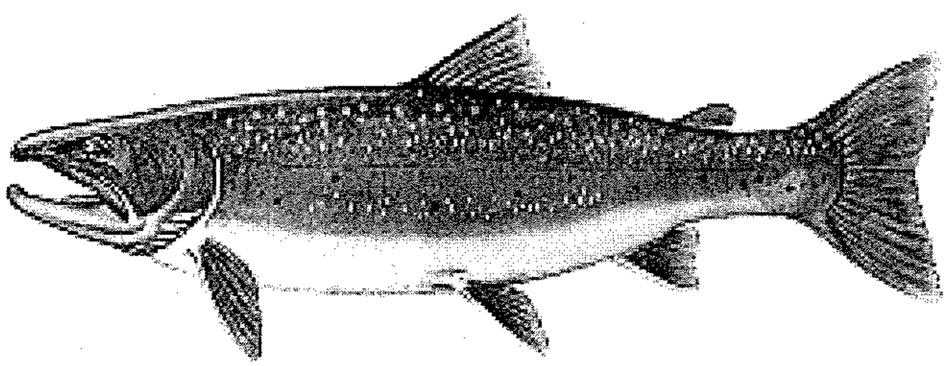
LOWER CLARK FORK RIVER DRAINAGE
BULL TROUT STATUS REPORT
(Cabinet Gorge Dam to Thompson Falls)



April 1996

Prepared for

The Montana Bull Trout Restoration Team

By

The Montana Bull Trout Scientific Group

Montana Bull Trout Restoration Team

Bonneville Power Administration

Confederated Salish & Kootenai Tribes

Department of State Lands

Montana Chapter American Fisheries Society

Montana Fish Wildlife & Parks

National Wildlife Federation

Plum Creek Timber Co.

US Fish & Wildlife Service

US Forest Service

TO: Bull Trout Restoration Interested Parties

Bull trout, a native Montana fish, has been the subject of extensive study and broad discussion since Governor Racicot appointed the Bull Trout Restoration Team in early 1994.

The bull trout status reports reflect a portion of both the study and discussion which has occurred during the last two years. These status reports, prepared by the Bull Trout Scientific Group, are designed to provide information about bull trout populations, habitat needs, and threats.

Status Reports have been prepared for bull trout populations in 11 restoration/conservation areas:

- Bitterroot River
- Lower Clark Fork River, downstream of Thompson Falls
- Middle Clark Fork River from Thompson Falls to Milltown, including the lower Flathead River to Kerr Dam
- Upper Clark Fork River, including Rock Creek
- Blackfoot River
- Flathead Lake, including the North and Middle Forks of the Flathead River, Stillwater and Whitefish rivers
- South Fork Flathead River, upstream of Hungry Horse Dam
- Swan Lake/River
- Lower Kootenai River, below Kootenai Falls
- Middle Kootenai River, between Kootenai Falls and Libby Dam
- Upper Kootenai River/Lake Koocanusa, upstream of Libby Dam

Each of these 11 restoration/conservation areas consist of a number of critical populations. The areas have been delineated on the basis of natural barriers and dam-caused fragmentation of historically connected river systems.

These status reports are **working documents**; they are the result of a collaboration of biologists, hydrologists, and other scientists and have drawn on information and research done by people working within each management area.

These documents are intended to provide the most current and accurate information available to the Bull Trout Restoration Team (see Introduction, p. 1) and the local bull trout watershed groups, which will assist them in making informed decisions affecting

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the restoration and conservation of bull trout in Montana. It is hoped that the watershed groups will develop specific recovery actions to help restore bull trout in watersheds throughout western Montana.

The status reports describe risks to bull trout in each watershed. This description of threats and risks to the fish is the best scientific judgement of the Scientific Group and is based on information provided by the local biologists. New and additional information provided by the public, the watershed groups, and the field biologists will add to our understanding of these risks as recovery proceeds. A status review is a continuous process, hence the description of these reports as "working documents."

Likewise, the restoration goal described in each status report is based on the best science available. The goal describes what would be necessary to recover fully functioning bull trout populations in each watershed and may not reflect what is realistically practical in all watersheds, considering time, budget, local interest, and/or other overriding constraints. It is presented as a goal, not necessarily as an inflexible expected outcome.

It is the sincere hope of the Restoration Team and Scientific Group that these documents will assist the watershed groups in "going forth and doing good things" for bull trout.

As always, we welcome your comments regarding bull trout restoration. Please send your thoughts or call Glenn Marx, Governor's Office, Capitol Station, Helena, MT 50620 (444-5506) or Shelley Spalding, Montana Fish, Wildlife and Parks, P.O. Box 20071, Helena, MT 59620 (444-7409).

Sincerely,

Larry P. Peterman

Larry Peterman, Chairman
Bull Trout Restoration Team

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EXECUTIVE SUMMARY

This report addresses the status of bull trout in the Lower Clark Fork River (LCFR) drainage, defined as the area between Cabinet Gorge Dam and Thompson Falls Dam, including associated tributaries. It is believed bull trout were once widely distributed in the Clark Fork River and its tributary streams. The present distribution and abundance of bull trout is reduced from historic levels.

Historically, migratory bull trout were the predominant life form with adults migrating out of Lake Pend Oreille. This component of the population is currently non-existent in Montana due to migration barriers. The Lake Pend Oreille population still uses portions of the Clark Fork River downstream from Cabinet Gorge Dam and other Lake Pend Oreille tributaries. In Montana, migratory bull trout persist, but their range is limited to Noxon Rapids and Cabinet Gorge reservoirs and their tributaries.

Risks

The primary risks to bull trout in the LCFR drainage are the fragmentation of the historic migratory populations caused by mainstem hydroelectric dams. Forestry practices and mining activities have further degraded existing habitat. Forestry practices have affected the remaining primary spawning streams, and future logging activity is expected to continue. The threat from mining is related primarily to the proposed development of a mine in the Rock Creek watershed.

Other risks to restoration include environmental instability from landslides and rain-on-snow events, thermal problems, rural/residential development, and illegal harvest.

Core Areas and Nodal Habitats

Core areas are drainages which historically and currently support the strongest remaining populations of bull trout. These habitats are considered key to the continued existence of bull trout and are the highest priority for protection and restoration activities. Core areas in the LCFR include the Prospect Creek, Vermillion River, Bull River and Rock Creek drainages.

The nodal habitats (waters containing migratory corridors, overwintering areas, and other critical habitats) are in Noxon and Cabinet Gorge reservoirs.

The Restoration Goal

The first component of the restoration goal is maintenance of self-sustaining bull trout populations in all watersheds where they presently exist, including the migratory life form, with maintenance of the population genetic structure throughout the watershed. Under this goal, the objective is for all existing populations to at least remain stable or increase above current numbers. In addition, the reestablishment of the historic bull trout migratory corridor in the Clark Fork River - Lake Pend Oreille system is needed for the long term survival of the species in this drainage.

Specifically, the objective is to have at least 100 redds or 2000 total individuals in migratory populations sustained over a period of 15 years (3 generations), with spawning well distributed within core areas. This preliminary goal is a minimum that would likely establish a marginally viable population. If the preliminary goal is reached, an increasing trend resulting in a higher, more stable number of fish would be the definitive goal. Baseline redd surveys should be established in all drainages that presently support spawning migratory bull trout.

This goal statement is based on the best information currently available. However, the level of uncertainty about the feasibility (both technical and biological) for fish passage are high.

At a minimum, appropriate studies to address the feasibility of providing fish passage should be initiated. Initial efforts should be experimental in nature. Modifications to this goal may be appropriate as more information becomes available.

LOWER CLARK FORK RIVER DRAINAGE
BULL TROUT STATUS REPORT

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 created a Scientific Group to provide guidance on technical issues related to the restoration of this fish.

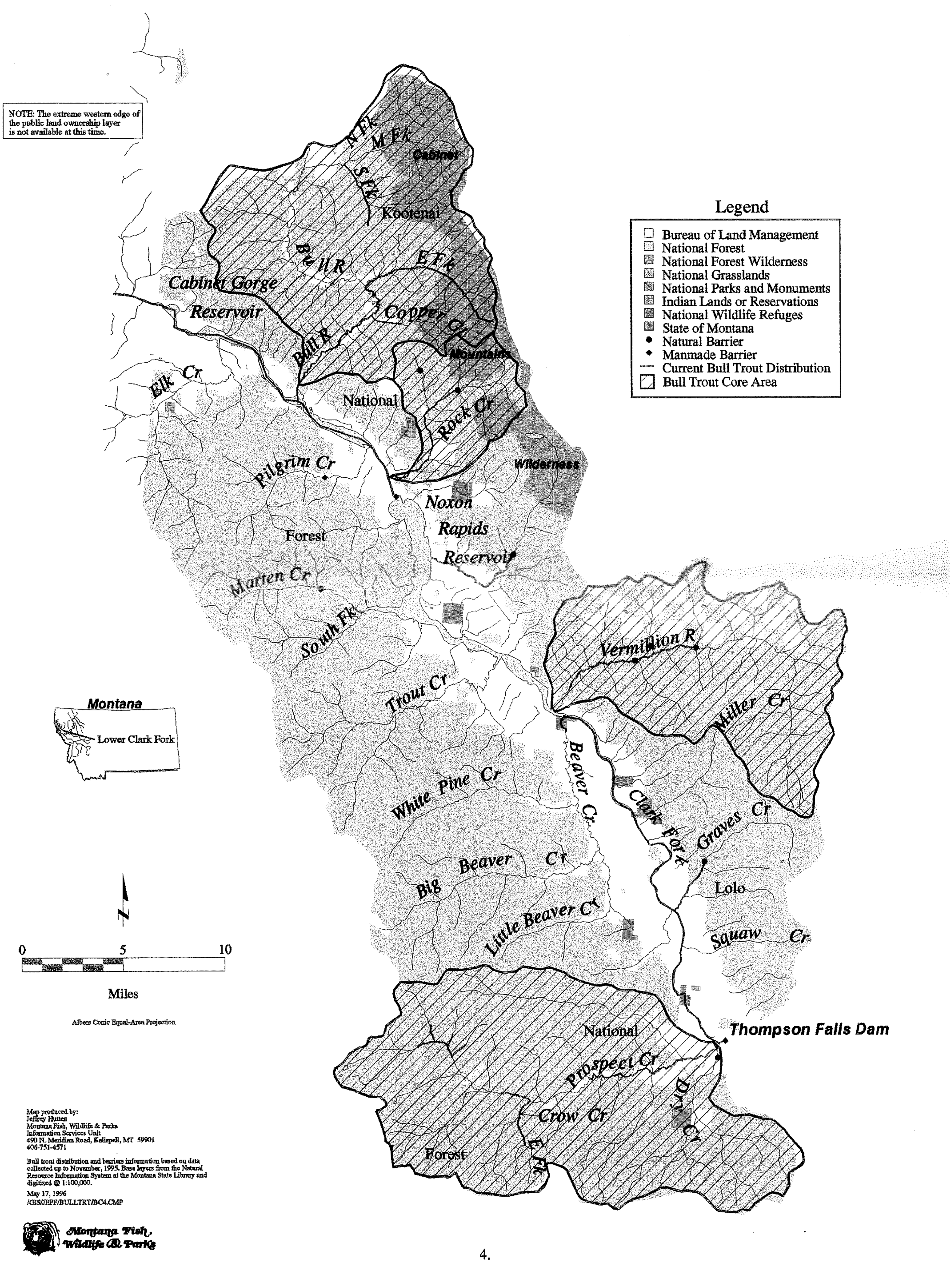
The Scientific Group reviewed the status of bull trout, identified risks to the survival of the species, and recommended restoration goals. In addition, the Scientific Group prepared reports on three of the most significant issues in bull trout restoration - land use impacts, removal and suppression of introduced species, and the use of hatcheries in restoration. Because the threats facing bull trout vary widely across the state, separate status reports were prepared for each of twelve bull trout restoration/conservation areas in Montana, except Rock Creek which is included in the Upper Clark Fork report. These areas were delineated based on physical barriers or other boundaries that establish discrete populations or identified jurisdictional limits (Figure 1).

This status report covers the Lower Clark Fork River drainage between Cabinet Gorge Dam and Thompson Falls Dam (Figure 2). The document addresses the historic and current status and distribution of bull trout in the LCFR, describes threats to its existence, delineates core areas and nodal habitats, and recommends research needs.

The Clark Fork River is Montana's largest river, with an average annual stream flow of 21,960 cfs at the Montana/Idaho border. The total drainage area is 22,073 mi^2 (USGS 1995). Land ownership within the drainage is mixed. Timber production is the primary land use activity.

Figure 1. Bull Trout Restoration/Conservation Areas in Montana

Figure 2. Bull trout distribution and core areas in the Lower Clark Fork drainage.



The LCFR flows through sedimentary formations (Belt rock) from the Precambrian time. Although the Clark Fork valley did not contain ice age glaciers, it did carry all of the flood flow from glacial Lake Missoula. The passage of this torrent left its mark on the local landscape.

There are three hydroelectric dams within the LCFR drainage. Thompson Falls Dam, completed in 1916, is owned and operated by the Montana Power Company (MPC) and is the upper boundary of the LCFR drainage area. Cabinet Gorge Dam, completed in 1952 is just downstream of the Montana\Idaho border. It currently operates as a re-regulating facility for Noxon Rapids Dam. Noxon Rapids Dam, completed in 1958, inundates that portion of the Clark Fork River between the backwaters of Cabinet Gorge Reservoir and the tailwaters of Thompson Falls Dam (Gaffney 1955). The Washington Water Power Company (WWP) owns and operates the Cabinet Gorge and Noxon Rapids hydroelectric dams.

Available fisheries information has been obtained by Montana Fish, Wildlife, & Parks (FWP) and by WWP in a cooperative effort with resource agencies. More recently, WWP initiated comprehensive inventories of the aquatic resources associated with its two Clark Fork River projects. These inventories were intended to provide baseline information for the Federal Energy Regulatory Commission (FERC) re-licensing process on Noxon Rapids and Cabinet Gorge dams. The current licenses will expire in 2001.

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

Historic Distribution

Historically, bull trout were one of three native salmonids distributed throughout the Clark Fork drainage. The others were westslope cutthroat trout *(Oncorhynchus clarki lewisi)*, and mountain whitefish *(Prosopium williamsoni)*. Sources of information about the historical distribution of bull trout in Montana are limited. However, it is likely that migratory bull trout from Lake Pend Oreille utilized most major Clark Fork River tributaries for spawning and rearing.

Evermann (1892), who traveled through Montana in the late 1890's sampling fish, stated that bull trout were common in most of the larger affluents of the Columbia River 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. Fish from Lake Pend Oreille had access to the Clark Fork up to its headwaters (Evermann 1892).

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 by Native Americans on the Lower Clark's Fork River. 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 are native to Montana.)

Pratt and Huston (1993) summarized oral history data on bull trout distribution in the LCFR drainage from the 1920's - 1950's. They concluded that bull trout were present in Stevens Creek, Swamp Creek, Galena Creek, Marten Creek (mouth to Devil's Gap), South Fork Marten Creek (to McNeeley Creek), Tuscor Creek, Vermillion River (mouth to falls), Canyon Creek, Graves Creek (mouth to falls), Mosquito Creek, Prospect Creek (some segments), Wilkes Creek, Clear Creek, Crow Creek, Elk Creek, East Fork Elk Creek, Bull River (mouth to South Fork), Copper Gulch, East Fork Bull River, North Fork East Fork Bull River, Pilgrim Creek, Government Creek, Rock Creek (mouth to West Fork Falls) and East Fork Rock Creek.

Pratt and Huston (1993) examined trapping records from the 1940's and 1950's and estimated the total spawning population of bull trout in the LCFR to be less than 2,000. About 300 - 500 spawners were estimated to use the Bull River, and the Vermillion River probably supported less than 100 spawners. Estimates for Prospect Creek varied from 100 - 200 to "somewhat less than" 400 spawners.

Most of the published information on bull trout from this drainage dates from the 1950's or later. Brunson (1952) trapped bull trout in the Bull River and Prospect Creek. He speculated that captured fish were migrants from the Clark Fork River and possibly Lake Pend Oreille. The traps collected 51 breeding adults, 23 males and 28 females, ranging in weight from 1.6 to 8.8 pounds.

Gaffney (1955) reported collecting mature bull trout in gill nets where Beaver Creek, Martin Creek, Elk Creek, and the Bull River empty into the reservoirs. He also observed large bull trout (presumably spawners) in the Vermillion River, Prospect Creek, and Martin Creek. He reports angler catches of bull trout from Beaver Creek Bay and the Vermillion River Bay.

Bull trout made up 50% of the game fish taken by anglers interviewed on Cabinet Gorge Reservoir in the summer of 1955 (catch rate was 0.17 fish/hr). It should be noted that this survey was done during the early years of impoundment. From 1948 to 1955 bull trout were also caught by anglers fishing the Clark Fork River between the Flathead River and Thompson Falls, although catch rates were far lower (.006 - .02 fish/hr) (Gaffney 1955).

Current Distribution

Bull trout currently exist in both Noxon Rapids and Cabinet Gorge reservoirs and utilize tributary streams for spawning and rearing. Movement of fish between the reservoirs (gene flow) is limited to a downstream direction, although the magnitude of bull trout movement out of either reservoir is unknown.

Cabinet Gorge bull trout populations are supported primarily by two spawning streams; Rock Creek and the Bull River. Large fish (presumably migratory) have been observed, however, no large redds have been located in Rock Creek in recent surveys. Smaller redds, presumably from the resident population, have been found in Rock Creek (J. Huston, FWP , Kalispell, Montana, personal communication).

Surveys of the Bull River found bull trout present in the mainstem, the North, East and South forks, and Copper Creek. Bull trout were not found in the Middle Fork of the Bull River. The East Fork Bull River is considered the most important bull trout stream in this watershed (Smith 1993; R. Smith, WWP, Noxon, Montana, personal communication).

Noxon Rapids Reservoir has five tributaries that support migratory bull trout spawning and rearing. Redd surveys in 1993 found the following (numbers of redds in parenthesis): Vermillion River (24), Prospect Creek (9), Swamp Creek (4), Graves Creek (1), Marten Creek (3) (Pratt and Huston 1993). As the redd count data indicate, the Vermillion River and Prospect Creek appear to be the most important spawning tributaries for migratory bull trout.

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

Core areas are drainages that currently contain the strongest remaining populations of bull trout. They are usually relatively undisturbed. These watersheds require the most stringent levels of protection as they will potentially provide the stock for recolonization (Rieman and McIntyre 1993).

Core areas in the LCFR are the Prospect Creek, Rock Creek, Vermillion River and Bull River drainages. The nodal habitats (waters containing migratory corridors, overwintering areas, and other critical habitats) are in Noxon and Cabinet Gorge reservoirs.

RISKS TO BULL TROUT IN THE LOWER CLARK FORK RIVER DRAINAGE

The risks to bull trout in the LCFR drainage are listed in Table 1. The risks were evaluated by the Scientific Group based on the degree to which a risk factor was presumed to contribute to the past and current decline of the species (designated as HISTORIC/CURRENT in the table) and the threat the risk factor poses to future restoration of the fish (RESTORATION in Table 1). Those risks which are of greatest concern are noted with a double asterisk.

In the LCFR drainage, fragmentation of the historic migratory populations is considered to be the highest risk historically and to restoration. Fragmentation has resulted in smaller, more discrete population units with less tributary accessability. The migratory component of these smaller units is at a higher threat of extirpation due to their limited abundance and available range. Forestry practices have affected primary spawning streams and future logging activity is expected. Mining threats are related to the proposed development of a mine in a core area, Rock Creek.

Other risks to restoration include environmental instability from landslides and rain on snow events, thermal problems, rural/residential development, and illegal harvest. Because of the historic population trend, the declining abundance of bull trout populations is also considered a risk.

Table 1. Risks to bull trout in the LCFR drainage. (* = high risk; ** = very high risk).

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 Development		
Mining	*	**
Grazing		
Agriculture		
Dam Operations	*	
Forestry	*	**
Recreational Developments		
Transportation		
Population		
Population Trend	*	*
Distribution/Fragmentation	*	**
Abundance	*	*
Biological Sampling		
Angling		
Illegal Harvest	*	**

Environmental Instability

Drought, Landslide/Geology (high risk), Flood/Rain on Snow (high risk), 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. Currently (as compared to historically), these events represent a higher risk because of the fragmentation of the historical migratory populations into smaller population units and then reliance on few spawning tributaries. Under current conditions, if a catastrophic event were to cause a loss of one of the few remaining spawning tributaries, the entire population would be at higher risk of extinction.

In the LCFR drainage, landslides and rain-on-snow events are relatively common natural events. (Rain on snow is a common term used to describe cloudy weather periods when warm winds and rain combine to produce rapid snowmelt during early to mid- winter periods.) Man's activities have increased the chances of landslides occurring in some areas. In other areas, such as the Vermillion River drainage, landslides are a natural result of the local geology.

Almost all streams entering the Clark Fork River (or reservoirs) from the Bitterroot mountains (south side of the drainage) have naturally occurring intermittent reaches. This could influence their usefulness to bull trout (Pratt and Huston 1993). Intermittency also occurs in streams entering from the north. This propensity for intermittency has been exacerbated by both natural and man caused events. Historical natural events include a major forest fire in 1910 and intermittent drought. Human disturbance is primarily the result of mining, silviculture, and agriculture practices discussed below.

Introduced Species

The introduced fish species found in the LCFR drainage include Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*), brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui*), black crappie (*Pomoxis nigromaculatus*), northern pike (*Esox lucius*), walleye (*Stizostedion vitreum*), yellow perch (*Perca flavescens*), pumpkinseed (*Lepomis gibbosus*), burbot (*Lota lota*), yellow bullhead (*Ictalurus natalis*), and black bullhead (*Ictalurus melas*).

In the mainstem reservoirs, yellow perch and pumpkinseed are now two of the most abundant species present (ND&T 1994; WWP 1995). Although the interactions between all of these introduced species and bull trout are not always clear, the possibility of adverse interspecies interactions and the sheer number of introduced species poses a high risk to bull trout.

Brook trout are believed to be a particularly high risk and are present in all streams in the LCFR drainage currently used by bull trout. Bull trout hybridize with brook trout and the offspring are generally sterile. The available data indicate this can created 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 (Nelson 1965; Moyle 1976; Rode 1990; Pratt and Huston 1993). The mechanism of the interaction (whether competition or predation) between bull trout and brown trout or other introduced species is currently not known and more information is needed. However, the result of the interaction may be detrimental to bull trout. Brown trout also use most of the waters inhabited by bull trout in the LCFR drainage. It is known that brown and bull trout spawn in the same area of the Bull River. Brown trout spawn later in the fall than bull trout and may disturb bull trout redds built earlier in the season (Pratt and Huston 1993).

Lake trout emigrate from Flathead Lake into the LCFR drainage. If these fish were to become established, they could pose a significant threat to bull trout (Donald and Alger 1992). However, the habitat in Noxon and Cabinet Gorge reservoirs may not be suitable for a self-sustaining lake trout population because of warm water temperatures.

Northern pike and walleye are present in the reservoirs. The presence of walleye is the result of a recent illegal introduction into the LCFR drainage but reproduction has not been documented. Northern pike have been in the LCFR drainage since the 1950's, are more abundant than walleye, and are reproducing. Given the predacious behavior of walleye and northern pike, predation and/or competition between these species and bull trout may occur.

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 FWP before they are stocked with fish, many people are unaware of, or circumvent, the law. The concern is that new species may be introduced and spread from ponds into waters where they do not presently exist.

Legal Introductions (very high risk)

In the past, FWP, other agencies, and individuals have stocked a variety of introduced species, including brook trout, Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*), rainbow, brown trout, smallmouth bass, burbot, kokanee (*Oncorhynchus nerka*), coho salmon (*Oncorhynchus kisutch*), and others. Many of these species have established self-sustaining populations in LCFR drainage waters and it is this legacy of past stocking practices that poses a significant risk to the survival of bull trout today.

At the present time, the fish species stocked in the LCFR drainage by FWP are largemouth bass, Kamloops 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 drainage. Kamloops rainbow trout are stocked into Noxon Rapids Reservoir under an informal agreement with Idaho Fish and Game to prevent further erosion of the Lake Pend Oreille Kamloops' genetics. All stocking programs should be evaluated to determine if they pose risks to bull trout.

Largemouth bass have been stocked in the Noxón and Cabinet Gorge reservoirs in recent years in an attempt to increase the genetic diversity of the present largemouth bass stocks. No further bass stocking is planned for these waters in the near future (J. Huston, FWP , Kalispell, Montana, personal communication).

Illegal Introductions (high risk)

The illegal introduction of fish species is a growing problem in western Montana. This is particularly true if these fish were introduced into an important bull trout drainage where they do not historically exist, or if they were stocked in an area where introduced fish had been removed. In addition to the threats posed by spreading introduced species, there is also a threat of introducing fish pathogens.

Fisheries Management (high risk)

Immediately prior to closure of Noxon Rapids Dam in August, 1958, Thompson Falls Reservoir and the Clark Fork River downstream to Cabinet Gorge Reservoir were chemically treated with rotenone to remove the existing fish populations (Huston 1985). This was a common management strategy during the era when new dams were being constructed. The hope was that poisoning, followed by stocking of rainbow trout, would result in a sport fishery for rainbow. Huston (1985) summarized fishery management activities in Noxon and Cabinet Gorge reservoirs between the early 1950's and the mid-1980's. In general, FWP stocked a variety of species, strains, and sizes of introduced fish in an attempt to establish a sport fishery. These efforts were largely unsuccessful.

Management emphasis in the early 1980's shifted away from coldwater salmonids and towards a warm-water bass fishery. Largemouth bass had persisted in the reservoirs, even following the chemical treatment of the late 1950's, and smallmouth bass were stocked into Noxon Reservoir several times, beginning in 1982. At about the same time, reservoir operations were modified to reduce drawdown. Since that time, bass numbers have increased, along with yellow perch and pumpkinseed, and the bass fishery is currently providing a viable sport fishery in Noxon Reservoir (Huston 1985). In the future the management goal of maintaining a viable sport fishery for introduced species may prove to be in conflict with the goal of restoring bull trout in this drainage.

Barriers

Natural migration barriers exist in several tributary streams. Vermillion Falls on the Vermillion River is considered the upstream limit for bull trout in this tributary. Graves Falls is a barrier to most of Graves Creek. Falls also block fish passage on the upper portion of the East and West forks of Rock Creek. Many streams in the LCFR drainage also have intermittently dewatered sections that can act as seasonal barriers.

Culverts

Culverts are not considered a significant risk in the LCFR drainage at this time as there are no known culvert barriers on spawning streams. A culvert near the mouth of Elk Creek historically created a barrier to upstream movement in this stream. It has since been replaced. New stream crossings below existing or potential bull trout habitats must be carefully designed and existing crossings appropriately maintained or removed to avoid creation of a barrier.

Diversions

Diversions are not a significant risk to the restoration of bull trout populations as there are very few diversions and relatively little agricultural land in the drainage. There is an existing diversion on Swamp Creek, which is a suspected barrier to migratory fish. There was a micro-hydropower proposal in the Prospect Creek drainage a few years ago that would have seasonally dewater a section of the stream. Given the limited availability of spawning tributaries, any existing or future diversion structures should provide fish passage and protection (e.g. fish screens).

Thermal

Rieman and McIntyre (1993) concluded that temperature is a critical habitat characteristic for bull trout. Temperatures in excess of 59° F are thought to limit bull trout distribution in many systems (Bjornn 1961; Fraley and Shepard 1989; Brown 1992).

Water temperatures in Noxon and Cabinet Gorge Reservoirs generally exceed 70° F in the summer months. Generally, these reservoirs do not stratify (i.e. form a thermocline). However, Noxon Reservoir sometimes has a temperature gradient from top to bottom of 10-20 degrees Fahrenheit. Thermal refuges for bull trout are generally limited to spring areas and bays receiving colder tributary inflows. The effects of reservoir temperature regimes on bull trout are unknown at this time.

Dams (very high risk)

Three hydroelectric dams in the LCFR drainage block upstream fish passage. Thompson Falls Dam blocks over 90% of the Clark Fork River basin previously accessible to Lake Pend

Oreille fish. Cabinet Gorge Dam completely eliminated migration of Lake Pend Oreille fish into Montana. Noxon Rapids Dam further inundated the river habitat between Thompson Falls dam and Cabinet Gorge reservoir. The construction of these dams was a primary cause of the decline of migratory bull trout in this system.

While none of these hydroelectric projects provide upstream fish passage, downstream movement has been demonstrated. Marked hatchery fish planted in Noxon Reservoir have been caught in Cabinet Gorge Reservoir and Lake Pend Oreille (Huston 1985).

FERC licences for both Noxon Rapids Dam and Cabinet Gorge Dam will expire in 2001. Washington Water Power (WWP), operator of both facilities, is currently gathering information about fisheries resources in these reservoirs and their tributaries in preparation for re-licensing (R. Smith, WWP, Noxon, Montana, personal communication).

Habitat

Rural Residential Development

This area of Montana is sparsely populated. However, in recent years, the human population has been increasing at a rapid rate. Rural residential development may be a high risk to the restoration of bull trout, particularly in core areas bordered by private lands such as along the Bull River.

Mining (very high risk)

Many portions of the drainage have experienced mining activity. A 10,000 ton/day underground copper/silver mine and mill is currently proposed in the Rock Creek drainage. The proposed tailings impoundment would store 100 million tons of tailings near the confluence of Rock Creek and the Clark Fork River. The Rock Creek drainage has been identified as one of two core area streams for the Cabinet Gorge bull trout population. Sediment levels in Rock Creek are over 40% fines (Smith 1993; Smith 1994), which is already considered high enough to significantly reduce bull trout survival to emergence. This mine and mill complex will pose a high risk to bull trout in the Rock Creek drainage and, potentially, in downstream waters as well.

Grazing

Grazing is not a major risk to fisheries in the LCFR drainage. There are grazing impacts that should be addressed on Elk Creek, Pilgrim Creek and some sections of the Bull River to enhance bull trout recovery in these areas.

Agriculture (water quantity and quality)

The LCFR drainage contains only about 6 miles of chronically dewatered streams, none of which are in core area streams for bull trout (FWP 1991). While the 1994 Montana 305b Report (MT DHES 1994) identifies several streams which suffer from impaired water quality as a result of agricultural activities, overall, agricultural impacts to bull trout are minor in this drainage.

A major deterrent to bull trout recovery in Swamp Creek is the intermittent section between the mouth and the Green Mountain Irrigation Company headgate (approximately 3.4 miles). The Green Mountain Irrigation Company has water rights equal to and exceeding the summer flows and has used the rights in the past. The habitat in the upper reaches of Swamp Creek are comparable to the East Fork of the Bull River. Bull trout are still present at low population levels and, with improved flows, Swamp Creek has the potential to become a core area.

Dam Operations

Thompson Falls Dam is operated by MPC as a run-of-the river facility. It has almost no storage capacity. Cabinet Gorge and Noxon Rapids dams are owned and operated by WWP. The current operational agreement between WWP and Bonneville Power Administration (BPA) for Noxon Reservoir allows for a ten foot maximum seasonal drawdown, which may be exceeded under special circumstances. Cabinet Gorge currently functions as a re-regulating facility for Noxon Rapids Dam. Cabinet Gorge drawdowns rarely exceed five feet (Huston 1985). The Aquatic environment has benefited to some extent from the current Noxon Rapids operational agreement. However, it is unknown if this operational scenario benefits other fish species to the detriment of bull trout.

Noxon Rapids Reservoir has a surface area of 8,000 acres at full pool and 5,500 acres at minimum pool (Huston 1985). Discharge from Noxon Dam varies daily and seasonally depending on the river inflow and demand for electrical power (Huston 1988). Noxon Rapids Reservoir is divided into two distinct habitat types with a broad transition zone that varies depending on river flow and project operation. The upper area, generally between Beaver Creek bay and Thompson Falls Dam, is characterized by visible current at almost all times of the year. The lower area, generally downstream from Beaver Creek Bay, has visible water currents only during spring high water or during severe reservoir drafting (Huston 1985).

Noxon Rapids Reservoir exhibits varying degrees of stratification depending on river flow and ambient conditions and occasionally has a weak thermocline (documented in late-July 1994 at about 25 feet) (ND&T 1994, WWP 1995). Surface temperatures average about 72°F during the hottest days, but uncommonly reach 75°F. Water temperatures cool with depth to 60 - 65°F at 100 feet deep to the low 50°'s F at 175- 200 feet. Water temperatures in littoral areas outside the main reservoir current sometimes reach 80°F. Generally, oxygen concentrations remain within the tolerance level for salmonids (Huston 1985). However, oxygen levels are low in the deepest portions of the reservoir. In late July 1994, DO fell below 7 ppm at a depth of about 100 feet, 6 ppm at 135 feet, 5 ppm at 150 feet, and less than 4 ppm below 155 feet (WWP 1995).

Cabinet Gorge Reservoir is 20 mi long and has a surface area of 3,200 acres at full pool and 2,450 acres at minimum pool (Huston 1988). The reservoir currently has typical daily water level fluctuations of two to four feet. The temperature of the reservoir is nearly isothermal (WWP 1995). This means there are few, if any, coldwater refuges in deep portions of the reservoir during the warm summer months. However, tributary and groundwater inflows may provide areas of cold water refuge for bull trout. Maximum temperature rarely exceeds 72°F except in backwater shallows outside the main current pattern. Dissolved oxygen levels in the reservoir are adequate for fish at all depths.

While spilling at these facilities is known to cause gas supersaturation, symptoms of gas bubble disease have not been detected in fish downstream (Huston 1985).

Forestry (very high risk)

Silviculture has been identified as a source of impaired water quality in Noxon Reservoir, Beaver Creek, Graves Creek, Prospect Creek, Snake Creek, Swamp Creek, and the Vermillion River (MT DHES 1994).

Past forestry practices (road construction, log skidding, riparian harvest, clear cutting) 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 instream woody debris, and channel instability. Many of these effects further exacerbate stream intermittency.

Current forestry practices are more progressive but the threat is still high because of the existing road system, mixed land ownership, forestry practices on private land, and the lingering results of past activities. Bull trout in Prospect Creek, the Vermillion River, and the Bull River (all core areas for bull trout) have been particularly impacted by past logging activities (J. Huston, FWP , Kalispell, Montana, personal communication). Deposited sediment levels in the Bull River and Rock Creek are high enough to significantly reduce bull trout survival to emergence (Huston 1988; Smith 1993)

Other streams with relatively high sediment levels include West Fork Elk Creek, Middle Fork Bull River, Pilgrim Creek, Elk Creek, and Marten Creek. While many of these streams do not currently contain bull trout, they might prove important in recovery.

Recreational Development

This is a low threat to bull trout in the LCFR drainage. There are no existing or proposed developments.

Transportation

Many 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 alterations had a major impact on certain streams at the time they were completed and the impacts continue today. Two core areas (Prospect Creek and the Bull River) have major roads which parallel the streams.

Population

Life History

Prior to hydroelectric development in the LCFR drainage, migratory bull trout from the Clark Fork River and Lake Pend Oreille had access to tributary streams both within the LCFR drainage and upstream of Thompson Falls Dam. Historically, the Clark Fork River within the LCFR drainage was likely utilized as a migration corridor between its tributaries and Lake Pend Oreille. Those tributaries within the LCFR drainage were likely used for spawning and rearing, with the most abundant fish present being juvenile fish of the migratory populations. The bull trout biology and life history patterns were probably similar to those documented in the Flathead Lake-River system (Fraley and Shepard 1989).

As dams were built, the migratory corridor for spawning bull trout was blocked. Dams were built concurrently with fish rehabilitation efforts (see Fisheries Management , page 15). Dam construction isolated the LCFR from migratory Lake Pend Oreille fish and created of two run-of-the-river reservoir habitats. The resulting reservoir habitats are not adequate substitutes for Lake Pend Oreille. The current situation could be described as one where the tributary spawning and rearing habitats still exist (although degraded) but rearing habitats for migratory adult and subadult fish have changed significantly. Over time, the migratory life history pattern was largely replaced by those fish expressing the resident life form in the tributaries. These changes have occurred over a 40 year period (4 to 8 bull trout generations).

The shift from larger migratory populations to smaller more isolated migratory and resident populations may increase the likelihood of extinction. Resident bull trout are typically smaller in body size compared to their migratory counterparts. Because fecundity is related to size, the migratory strategy can confer an adaptive strategy by increasing reproductive potential. In productive environments, migratory forms should dominate resident forms and should be more resilient and more resistant to environmental variation and stressors (Rieman and McIntyre 1993). In addition, migratory fish are more likely to stray between streams than resident fish, which provides for genetic exchange and higher chances of refounding locally extinct populations. In their study of demographic requirements for bull trout, Rieman and McIntyre (1993) concluded that maintenance of the migratory life history form is necessary for the long term survival of the species.

Trend (high risk)

There are no population trend data available for bull trout in the LCFR drainage prior to construction of Cabinet Gorge Dam. Since construction of the dams, the catch of bull trout during gill net surveys in the reservoirs (between 1960 and 1985) indicates that bull trout declined in Noxon Reservoir but remained somewhat stable in Cabinet Gorge Reservoir (Huston 1985). Pratt and Huston (1993) evaluated the past and current bull trout population status of the LCFR drainage and concluded that bull trout populations in Cabinet Gorge and Noxon reservoirs are presently stable, but fragile. More recently, WWP has conducted extensive gill netting surveys (in preparation for FERC relicensing) and documented very few bull trout in the catch. While these populations persist at this time, they are susceptible to extinction from events that could cause further population declines.

Distribution/Fragmentation (very high risk)

In the LCFR drainage, fragmentation of the historic bull trout populations can be characterized as extreme (Fairman et al. 1995). Dams have fragmented the once contiguous, historic habitats into two discrete habitats in the reservoirs and tributaries. Only remnant populations of a former larger migratory bull trout population now have access to only a limited number of tributaries for spawning and rearing. In addition, stream intermittency problems further fragment populations by periodically limiting access to some of these remaining habitats. This disruption of migratory corridors has lead to a decline of the migratory life history form (see Life history, above) and has resulted in more isolated populations. Many of these populations persist in more degraded habitats than they historically occupied. If local extinctions occur, there is less chance of refounding due to fragmentation. Rieman and McIntyre (1993) concluded that open migratory corridors are critical to the long-term persistence of the species.

Abundance (high risk)

If a population is small enough, random demographic variation can lead to a decline in the population long enough for it to go extinct (Rieman and McIntyre 1993). 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. The processes of extinction do not operate independently. For example, habitat changes that stress or act to isolate population segments, thereby reducing abundance, may increase the population's susceptibility to other risks such as environmental instability or detrimental genetic effects. Low abundance may result in loss of genetic diversity that could reduce fitness and increase sensitivity to environmental variation.

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 to fish. There is a FWP policy minimizing 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. However, WWP, and others are sampling extensively in the drainage in preparation for the FERC re-licensing of Noxon Rapids and Cabinet Gorge Dams. This sampling needs to be conducted with the maximum amount of caution to minimize loss of bull trout.

Angling

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, the core watersheds should be closed to fishing entirely, particularly during spawning season.

The portion of the drainage that receives the most significant angling pressure is Noxon Reservoir. In 1993, Noxon Reservoir received an estimated 6,329 angler days of pressure, up from an estimated 4,297 angler days in 1991 (FWP 1992b; FWP 1994). Fishing pressure in Cabinet Gorge Reservoir is quite low. In 1993, there was an estimated 353 angler days of pressure, up from an estimated 148 angler days in 1991. Most of the anglers fishing the reservoirs are seeking bass. If bass anglers catch and release bull trout, hooking mortality could be a concern.

Most of Prospect Creek and the Bull River are on private land. Access is limited and fishing pressure is low.

Illegal Harvest (high risk)

Accurate information on illegal harvest is difficult to obtain. Pratt and Huston (1993) describe poaching techniques and locations in the Lower Clark Fork River. Dynamiting, spearing, snagging, and shooting were all historically used by poachers in this area. It is known that heavy snagging harvest once occurred in the Bull River. In addition, hooking mortality in snag fisheries tends to be high. In areas where the population is small, the loss of even a few fish can be significant. Consequently, the risk to bull trout restoration from illegal harvest was judged to be high.

RESTORATION GOAL

The first component of the restoration goal is maintenance of self-sustaining bull trout populations in all watersheds where they presently exist, including the migratory life form, with maintenance of the population genetic structure throughout the watershed. Under this goal, the objective is for all existing populations to at least remain stable or increase above current numbers. In addition, the reestablishment of the historic bull trout migratory corridor in the Clark Fork River - Lake Pend Oreille system is needed for the long term survival of the species in this drainage.

Specifically, the objective is to have at least 100 redds or 2000 total individuals in migratory populations sustained over a period of 15 years (3 generations), with spawning well distributed within core areas. This preliminary goal is a minimum that would likely result in a marginally viable population. If the preliminary goal is reached, an increasing trend and a higher, more stable number of fish would be the definitive goal. Baseline redd surveys should be established in all drainages that presently support spawning migratory bull trout.

It should be recognized that this goal statement is based on the best information currently available, however the level of uncertainty about the feasibility (both technical and biological) for fish passage is high. At a minimum, appropriate studies to address the feasibility of providing fish passage should be initiated. Initial efforts should be experimental in nature. Modifications to this goal may be appropriate as more information becomes available.

SOURCES OF UNCERTAINTY, DATA NEEDS

Migratory Populations

Feasibility studies with cost estimates are needed to determine whether fish passage around the LCFR dams is necessary and if so, what methods should be used. A trap and haul/telemetry study would be valuable to determine the biological value of fish passage at these facilities. Downstream migration through reservoirs and across dams should be evaluated.

Distribution

More survey work is needed to determine the distribution of both resident and migratory bull trout in the drainage. A genetics survey is needed to determine the population genetic structure. Drainage wide redd surveys are needed for monitoring population status.

Introduced Species Interactions

A food habits study of all predator fish would help shed light on species interactions.

Habitat

The suitability of reservoir habitat for bull trout is unknown but water temperatures appear to be well above optimum. The habitats used and survival of juvenile bull trout in the reservoirs are unknown. Current reservoir operation plans are aimed at maintaining the overall productivity of the reservoirs. Whether the current operations benefit some species to the detriment of others is unknown. How to optimize reservoir operations to benefit bull trout should be an area of research.

Dam Operations

The potential impacts of selective withdrawal at Noxon Rapids Dam should be evaluated. This should include extensive temperature, chemistry, zooplankton and fish distribution studies in the Noxon Dam forebay.

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APPENDIX A

ACRONYMS

FWP	Montana Fish, Wildlife, and Parks
LCFR	Lower Clark Fork River
MDHES	Montana Department of Health and Environmental Services
TMDL	Total Mean Daily Load
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey

GLOSSARY

aggrade:	raise the grade or level of a river valley or streambed by depositing streambed material or material or debris
core area:	a drainage that currently contains the strongest remaining populations of bull trout in a restoration area; usually relatively undisturbed habitat
cover:	anything that provides visual isolation or physical protection for a fish, including vegetation that overhangs the water, undercut banks, rocks, logs and other woody debris, turbulent water surfaces, and deep water
disjunct population:	a population found in a headwater lake, that appears to be self-reproducing, but is functionally isolated from the rest of the system
drainage:	an area (basin) mostly bounded upstream by ridges or other topographic features, encompassing part or all of a watershed
entrainment:	displacement of fish from a reservoir through an outlet from a dam or from a river into an irrigation ditch
escapement:	adult fish which return to spawn
fragmentation:	the breaking up of a larger population of fish into smaller disconnected subpopulations
fry:	first-year fish

migratory:	describes the life history pattern in which fish spawn and spend their early rearing years in specific tributaries, but migrate to larger rivers, lakes or reservoirs as adults during their non-spawning time
nodal habitat:	waters which provide migratory corridors, overwintering areas, or other critical life history requirements
redd:	a disturbed area in the gravel, or a nest, constructed by spawning fish in order to bury the fertilized eggs
resident:	fish, which are often found in tributary or small headwater streams, where the fish spend their entire lives
risk:	a factor which has contributed to the past or current decline of the species
restoration:	the process by which the decline of a species is stopped or reversed, and threats to its survival are removed or decreased so that its long-term survival in nature can be ensured
Restoration Team:	a policy-level group with representatives from state and federal agencies, conservation organizations and private industry; created by Governor Racicot to establish a Bull Trout Restoration Plan for Montana
population:	an interbreeding group of fish that spawn in a particular river system (or part of it) and are reproductively isolated
riparian area:	lands adjacent to water such as creeks, streams and rivers and, where vegetation is strongly influenced by the presence of water
Scientific Group:	composed of agency, private and university scientists appointed by the Restoration Team to conduct technical analysis
threat:	a factor which jeopardizes the future conservation of the species
watershed:	a drainage basin which contributes water, organic matter, dissolved nutrients, and sediments to a river, stream or lake (USDA 1995)
Watershed Group:	a group of agency representatives, landowners and recreational and commercial users of a watershed, plus a liaison from the Scientific Group; created by the Restoration Team and charged with developing recovery actions to help restore bull trout

APPENDIX B

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