with spawning distributed among all the core watersheds. This preliminary goal is a minimum that would likely be at risk due to instability. If the preliminary goal is reached, an increasing trend and a higher, more stable number of fish would be the ultimate goal.

Maintenance of self-sustaining bull trout populations in all the watersheds where they presently exist and maintenance of the

population genetic structure throughout the watershed is part of the restoration goal. Under this goal, all existing populations will at least remain stable or will increase from current numbers in the future. Reestablishment of a migratory corridor through Milltown Dam between the upper Clark Fork and middle Clark Fork is also part of the goal.

The Rock Creek watershed may be of sufficient size to support healthy bull trout populations in that drainage over the long term if adequate habitat quality is preserved and enhanced. Therefore, a preliminary restoration goal specific to the Rock Creek drainage should be established. A monitoring program should be started to build a baseline of population data for the entire Rock Creek drainage. From this data, a specific restoration goal could be established. Until then, the restoration goal for the Rock Creek drainage is at least 100 redds or 2000 migratory individuals for 15 years. Once the monitoring program has established a population baseline, an increasing trend in number of fish and a higher, more stable number of fish should be the definitive goal.

Once a restoration plan is finalized and implemented, a monitoring schedule will need to be developed to determine the success of the program. In addition, research needs are outlined in the plan.

UPPER CLARK FORK RIVER DRAINAGE
BULL TROUT STATUS REVIEW

INTRODUCTION

In January, 1994, the Governor of Montana established a Bull Trout Restoration Team to develop a restoration plan for bull trout (Salvelinus confluentus) in Montana. The Restoration Team appointed a Scientific Group to provide guidance on technical issues related to the restoration of this fish.

The Scientific Group prepared this document which includes a review of the status of bull trout and risks to the survival of the species. Specific restoration strategies that address the highest risks will be discussed in a separate document. In addition, the Scientific Group prepared reports on three of the most significant issues in bull trout restoration: (1) Land management concerns (2) Removal or suppression of introduced species and, (3) The use of hatcheries and transplantation in bull trout restoration. Because the risks facing bull trout vary widely across the state, separate reports were prepared for each of the twelve major recovery areas in Montana. These recovery areas have been delineated largely due to fragmentation of historically connected systems. Loss of interconnectivity results from migration barriers like dams or habitat changes such as altered thermal regimes or dewatering. Each of the twelve recovery areas contains core and nodal habitats for bull trout restoration.

This document addresses the historic and current status and distribution of bull trout, describes major risks to these populations, and identifies goals and core and nodal watersheds for bull trout recovery in the upper Clark Fork River drainage

upstream from Milltown Dam. It does not include the Blackfoot River, which will be covered in a separate plan.

The Clark Fork River is Montana's largest river in terms of stream discharge. Originating at the confluence of Silver Bow and Warm Springs creeks in the Deerlodge Valley, the river flows primarily in a northwesterly direction for about 350 river miles to its terminus at Lake Pend Oreille, Idaho (Ingman and Kerr 1990).

Major land ownership within the Upper Clark Fork drainage includes U. S. Forest Service, state of Montana, and private lands. Forest Service ownership includes most of the higher elevation, forested lands. Most of the private lands are located within the non-forested valley floors or include patented minerals lands interspersed within Forest Service boundaries. Land ownership in the Rock Creek drainage is 80% Forest Service, 17% private, 2% Bureau of Land Management and 1% state of Montana.

The upper segment of the Clark Fork River (above Milltown Dam) is about 119 miles long and has an annual average streamflow of about 1354 cfs, (USGS 1995). The total drainage area is approximately 3641 mi^2 upstream from Bonner (not including the Blackfoot River drainage) (USGS 1995). In an average year, about 22% of the annual runoff occurs in May and 24% in June. The periods of greatest consumptive demand for water are July and August (UCFRBSC 1994)

Rock Creek, which enters the Clark Fork River near Clinton, is the largest tributary to the Clark Fork River upstream of the Blackfoot River. Rock Creek has a drainage area of 885 mi^2 and an average annual flow of 513 cfs (USGS 1995).

The diverse land uses and economic activities in the Clark Fork River drainage have led to numerous water quality problems. A century of mining and smelting has left the upper Clark Fork River and some its tributaries polluted by toxic metals and other chemicals. Overall, metals contamination is most prevalent in the headwater tributaries, Silver Bow Creek, and the lower reaches of Warm Springs Creek (MT DHES 1994). The Environmental Protection Agency's (EPA) National Priority List has listed four Superfund sites in the upper Clark Fork River basin, including the mainstem from Warm Springs Creek to Milltown Dam. Since 1982, EPA, together with other state, federal and private entities have worked to investigate and prescribe clean-up procedures (US EPA 1993).

Excessive concentrations of nutrients (phosphorus and nitrogen) are another water quality problem. High concentrations of nutrients have led to blooms of filamentous algae in the Clark Fork River above Missoula, impairing beneficial uses of river water (US EPA 1993). The main nutrient point sources are the sewage effluent from the towns of Butte and Deerlodge. The primary nonpoint sources of sediments and nutrients are the Bitterroot River and the Blackfoot River (discussed in a separate report) (MT DHES 1994).

About 450 miles of stream are reported to be impaired or partially impaired for beneficial uses. Some streams that are impaired are not discussed in the report. The upper Clark Fork is among the State's highest priority streams that will be incorporated into the Total Mean Daily Load (TMDL) process during the coming year (MT DHES 1994). Although algae and metals continue to affect the mainstem and tributaries in the upper basin, McGuire (1993) and US EPA (1993) report slightly improving trends due to more strict standards and cleanup measures.

Many water quality studies have been done, or are underway, in the Clark Fork River. For more detailed information about water quality issues in the Clark Fork River see, among others, Ingman and Kerr (1990); Watson (1991); Ingman (1992a); Ingman (1992b); Knudsen (1992); McGuire (1995); and Weber (1995).

The life history forms of bull trout present in the upper Clark Fork drainage are the migratory form that exists exclusively in the Rock Creek drainage, and resident form that live in the upper ends of tributary streams.

Figure 1. Bull trout distribution and core areas in the Upper Clark Fork drainage.

HISTORIC AND CURRENT STATUS OF BULL TROUT IN THE UPPER CLARK FORK RIVER DRAINAGE

Historic distribution

Sources of information on the historical distribution of bull trout in Montana are limited. However, it is clear that bull trout were one of the three native salmonids found in the mainstem Clark Fork River upstream of Missoula. The other native salmonids were westslope cutthroat trout, Oncorhynchus clarki lewisi, and mountain whitefish, Prosopium williamsoni.

Historically, bull trout were likely distributed throughout the Upper Clark Fork drainage. There are no major natural barriers to fish migration that would have excluded bull trout from any significant portions of the upper Clark Fork drainage except barrier falls at higher elevations in tributary streams. Most likely they used the river and all of the major tributaries as well as some of the smaller ones. It is possible, but unknown, whether there was historic use of the Upper Clark Fork River by bull trout from Lake Pend Oreille in Idaho.

The report of Evermann (1892), who traveled through Montana in the 1890's sampling fish, states that bull trout were common in most of the larger affluents of the Columbia in Montana, particularly the Hellgate, Missoula, Pend d'Oreille, Flathead, Bitterroot and Big Blackfoot Rivers and in Flathead and Swan lakes. In today's terminology, this would be the Clark Fork River above and below Missoula and the Flathead River above and below Flathead Lake as well as the Bitterroot and Blackfoot rivers.

The Missoula Gazette (1892) stated that bull trout were found in most of the streams and lakes of the area. Henshall (1906) stated that bull trout are found in Montana on the Pacific slope in both lakes and streams.

The ethnographic literature (reports describing the socio-economic systems of technologically primitive societies) also provides some information about historic bull trout distribution. Chalfant (1974), in describing the aboriginal territory of the Kalispel Indians, stated that bull trout were found in Clark's Fork River, among other places.

Malouf (1952) stated that bull trout were widely used on the upper Clark's Fork River. The Salish names of Missoula, Milltown and Butte refer to the bull trout which were once caught there. His sources mention, in particular, a small stream near present day Silver Bow, just west of Butte. Phillips (1974) stated that [in these valleys of western Montana] the streams produced an abundance of trout and salmon, available at all times for food. (Bull trout were frequently referred to as salmon or salmon-trout in the older writings. No anadromous salmon were ever present in Montana.) The current distribution of bull trout in this drainage also indicates that bull trout were distributed throughout the drainage historically.

Evermann (1892) seined the Clark Fork River in the vicinity of Deerlodge "very thoroughly" and did not find any fish whatever. He stated that the river "is said to have been well supplied with trout and other fish, but none has been seen since the concentrators began operations". Of Silver Bow Creek, Evermann (1892) found the water to be "the consistency of thick soup, made so by the tailings which it receives from the mills at Butte. No fish could live in such a mixture". It appears that mining operations in the Butte area probably eliminated bull trout from the mainstem and portions of the headwaters of the upper Clark Fork River prior to the turn of the century.

Evermann (1892) also sampled the Little Blackfoot River and other tributary streams. Of the Little Blackfoot, he stated that, "though we obtained no specimens, there is no doubt that

the salmon trout also occurs there". The other streams he sampled are described as small streams that are, with a few exceptions, well-filled with trout. (The exceptions were Warm Springs and Silver Bow creeks, which were ruined by mining operations).

Unpublished data collected prior to 1970 by the Montana Fish, Wildlife and Parks reported bull trout in the following waters (date of collection in parenthesis): East Fork Reservoir (1961), Kaiser Lake (1961), Moose Lake (1961), Bobcat Creek (1959), Butte Cabin Creek (1959), Cinnamon Bear Creek (1964), Cougar Creek (1959), Little Hogback Creek (1959), Ranch Creek (1959), Rock Creek (1960, 1963, 1966), Stoney Creek (1959), Silver Lake (1961), Storm Lake (1958), and in the Clark Fork River T11N R13W sec 16 (1969). Age and growth data collected in the 1950's and early 1960's for bull trout from East Fork Reservoir, Boulder Creek, and Rock Creek was published in Peters (1964). A creel census was conducted on Georgetown Lake in 1958 and 1959. One bull trout was checked during both seasons from this lake (Averett and Whitney 1959a). However, it is likely that this fish was not a resident of Georgetown Lake, but a downstream migrant from Silver Lake that entered Georgetown Lake via Hardtla Creek.

Current distribution

In general, bull trout populations in the upper Clark Fork River basin are highly depressed, with the major exception of the Rock Creek drainage. Figure 1 shows the present known distribution of bull trout in the upper Clark Fork. Bull trout are rare, or nonexistent, in the mainstem Clark Fork River between the Blackfoot River and Warm Springs Creek.

In comparison to other major drainages in Montana, the Rock Creek drainage may be one of the best bull trout drainages in the state outside of the upper Flathead River/Swan River and Blackfoot River systems (Thomas 1992). In general, the Rock Creek drainage has had relatively few human impacts compared to other western Montana drainages of similar size, although there are some impacts from mining, logging, agriculture, and residential development.

The only portions of the Little Blackfoot River which still contain bull trout are the upper sections above Elliston, Montana. Below this point, bull trout appear to have been eliminated. Harvey Creek has a population of resident bull trout. A barrier at the mouth of the stream prevents any Clark Fork River fish from utilizing this stream for spawning. Upstream of the barrier on Harvey Creek a native fish assemblage exists that may be the most secure population of bull trout in this portion of the drainage (above Rock Creek).

Some sections of Warm Springs Creek drainage contain bull trout but they are primarily resident populations residing in the headwaters and Barker Lake, Storm Lake, Twin Lakes, Cable and Foster Creeks. Lost Creek, Racetrack Creek, and Schwartz Creek also contain bull trout. There are a number of other tributary streams in the drainage that have not yet been sampled so the presence or absence of bull trout has not been documented.

Given the extensive mining and other impacts that have occurred in the Upper Clark Fork drainage it is not surprising that bull trout are rare and primarily restricted to the headwaters of relatively pristine tributaries.

In the mainstem of Rock Creek, bull trout are more common in the upper portion of the drainage above Welcome Creek. Biologists rate the habitat in Rock Creek as high quality. Bull trout population estimates in the Fish and Game section of Rock Creek (downstream of Welcome Creek) in three years of sampling were 49, 95 and 16 fish > 10" per mile, in 1986, 1989 and 1993, respectively. In the Hogback Creek section, upstream from the Fish and Game section, there were 32 bull trout > 10" per mile in 1989 and 12 bull trout > 10" per mile in 1993 (MDFWP unpublished file data).

Outside of Rock Creek, quantitative monitoring of redds is not possible due to the lack of migratory bull trout. Information on the distribution of bull trout is limited to inventory data collected from various sites.

Brook trout (Salvelinus fontinalis) are present in Rock Creek and in a number of the important spawning tributaries. Electrofishing surveys done in 1984 noted some apparent bull trout X brook trout hybrids in several of the tributary streams, but this was not confirmed electrophoretically. Bull trout X brook trout hydrids have been documented through electrophesis in Stony and Upper Willow Creeks, and pure bull trout have been documented in several other streams (Leary et al 1983, Leary 1995). To date, in the Rock Creek Drainage, brook trout have not been detected in Alder Creek, Bowles Creek, Carpp Creek, Cinnamon Bear Creek, Little Stony Creek, Meyers Creek, South Fork of Ross Fork, West Fork Rock Creek, Wyman Creek, and Welcome Creek.

Preliminary data indicates that the Rock Creek drainage could be a critical component of the Clark Fork River drainage bull trout populations. In 1994, several large bull trout were collected below Milltown Dam on the Clark Fork River and fitted with radio telemetry devices. These fish were then released upstream of the Dam. Of the six fish tracked, two moved upstream into the Rock Creek drainage (Don Peters, Montana Fish, Wildlife and Parks, Missoula, Montana, personal communication).

The Flint Creek drainage has had considerably more human impacts than Rock Creek and bull trout densities are generally very low. Bull trout are uncommon in Boulder and South Boulder creeks. They are rare in Flint Creek and Copper Creek.

A few headwaters lakes contain the migratory life form of bull trout. They are: East Fork Reservoir, Kaiser Lake, Moose Lake, Lower Twin Lake, Upper Twin Lake and Storm Lake.

CORE AND NODAL HABITATS FOR BULL TROUT IN THE UPPER CLARK FORK RIVER DRAINAGE

Core watersheds are drainages that currently contain the strongest remaining populations of bull trout. They are usually relatively undisturbed. These watersheds need to have the most stringent levels of protection as they will potentially provide the stock for recolonization.

Core watersheds are Rock Creek drainage, Boulder Creek drainage, Warm Springs Creek drainage, Harvey Creek drainage, and Racetrack Creek drainage. The Little Blackfoot drainage is also identified as a core watershed at this time, but the population of bull trout is small and possibly declining.

Nodal habitat (waters containing migratory corridors, overwintering areas and other critical habitat) is the Clark Fork River from Warm Springs Creek downstream to Milltown Dam.

RISKS TO BULL TROUT IN THE UPPER CLARK FORK RIVER DRAINAGE

The risks to bull trout in the Upper Clark Fork River drainage are listed in Table 1. The risks were evaluated based on the degree to which a risk contributed to the past and current decline of the species (designated as current/historic in the table) and the threat the risk factor poses to future restoration of the fish (designated as restoration in the table). Those risks which are of greatest concern are noted with a double asterisk.

The over-riding high risk factor is mining, including historical and current. Water pollution occurring prior to the turn of the century essentially eliminated fluvial bull trout from most of the drainage except Rock Creek.

Dewatering from agriculture and interactions with introduced species also ranked as high concerns in the basin. Other major risk factors include habitat degradation from grazing in riparian areas and roads associated with forestry and mining. Warm water temperatures in the river and the Milltown Dam are major factors affecting distribution and fragmentation.

It should be noted that there has been a great deal of information collected on the upper Clark Fork River in connection with litigation between the State of Montana and ARCO. This information is currently unavailable to the public. When the data is released, it will be helpful to the Restoration Team and the watershed group in planning for bull trout restoration.

Table 1. **Risks to bull trout.** * = high risk in Upper Clark Fork River
** = very high risk to recovery

RISK	CURRENT/HISTORIC	RESTORATION
Environmental instability:		
Drought		*
Landslide/geology		
Flood/rain on snow		
Fire		*
Introduced species		
Private ponds		
Legal introductions	*	**
Illegal introductions		*
Fisheries Management		
Barriers		
Culverts		
Diversions	*	*
Thermal	*	**
Dams	*	**
Habitat		
Rural residential develop.		
Mining	*	**
Grazing	*	**
Agriculture and dewatering	*	**
Dam operations		
Forestry	*	**
Recreational developments		
Transportation	*	
Population -		
Population trend	*	*
Distribution/fragmentation	*	*
Abundance	*	*
Biological sampling		
Angling	*	
Illegal harvest		*

Environmental instability (high risk)

Drought
Landslide/geology
Flood/rain on snow
Fire

There are two components to the risk from environmental instability. First, the likelihood of a catastrophic event occurring and, second, the risk to the bull trout population if such an event should occur.

In the upper Clark Fork River drainage, fire, flood and drought are more likely to occur than landslides or rain on snow events. (Rain on snow is a common term used to describe cloudy weather periods when warm winds and rain combine to produce rapid snowmelt. These events generally occur during early to mid-winter periods). Man's activities have increased the chances of some of these events occurring. However, the primary reason these events are of concern is because the bull trout population is fragmented. Even Rock Creek, which retains connections to its tributaries, is fragmented from the mainstem Clark Fork River by Milltown Dam. Under current conditions, if a catastrophic event were to cause a local extinction of the species, the opportunity for the fish to recolonize the habitat is extremely limited.

If the connections between bull trout populations can be restored, then the risk from environmental instability would be low. The Rock Creek drainage is less at risk than other areas of the drainage with remnant populations.

Introduced species

The introduced sportfish species found in the upper Clark Fork River drainage include brook, brown (Salmo trutta), rainbow (Oncorhynchus mykiss), lake (Salvelinus namaycush), Yellowstone

cutthroat trout (Oncorhynchus clarki bouvieri), largemouth bass (Micropterus salmoides) and kokanee (Oncorhynchus nerka).

Brook trout are believed to be the greatest threat to bull trout. Bull trout hybridize with brook trout and the offspring are generally sterile. The available data indicate this can be an unstable situation resulting in a dramatic decline or replacement of bull trout (Leary et al 1983).

Brown trout are suspected to adversely affect bull trout (Rode 1990, Pratt and Huston 1993, Moyle 1976, Nelson 1965). At this point, the mechanism of the supposed adverse interaction (whether competition or predation) between bull trout and brown trout or other introduced species is not known and more information is needed. However, the result of the interaction may be detrimental to bull trout.

Private ponds

In the past, private ponds have not been a major source of introduced species spreading throughout this drainage. However, as more people move into the area and build ponds, there is an increasing risk from private ponds. Although there is a requirement that private ponds be licensed by the Montana Fish, Wildlife, and Parks before they are stocked with fish, some people are unaware of, or circumvent, the law. The existing permit system is inadequate to control the spread of introduced species. The concern is that brook trout, or other species, may spread from ponds into waters where they do not presently exist. There is also the potential for introduction of fish diseases through private fish stocking.

The upper Clark Fork River valley does not seem to be experiencing the same sort of growth and subdivision development as other areas of western Montana at this time. The portions of

the basin that are seeing population increases are upper and lower Rock Creek and the upper portions of the Clark Fork. However, relative to other risks to the species in this drainage, private ponds are a relatively minor concern.

Legal introductions (high risk)

At the present time, the fish species stocked in the upper Clark Fork River drainage by the Montana Fish, Wildlife, and Parks are rainbow trout and westslope cutthroat trout. Westslope cutthroat trout are native throughout the drainage and are stocked into some of the high mountain lakes in the basin. Rainbow trout are stocked into some lakes. This stocking program is not believed to be detrimental to bull trout.

However, in the past, Fish, Wildlife and Parks, other agencies, and individuals have stocked a variety of non-native species, including brook trout, brown trout, rainbow trout and others. These fish have established self-sustaining populations in many Clark Fork valley waters. It is the legacy of these past stocking practices that poses a significant threat to the survival of bull trout today.

Illegal introductions (high risk)

The illegal introduction of non-native species is a growing problem in western Montana. In addition to the risks posed by spreading introduced species, there is also a risk of introducing fish pathogens. In the upper Clark Fork drainage, most of the risk would be from illegal stocking of brook trout. This is particularly true if these fish were placed in an important bull trout drainage where they do not presently exist, or if they were stocked in an area where brook trout had been removed.

Illegal stocking of warmwater or coolwater species such as northern pike (Esox lucius), bass (Micropterus sp.) or walleye (Stizostedion vitreum) also poses a potentially significant risk to native species.

Fisheries management

Fisheries managers have concentrated their efforts in the mainstem upper Clark Fork River on addressing the water quality and habitat problems that affect the river. Much of the recreational fishing in the drainage occurs in the lakes and tributary streams.

The greatest numbers of brown trout in the Upper Clark Fork River occur in the upstream reach of the river near Warm Springs where numbers of catchable brown trout consistently exceed 1,000 fish\mile. Numbers decline rapidly downstream to only 50 fish\mile near Bearmouth. Downstream of the confluence with Rock Creek fish numbers begin to increase (Phillips 1985).

Rock Creek supports a very significant sport fishery. In 1993 Rock Creek supported 27,400 angler days (Montana Fish, Wildlife and Parks mail survey). Fisheries management in Rock Creek has changed since the early 1970's with the elimination of stocking of catchable trout. In 1979, creel limits were greatly reduced and terminal gear restrictions were imposed. These changes were successful in increasing the number of rainbow trout greater than 11" in the stream (Peters 1987).

Currently, the management goal of the Montana Fish, Wildlife, and Parks for Rock Creek is to maximize the opportunities for catching large trout (over 14") (MFWP 1989). The Rock Creek sport fishery is comprised primarily of rainbow and brown trout. The strategy that is used to obtain the management goal is to restrict catch limits (three trout per day

under 12 inches, or two trout under 12 inches and one over 20 inches). Brook trout are exempted from the special limits and have a limit of 20 fish daily and in possession.

At this time, there is no solid information as to whether or not rainbow and brown trout are a detriment to bull trout in this drainage. The current management goal may prove to be in conflict with the future goal of restoring bull trout. If bull trout are to persist over the long term the focus of fisheries management may have to change towards a goal of further protecting imperiled native species.

Barriers

Culverts

There are some culverts in the drainage that are barriers to fish passage. However, in some areas, impassable culverts assist in keeping introduced fish out of a watershed. They are not considered a significant threat in the upper Clark Fork at this time.

Diversions (high risk)

Diversions are a very significant threat to the restoration of bull trout populations in some portions of the drainage. Diversions may make it impossible for fish to migrate upstream. In addition, downstream migrants may be trapped in the irrigation diversions and displaced from stream habitat into ditches where they become lost to the system. Significant numbers of entrained juvenile and adult bull trout have been documented in other drainages (D. Peters, Montana Fish, Wildlife, and Parks, Missoula, Montana, personal communication). Diversions are a particular problem in the Little Blackfoot River drainage, in the upper portions of the Clark Fork drainage, and in the Flint Creek

drainage. The Rock Creek drainage contains relatively few diversions.

Seasonally, there are diversion barriers on the mainstem Clark Fork River, and there is a large diversion on Warm Springs Creek. Most of the diversions in the basin are seasonal barriers to fish passage.

Thermal (High risk)

Rieman and McIntyre (1993) concluded that temperature is a critical habitat characteristic for bull trout. Temperatures in excess of 15° C are thought to limit bull trout distribution in many systems (Bjornn 1961; Brown 1992; Fraley and Shepard 1989). The causes of the thermal problems include dewatering, lack of riparian vegetation to shade the water, and warm irrigation return flows entering tributary streams and the main river.

In the Little Blackfoot River and Flint Creek, irrigation diversions and resultant return flows result in elevated water temperatures. The consensus of the biologists and hydrologists working in the area is that water temperatures probably exceed the tolerance limits for bull trout in portions of these streams.

The mainstem Clark Fork River has elevated temperatures from Perkins Lane bridge downstream. For the 92 day period from June through August, 1992, water temperatures exceeded 20 degrees C on 61, 36, 49 and 35 days near Warm Springs Creek, Deerlodge, Gold Creek and Turah, respectively. The maximum temperature was over 25 degrees C near Warm Springs Creek, Gold Creek and Turah (USGS 1993). Stretches of the river between major tributaries exceed the tolerance limits for bull trout, because only a few of the major tributaries maintain sufficient cold water flow in the summer to have a cooling effect on the river. Most of these tributaries are located from Rock Creek, downstream.

Dams (high risk)

Milltown Dam was constructed on the Clark Fork River in 1906 and 1907 just downstream of the confluence of the Blackfoot River and the Clark Fork River (Periman 1985). This dam is a hydroelectric facility that blocks upstream fish passage.

The Montana Power Company, which owns and operates Milltown Dam, is currently involved in re-licensing of the dam under the authority of the Federal Energy Regulatory Commission. A fisheries mitigation plan is being developed which includes provisions for providing selective fish passage at this facility. This project is in the experimental phase and its ultimate success is unknown.

Willow Creek Reservoir is built on what was likely a historic bull trout stream. Irrigation practices and pollution from mine wastes probably caused the elimination of bull trout from this drainage. East Fork Dam on the East Fork of Rock Creek is also a barrier to upstream fish passage.

Habitat risk factors

Rural residential development

Because of the presence of a large Superfund site in the upper Clark Fork, this portion of the state is somewhat less attractive for residential development than other areas of western Montana. Some areas in the upper portions of Rock Creek are being developed now, other areas have potential for future development.

Excessive nutrients have been reported for many years throughout the mainstem Clark Fork River. The communities of Butte and Deerlodge discharge municipal sewage effluent into the

Clark Fork River and are the main point sources for nutrients in the upper Clark Fork River (MT DHES 1994).

Mining (High risk)

Over a century of mining and smelting activity in the Butte and Anaconda areas has resulted in the nation's largest Superfund site. Descriptions of the river from early researchers make it clear that Silver Bow and lower Warm Springs creeks and the upper Clark Fork River were void of fish prior to the turn of the century as a result of mining related pollution (Evermann 1892) (see section on historic distribution).

To this day, the entire length of Silver Bow Creek (25 miles) is fishless due to mining wastes originating in Butte. The bed, banks, and much of the floodplain of Silver Bow Creek and the upper Clark Fork River are contaminated with mine tailings. Some recovery of the upper Clark Fork River has occurred because of improved waste treatment and reductions in the discharge of mining wastes to the river. Still, fish populations in the upper 120 miles of the Clark Fork remain depressed in some reaches due to mining wastes (Phillips 1985).

Declines in fish abundance are attributed to copper originating from erosion of riverbanks, resulting in increasing copper loading and a more prolonged period of elevated copper concentrations in a downstream direction. Copper concentrations are lower downstream of the Little Blackfoot River and Rock Creek, demonstrating the beneficial influence of tributary dilution (Phillips 1985).

Most other drainages in the basin have also been impacted by mining activity. The first Montana gold discovery was at Gold Creek (tributary to the Clark Fork) in 1852. In the placer gold rush period of 1859 - 1866, individual prospectors panned along

creeks looking for gold. If gold was found, the stream banks were sampled to locate the source of the mineral. Hydraulic mining came into heavy use in the 1870's. The large scale destruction from hydraulic mining is still very much in evidence in south central Montana (Periman 1994). Within the Upper Clark Fork, 349 miles of streams have been identified as impaired by mining (DHES 1994). However, some streams have not been included in this analysis.

Placer and hardrock mining have occurred in both the Little Blackfoot River and Rock Creek drainage. In the Little Blackfoot River, pollution from historic mines continues to impact fisheries resources. The Brooklyn mine in the Boulder Creek drainage has been identified as having adverse effects and is scheduled for reclamation. The Rock Creek drainage contains the Gem Mountain Mine as well as several historic mining districts. Exploration continues for new hard rock developments. Most Clark Fork River and Flint Creek tributary streams have historic and/or current mines. Mining, both past and present, continues to be a major threat to the restoration of bull trout in this drainage.

Grazing (high risk)

The first cattle were brought to the Deer Lodge Valley in the 1850's. By the early 1860's, there were thousands of cattle grazing in the Deerlodge and Flint Creek valleys. Rangelands in the 1880's were commonly overgrazed and overstocked (Periman 1994).

Grazing has been and continues to be a major impact on fisheries in many portions of the upper Clark Fork River. Grazing directly affects streams by reducing bank stability and riparian vegetation. This, in turn, increases sediment loads and water temperatures, and reduces instream water quality.

Agriculture (water quantity and quality) (high risk)

The upper Clark Fork River drainage contains approximately 389 mi of chronically dewatered streams and 9 mi. of periodically dewatered streams (MDFWP 1991). Most of the water diverted from streams for irrigation in this basin is used for raising feed for cattle. Water is diverted from streams to irrigate over 100,000 acres of land upstream of Turah (USGS 1993). Dewatering of streams restricts the distribution and movement of bull trout in tributary streams. Dewatered areas will be a hindrance to the restoration of the species in this drainage. Only a handful of the tributary streams located upstream of Rock Creek contain surface flow on a year round basis. The Little Blackfoot River generally has some flow at its mouth. Some other tributary streams contain only warm irrigation return flows in late summer.

Some streams have elevated temperatures as a result of depleted streamflows. Flint Creek, the Little Blackfoot River, and the Clark Fork River are among the most impacted.

Agriculture also impacts bull trout when farming practices encroach on riparian zones. This is a widespread problem in the upper Clark Fork basin. Loss of riparian vegetation can result in bank destabilization, warmer water temperatures and increased sediment loads among other problems.

Agriculture can also impact water quality though increased nutrients. For example, feedlots are known to negatively impact water quality. In some areas, streams have been channelized for agricultural purposes.

Bull trout losses through unscreened irrigation diversions is another potentially significant problem. More information is needed to determine the extent of the problem (see the section on diversions for more information).

Dam operations

Milltown Dam is a run-of-the-river facility so, in this case, the impact on bull trout is fish passage and not dam operations.

Operation of East Fork Reservoir results in seasonal dewatering of the downstream reaches of the East Fork of Rock Creek. Trout Creek and Flint Creek are used as a conveyance channel for East Fork Reservoir water and are impacted by too much stream flow.

Forestry (high risk)

Past forestry practices (road construction, log skidding, harvest in riparian areas, clearcutting, terracing) were often damaging to watershed conditions and were a major contributing cause of the decline of bull trout. The effects of these practices include increased sediment in streams, increased peak flows, thermal modifications, loss of in-stream woody debris, and channel instability.

Mining activity and the construction of railroads resulted in the cutting of vast amounts of timber from what was to become the Deerlodge National Forest. Between 1880 and 1918, approximately 50 million board feet were annually harvested from lands surrounding Butte. The Mount Haggin area was also extensively logged to provide wood to the Anaconda Copper Mining Company. Millions of board feet were taken from this area between 1883 and 1910 (Periman 1994).

The road system and skid trails from this era are having lingering effects in some areas. In addition, a number of roads were built for other purposes, such as recreation and accessing

mining claims and private lands. Some of these roads are in need of rehabilitation. Impacts from roads can include high sediment loads, channelization and valley bottom restriction resulting in loss of stream pool habitat and lost riparian vegetation.

On the Lolo and Deerlodge National Forests, percent surface fines (a measure of fine sediment) in streams is positively correlated to, among other variables, road densities (Kramer et al 1991). Measures of fine sediment in relatively undeveloped watersheds on the Lolo and Deerlodge forests appear to be roughly half of those measured in managed watersheds on the same forests (Kramer et al. 1994).

Current forestry practices are more progressive but the risk to bull trout recovery is still high because of the existing road systems, forestry practices on private land and the lingering results of past activities.

Recreational development

This is a low risk to bull trout in the upper Clark Fork River basin.

Transportation

Two railroads, a highway and, now, I-90 have been constructed in the Clark Fork River Valley. These intrusions have adversely affected stream channels that provided habitat for bull trout. Railroad and highway construction have also affected some tributary streams.

Some railroad and highway stream crossings are fish passage barriers. In addition, some streams were channelized during road and railroad construction, resulting in shortening of stream channels, increased erosion, higher water velocities and loss of

fish habitat. These developments may have had a major impact at the time they were constructed and the impacts continue today.

During the 1880's, railroads were built across Montana. By 1940 there were two rail lines between Butte and Missoula, that followed the Clark Fork River. There were also spurs between Drummond and Philipsburg along Flint Creek, from Butte to Georgetown along Warm Springs Creek and along the Little Blackfoot River (Periman 1994). Although most of these railroads are no longer in operation, they may have had a significant impact on these rivers due to the modifications that were made to stream channels during their construction.

Major road development began in the 1860's with the construction of the Mullan Trail (Periman 1994). At the present time all the major drainages have paved roads, and most of the minor drainages have roads of varying types. The Clark Fork River has major transportation corridors on both sides of the river - a four lane Interstate highway and a railroad. A considerable amount of the river has been channelized. Portions of Flint Creek have been channelized for the highway and railroad as well. The Little Blackfoot River is impacted by two railroads and a highway.

Population risks

Life history

Resident bull trout are now the predominant life history form in the upper Clark Fork. Migratory fish are only found in the Rock Creek watershed. Fish that migrate out of Rock Creek and pass downstream of Milltown Dam cannot return back upstream.

Trend (declining) (high risk)

There is relatively little trend data available. However, evidence indicates that resident and migratory bull trout are probably continuing to decline from their historic distribution and abundance.

Distribution/fragmentation (high risk)

Disruption of migratory corridors leads to the loss of the migratory life history form. Resident stocks living upstream from barriers are at an increased risk of extinction (Rieman and McIntyre 1993). Restoration of the migratory life history form is needed for the long term survival of bull trout in this drainage. The migratory form persists in the Rock Creek drainage. All the other populations of bull trout are isolated resident populations.

Abundance (high risk)

If a population is small enough, random variation among individuals can lead to negative growth in the population long enough for the population to go extinct. As a population is restricted in abundance, or as the variation in its birth rate or survival increases, the predicted mean time to extinction will decrease (Rieman and McIntyre 1993).

The abundance risk was judged to be very high for bull trout in this basin because many streams appear to contain low or very low numbers of bull trout.

Biological sampling loss

As a result of research on the impacts of electrofishing on fish, electrofishing techniques and equipment have been modified to minimize electrofishing injury. Stream monitoring of bull trout in the upper Clark Fork River is limited to reaches of stream that are only sampled periodically so most bull trout habitat is not electrofished. There is also a MFWP policy limiting the use of electrofishing in waters containing species of special concern. Overall, the risk of loss of bull trout due to sampling was judged to be minimal.

Angling

Rock Creek receives approximately 27,400 angler days of fishing pressure annually. The Clark Fork River, upstream of the Bitterroot River, receives approximately 22,000 angler days of fishing pressure annually. They are among the top ten most heavily fished waters of Region 2 (MFWP 1993).

A creel census on Rock Creek in 1958-1959 found that bull trout comprised 5% of the catch. The total catch from Rock Creek was estimated to be 50,300 game fish, meaning approximately 2,515 bull trout were caught (Averett and Whitney 1959b). In 1959, the creel census was expanded to included the tributaries. A total of 120 bull trout were checked that had been harvested in the tributaries. The majority of these (103 fish) came from Ranch Creek. Bull trout were also harvested from Welcome Creek, Gilbert Creek, Cougar Creek, Stoney Creek and Wyman Creek (Smith 1960).

Due to a variety of factors, by 1993, bull trout were 1% of the catch on Rock Creek, meaning approximately 203 bull trout were caught and released.

The current risk from angling is low because harvest of bull trout is no longer legal in this drainage. However, there is still some risk to bull trout from incidental hooking and handling mortality. If, in the future, data indicate that hooking mortality is a significant problem, then the core and nodal watersheds may need additional angling restrictions, particularly during spawning season. Those drainages that receive significant fishing pressure (such as Rock Creek) may be more likely to have hooking mortality problems than more lightly fished waters. At this time such action is unnecessary because the risk from angling is small in comparison to other risks.

Illegal harvest (High risk)

Accurate information on illegal harvest is difficult to obtain. However, there is anecdotal information that concentrations of large bull trout are targeted by poachers. In areas where the population is small, the loss of even a few fish can be significant. Consequently, the risk to bull trout restoration was judged to be high.

RESTORATION GOAL

The restoration goal for bull trout in the Upper Clark Fork drainage is to establish a self-reproducing migratory population in the Clark Fork River which spawns in tributary streams. Specifically, a preliminary goal is to have at least 100 redds or 2000 total individuals in the migratory population over a period of 15 years (3 generations), with spawning distributed among all the core watersheds. This preliminary goal is a minimum that would likely be at risk due to instability. If the preliminary goal is reached, an increasing trend and a higher, more stable number of fish would be the ultimate goal.

Maintenance of self-sustaining bull trout populations in all the watersheds where they presently exist and maintenance of the population genetic structure throughout the watershed is part of the restoration goal. Under this goal all existing populations will at least remain stable or increase from current numbers. Reestablishment of a migratory corridor through Milltown Dam between the upper Clark Fork and middle Clark Fork is also part of the goal.

The Rock Creek watershed may be of sufficient size to support healthy bull trout populations in that drainage over the long term if adequate habitat quality is preserved and enhanced. Therefore, a preliminary restoration goal specific to the Rock Creek drainage should be established. A monitoring program should be started to build a baseline of data for the entire Rock Creek drainage. From this data a specific restoration goal could be established. Until then, the restoration goal is at least 100 redds or 2000 individuals for 15 years. Once the monitoring program has established a baseline, an increasing trend in number of fish and a higher more stable number of fish should be the definitive goal. Restoring the connectivity within the Clark Fork River may be an integral component of reaching recovery goals.

If the migratory form of bull trout is not restored, it is believed that demographic factors, genetic factors and natural or human caused catastrophic events will act in concert to gradually cause the elimination of remaining populations. Once extirpated, the chances of natural recolonization, given the present situation, are essentially zero. A key component of the restoration goal for bull trout in the upper Clark Fork River drainage is to establish a self-reproducing migratory population in the Clark Fork River which is connected to its tributary streams.

The appropriate number of fish for the restoration goal is highly uncertain. This number could change in the future as more information becomes available. Once a restoration plan is finalized and implemented, a monitoring schedule will need to be developed to determine the success of the program.

SOURCES OF UNCERTAINTY, DATA NEEDS

Distribution

More detailed information is needed on the longitudinal distribution of bull trout and other species in the Upper Clark Fork drainage. Identification of the habitats important to the various life stages of bull trout should be identified. Time series monitoring of bull trout redds and resident populations should be established in all core area streams.

Migratory populations

We need to better understand migratory populations - why we don't have more, how many fish constitute a viable population and where they spawn. How much impact do mainstem dams on the Clark Fork River have on bull trout in the upper Clark Fork River?

The ability of remnant populations of bull trout to found a migratory form must be studied. If the migratory form cannot be refounded, it is important to know if the remnant population will eventually disappear.

Water quality

Tolerance of bull trout to elevated levels of metals and other consituents in the upper Clark Fork River should be studied.

Temperature

We need to gather more information about water temperature regimes in the drainage, the causes of elevated temperatures and their impact on bull trout behavior and distribution.

Species interactions

We need to know more about bull trout interactions with introduced species. In the upper Clark Fork, the primary concerns are interactions with brook and brown trout.

Barriers

We need an assessment of barriers - culverts, diversions, etc., to determine which ones need remediation.

Restoration sites

We need to identify potential restoration sites.

Contingencies

Considering the limited distribution of many of the tributary bull trout populations, it would be prudent to devise a plan to conserve the populations that have a high extinction risk.

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