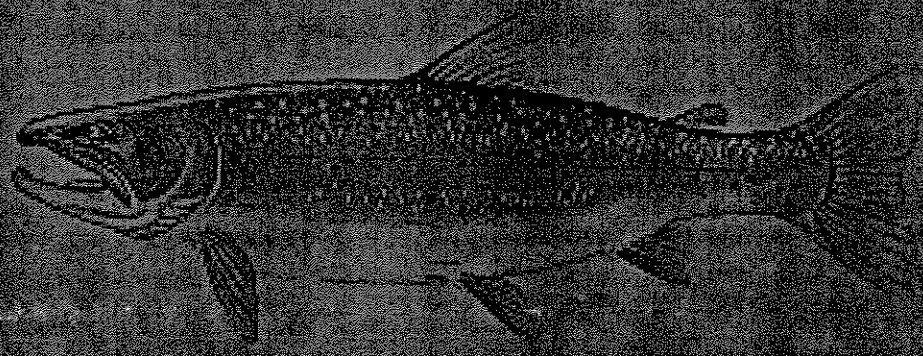
UPPER KOOTENAI RIVER DRAINAGE

BULL TROUT STATUS REPORT

(Including Lake Koocanusa, Upstream of Libby Dam)



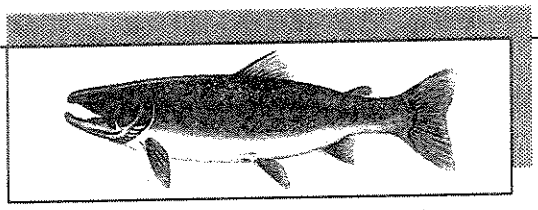
May 1996

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

P.O. Box 200701 - Helena, MT 59620-0701
(406) 444 - 2449 Fax (406) 444 - 4952

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

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This document addresses historic and current status and distribution of bull trout in the upper Kootenai River drainage. Core areas are described and major threats to the population are identified. Disjunct bull trout populations are also described with core areas delineated.

Bull trout were one of six salmonids native to the Kootenai River. It is believed bull trout were once widely distributed in the Kootenai River and certain tributary streams. Libby Dam now isolates this bull trout population from the Kootenai River downstream. The present distribution of bull trout upstream from Libby Dam is similar to historic distribution in this drainage.

Risks

The threats to bull trout in the upper Kootenai River drainage include illegal fish introduction, introduced fish species currently present, rural residential development, and forestry. Additional risks to this population are mining, agriculture, diversions, and illegal harvest. The majority of the spawning and nursery areas for this population are in British Columbia. There is a need for increased coordination with British Columbia in addressing threats to this population.

Core Areas and Nodal Habitats

Core areas (those drainages which currently support the strongest remaining populations of bull trout) in the Kootenai River drainage upstream from Libby Dam include the Grave Creek drainage in the United States and the Wigwam Drainage in British Columbia. The headwaters of the Wigwam River are in the United States. Additional survey work is required to better document bull trout distribution and abundance information. Core areas may be redefined when more information becomes available.

Nodal habitats are waters which provide migratory corridors, overwintering areas or are

otherwise critical to the population at some point during its life history. Nodal habitats for this population are provided by Lake Koocanusa, the Kootenay River upstream of Lake Koocanusa, and the Tobacco River.

A disjunct bull trout population is present in Sophie Lake. These fish reach maturity in Sophie Lake (nodal habitat) with spawning and rearing areas in Phillips Creek (core area). Little information is available for this population. Glen Lake also supports a disjunct bull trout population. It is believed this population resulted from juvenile fish out-migrating from Grave Creek being diverted by the Glen Lake Ditch. These fish have no chance of returning to Grave Creek upon reaching maturity and are essentially lost from the upper Kootenai population.

Restoration Goal

Because the upper Kootenai River drainage has been an isolated system for only a short period of time (25 years) there remains uncertainty as to what factors will be necessary to maintain a healthy bull trout population. Due to the existing uncertainties and data needs, the following restoration goal should be considered as interim, pending further study and better coordination with British Columbia.

The restoration goal for bull trout in the Kootenai River drainage upstream from Libby Dam is to maintain a self-sustaining population dominated by the migratory life form; a stable or increasing trend in spawner escapement (redd counts) for three generations (15 years); to maintain the population genetic structure and to stabilize and improve habitat in core areas. Initial efforts should focus on documenting current distribution and abundance so core areas can be reevaluated. Adopt the Integrated Rule Curves for operation of Libby Dam and adhere to the 90-110 foot recommended drawdown limit until this occurs. Coordination with public and private entities in British Columbia will be necessary to accomplish this restoration goal.

UPPER KOOTENAI 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 is preparing components of a Montana Bull Trout Restoration Plan which includes a review of the status of bull trout, risks to the survival of the species and restoration or conservation goals. In addition, the Scientific Group prepared reports on three of the major issues in bull trout restoration - habitat requirements and land use impacts, removal and suppression of introduced species, and the use of transplants or stocking in restoration. Because the risks and threats facing bull trout vary widely across their range in the state, separate reports were prepared for each of the twelve major bull trout restoration/conservation areas identified in Montana, except Rock Creek which is included in the Upper Clark Fork report. These areas have been delineated largely based on fragmentation of historically connected systems (Figure 1). Loss of interconnectivity results from migration barriers like dams or other habitat changes, such as altered thermal regimes or dewatering. Each of the twelve restoration/conservation areas contain core areas (drainages currently supporting the strongest remaining populations) and nodal habitats (waters which provide migratory corridors, overwintering areas, or other critical life history requirements) for bull trout currently present.

This document addresses historic and current status and distribution, describes major risks and delineates core areas and nodal habitats for bull trout in the Kootenai River Drainage upstream from Libby Dam (Figure 2). This population's present range includes Lake Koocanusa and its immediate tributary system, as well as the Kootenay River drainage in British Columbia.

The information available is for migratory fish occupying Lake Koocanusa or the Kootenay River upstream as adults. Bull trout populations also exist in the Kootenai River drainage downstream from Kootenai Falls and in the Kootenai River between Kootenai Falls and Libby Dam. These populations are addressed in separate reports.

The Kootenai River basin is an international watershed, with approximately two-thirds of the drainage basin within the province of British Columbia, Canada (Knudsen 1994). The total drainage area of the basin is 14,000 mi^2, with 3,750 mi^2 of that in the state of Montana (Knudsen 1994). The Kootenai River is the second largest tributary to the Columbia River in terms of flow and has an average annual flow of 14,150 cfs (USGS 1993).

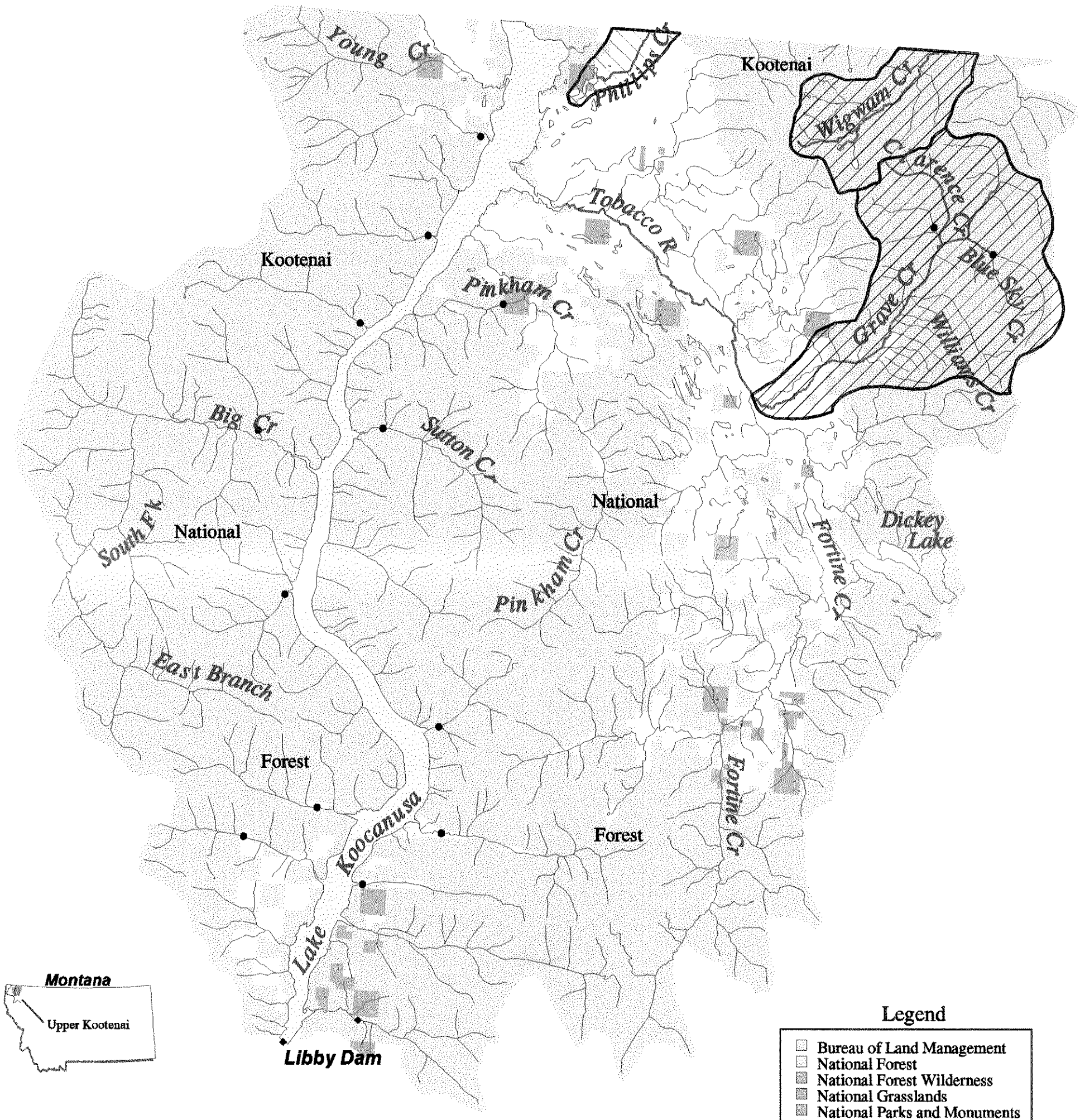
The river originates in Kootenay National Park, near Banff, British Columbia. The river flows southward and enters the reservoir created by Libby Dam. This reservoir, called Lake Koocanusa, is approximately 90 miles long and is centered on the international border. At full pool, Lake Koocanusa is 46,500 acres in size; at minimum pool the reservoir is 14,487 acres. Maximum depth is 350 feet (Chisholm et al. 1989). As much as 90 percent of the Kootenai basin is coniferous forest; a small portion of the basin is agricultural land, used mainly for pasture and forage production (Marotz et al. 1988).

The Kootenai River basin remains remote and sparsely populated. Fewer than 100,000 people live within the basin. The forest products industry is the dominant development activity in the Kootenai basin. Other important industries are coal and hard rock mining and the production of hydroelectric energy (Knudsen 1994).

Libby Reservoir (Lake Koocanusa) was created under the International Columbia River Treaty between the United States and Canada for cooperative water development of the Columbia River basin in 1972. The authorized purpose of Libby Dam is to provide power, flood control, navigation, and other benefits. The dam is located approximately 17 miles upstream from the town of Libby, Montana (Chisholm et al. 1989).

Figure 1. Bull Trout Restoration/Conservation Areas in Montana

Figure 2. Bull trout distribution and core areas in the Upper Kootenai drainage.



Map produced by:
Jeffrey Hutten
Montana Fish, Wildlife & Parks
Information Services Unit
490 N. Meridian Road, Kalispell, MT 59901
406-751-4571

Bull trout distribution and barriers information based on data collected up to November, 1995. Base layers from the Natural Resource Information System at the Montana State Library and digitized @ 1:100,000.

May 17, 1996
/GIS/JEFF/BULLTRT/BC1.CMP

Montana Fish, Wildlife & Parks

Albers Conic Equal-Area Projection

HISTORIC AND CURRENT STATUS OF BULL TROUT IN THE UPPER KOOTENAI RIVER RESTORATION AREA

Historic Distribution

Historically, bull trout were one of six native salmonid species distributed throughout the Kootenai River drainage. The other native salmonids were westslope cutthroat trout (*Oncorhynchus clarki lewisi*), redband rainbow trout (*Oncorhynchus mykiss gairdneri*), pygmy whitefish (*Prosopium coulteri*), mountain whitefish (*Prosopium williamsoni*), and kokanee salmon (*Oncorhynchus nerka*) (Brown 1971). There is some question as to whether Kootenai Falls was an upstream migration barrier to fish prior to the construction of Libby Dam. High spring flows may have allowed seasonal passage by some fish species, connecting the entire system. If this was the case, this bull trout population likely included migratory fish from Kootenay Lake in British Columbia as well as Kootenai River fish which may have moved freely throughout the drainage. Resident bull trout may have been present, but this life history has not been confirmed in this restoration area. If upstream passage did not occur over Kootenai Falls, the bull trout population in the Kootenai Drainage upstream was isolated at this point. One-way gene flow likely occurred downstream.

Little quantitative information exists regarding historic bull trout abundance in the Kootenai River drainage. We recognize this as a major gap in our knowledge of the drainage. Suckley (1861) reported collecting a bull trout from the Kootenay River, but the exact location of this collection is unknown.

The ethnographic literature (reports describing the socio-economic systems of technologically primitive societies) provides some information about historic bull trout distribution. Schaeffer (1940) said of the Kutenai Indians that char [bull trout], trout, and whitefish were the important fish varieties, taken principally during the period of summer freshet. He mentions the Upper Kutenai using basket traps for fishing in the tributaries of the Kootenai and Elk rivers, where trout and char [bull trout] were taken when they were moving

RISKS TO BULL TROUT IN THE UPPER KOOTENAI RIVER RESTORATION AREA

The risks to bull trout in the upper Kootenai River Drainage, listed in Table 2, were evaluated by the Scientific Group based on the degree to which a risk was presumed to contribute to the past and current status of the species (designated as "current/historic" in the table) and the threat the risk factor poses to future restoration of the fish ("restoration" in the table). No effort was made to assess risks for the disjunct populations in Sophie and Glen lakes. Those risks which are of greatest concern are noted with an asterisk. The risks which are the greatest concern to restoration of bull trout in this area in the future are noted with a double asterisk. All risks are discussed in the text.

The three primary concerns in the upper Kootenai restoration area are considered to be forestry practices, cooperation with Canada and illegal fish introductions. Forestry has resulted in increased water and sediment yields in the primary spawning tributaries, Grave Creek and the Wigwam River drainage. Canadian cooperation is essential as the majority of spawning occurs in Canada.

Other high risks were introduced species already present, dam operations, and illegal harvest. Illegal harvest is a threat because adult fish in Grave Creek are targeted by poachers. There is a lot of uncertainty about the relationship between bull trout and introduced species in Lake Koocanusa. Management of reservoir levels may have over-arching effects on the whole system.

Other risks are the increasing number of private ponds which could expand the range of introduced species, water diversions from Grave Creek, future rural residential development, and agriculture in riparian zones.

Table 2. Risks to bull trout in the Upper Kootenai River.

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, 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.

Bull trout in the upper Kootenai River restoration area are at relatively low risk of decline due to environmental instability. The geology of this portion of the river basin is more stable than areas downstream from Libby Dam. The core area watersheds drain higher elevation areas and are not as susceptible to flooding from rain-on-snow events (rain on snow is a term commonly 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). Streamflows in core areas are maintained through drought periods due to extensive groundwater recharge. Fire impacts could be a problem in the event that a core area burned catastrophically, however, overall fire risks are not high. The presence of migratory bull trout with access to a relatively large geographic area reduces the chance of extinction due to catastrophic events.

Introduced Species (Risk Factors)

Introduced fish species found in the upper Kootenai drainage include brook trout (*Salvelinus fontinalis*), kamloops and coastal rainbow (*Oncorhynchus mykiss*), kokanee salmon (*Oncorhynchus nerka*), northern pike (*Esox lucius*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*) and yellow perch (*Perca flavescens*).

Brook trout are the introduced species that present the greatest risk to bull trout because of competition and hybridization. Hybridized offspring are generally sterile but available data suggests this creates an unstable situation resulting in an overall decline or replacement of bull trout (Leary et al. 1983). Degraded habitat appears to favor brook trout dominance over bull

trout. Within the United States portion of this management area there is only one spawning stream and there are brook trout present. It is unknown if hybridization is taking place; more research is needed in this area.

Predation or competition by kamloops, rainbow or northern pike could have negative impacts in localized situations. The current presence of kokanee salmon may benefit the bull trout population in Lake Koocanusa by providing an abundant, food source for sub-adult and adult fish.

On the U. S. side of the border, extensive gravel mining occurred when Highway 93 was recently reconstructed. The pits created by this mining have now filled with water, potentially creating habitat for non-native fish species such as perch and northern pike. There is a concern that this newly created habitat may exacerbate the spread of introduced species.

Private Ponds (high risk)

Historically few private fish ponds existed in the upper Kootenai drainage. Several unlicensed ponds are known to be present in the Grave Creek drainage. The Lincoln County Conservation District has received at least eight requests for private pond construction permits during the past two years. Many applicants for private pond stocking permits request brook trout. This increasing trend in requests for private fish pond permits is likely to continue to increase along with local population growth. This proliferation of private ponds presents a high risk to bull trout restoration efforts.

Legal Introductions (very high risk)

Most non-native species were introduced through agency stocking. Agency stocking of brook trout, coastal rainbow trout and kamloops rainbow has occurred in the upper Kootenai River drainage. The kokanee salmon population in Lake Koocanusa resulted from an accidental release of fish from a hatchery in British Columbia in 1979. Presently, coastal rainbow trout are planted in isolated lakes. All other plants, with the exception of Lake Koocanusa are westslope cutthroat trout, which are native to this area. Lake Koocanusa is being stocked with Kamloops

rainbow trout to provide a trophy fishery sustained by the kokanee salmon population. Threats from future agency stocking should be less than they were historically.

Illegal introductions (very high risk)

Risks due to illegal introductions rated high, both current and historically as well as for restoration. Illegal introductions are likely to occur in the future as the human population of the valley increases. Brook trout have been illegally dispersed throughout the upper Kootenai River drainage. The danger from illegal introduction is compounded by the threat of spreading fish diseases.

Fisheries Management

In the late 1960's and early 1970's, just prior to completion of the dam, several tributaries to Lake Koocanusa were treated with toxicants to remove rainbow trout and restore westslope cutthroat trout. These included Young, Big, Five Mile, Sullivan, and Clarence creeks. At the time of treatment only Clarence Creek supported bull trout.

In recent years the fisheries management emphasis in Lake Koocanusa has switched from westslope cutthroat trout to Kamloops rainbow trout. The interactions between these two large, piscivorous species (Kamloops and bull trout) are unknown. Angling techniques that are effective on Kamloops are likely to be effective on bull trout as well, raising concerns about incidental capture and hooking mortality.

Barriers

Culverts

There are several culverts in the United States portion of the drainage which may be barriers to fish passage. However, they are not believed to be a major threat to the bull trout population. A culvert at the mouth of Foundation Creek in the upper Grave Creek drainage is the

only known barrier to bull trout migration.

Diversions (high risk)

There are at least two irrigation diversions in Grave Creek. The North Fork of Grave Creek is actually an irrigation ditch and requires occasional work within the stream channel to maintain suitable conditions. The Glen Lake ditch is reported to have inadequate fish screening and bull trout moving downstream are lost into this irrigation ditch. It is likely that the bull trout population in Glen Lake resulted from Grave Creek fish entering this ditch and migrating into the lake itself. A concrete drop structure blocks any chance of migrating adult fish from Glen Lake returning to spawning areas in the Grave Creek drainage. Due to the fact that Grave Creek provides the only core area for this population in the United States, the risk from diversion was rated as high both current/historically as well as presenting a high ranking threat for restoration.

Thermal

Rieman and McIntyre (1993) concluded that temperature represents 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).

Natural thermal limits to bull trout distribution are suspected at several locations. For example, Fortine Creek joins Grave Creek forming the Tobacco River. Fortine Creek drains mostly low elevation lands and summer maximum water temperatures in Fortine Creek greatly exceed those recorded in Grave Creek which drains the Whitefish Divide. Bull trout presence was not documented in the Fortine Creek drainage during extensive electrofishing survey work in the early 1970's. Grave Creek is the only core area for this restoration area in the United States and the Tobacco River provides the corridor (nodal habitat) linking it to Lake Koocanusa.

Dams

Libby Dam presents a total upstream barrier and a partial downstream barrier. Unless

spilling over the dam occurs, entrainment and passage through the turbines is the only way fish can move downstream. Substantial entrainment of kokanee salmon is known to occur, but bull trout entrainment through the dam appears to be insignificant (Skaar 1995). The long-term genetic effects of fragmenting the bull trout population at Libby Dam are unknown.

Field crews noted extensive beaver activity during spawning site inventories in the Grave Creek drainage. However, beaver dams do not appear to have blocked or impeded spawning migrations.

Habitat

Rural Residential Development (very high risk)

Large tracts of private land exist along the stream channels throughout this area. Presently, development is clustered. However, rapid population growth is resulting in increasing rural residential development in core areas and nodal habitats. Many of these private landowners are requesting fish pond permits for construction within the 100 year flood plain. Due to the proximity of this development to stream channels in core areas and nodal watersheds, threats to bull trout restoration are rated as high.

Mining (high risk)

Mining operations in the upper Kootenai River Drainage presented a high risk to bull trout historically, although the situation has improved in recent years.

Annual discharges from the Cominco, Ltd. phosphate plant in Kimberly, British Columbia, exceeded 8,000 tons of phosphorous in the mid to late 1960's. Pollution abatement measures were installed in 1975 and the plant closed in 1987 (Knudsen 1994). Phosphorus levels in Lake Koocanusa are now low. High fluoride levels existed in the Kootenai River prior to the early 1970's (May 1974).

The Sullivan Mine, at Kimberly, British Columbia, has been in operation since 1900. Until 1979 acid mine drainage and heavy metals from the mine and concentrator were discharged untreated, into Mark, Kimberly, and James creeks, tributaries of the St Mary's River. This discharge negatively affected fish and aquatic life in the these tributaries as well as the Kootenay River itself. Wastewater treatment facilities were installed in 1979 which significantly decreased the quantity of heavy metals reaching the Kootenay River (Knudsen 1994).

An open pit coal mine is located in the Elk River drainage. The major water quality problem associated with these coal fields is increased delivery of suspended sediment to the Elk River and its tributaries. In recent years, with the initiation of better runoff collection systems, settling ponds and selective use of chemical flocculents at the mines, suspended sediment concentrations in effluents are not, under permit stipulations, to exceed 50 mg/l. Today, impacts are likely only occurring on a localized scale (Knudsen 1994).

Grazing

There are several small grazing allotments on Kootenai National Forest. Some private lands are also grazed but do not present a major threat to bull trout in the upper Kootenai River drainage.

Agriculture (high risk)

Agricultural development in the Grave Creek drainage is principally dispersed hay land irrigated from the Glen Lake ditch. This results in some dewatering of several tributaries of Grave Creek. Dewatered streams in the upper Kootenai drainage include Grave Creek, Phillips Creek, Sinclair Creek, and Therriault Creek - a total of 14 miles of streams (FWP 1992). There has been discussion of doubling agricultural water withdrawal in this area so the threats to restoration were rated as higher than they are currently.

The Montana Department of Health and Environmental Sciences (MT DHES 1994) lists six streams (84 stream miles) in the upper Kootenai River restoration area in Montana as having

impaired water quality as a result of agriculture.

Dam Operations (high risk)

At Lake Koocanusa (Libby Dam), drawdown limits to protect fishery resources have been in effect since 1987. Since that time, drawdown limits were exceeded in 1988, 1989, 1990, 1991, 1993 and 1994. Extreme drawdowns have negative consequences on benthic insect production, zooplankton production, and terrestrial insect deposition. The entire food web has been impacted. Montana Fish, Wildlife & Parks is concerned about the long-term prospects for maintenance of fisheries in Lake Koocanusa given the continuing operational fluctuation (FWP 1993).

A selective withdrawal system was installed at Libby Dam in 1978. Selective withdrawal results in little or no thermocline formation in Lake Koocanusa which may increase entrainment of fish. Current sampling is not designed to identify operational problems relative to bull trout utilization of the reservoir. Determining whether existing biological rule curves may be favoring other fish species over bull trout presents a major research need.

Forestry (very high risk)

Past forestry practices (road construction, log skidding, riparian harvest, clearcutting) were often damaging to watershed condition. The effects of these practices include increased sediment in streams, increased peak flows, thermal modifications, loss of woody debris, and channel instability.

Timber management is the dominant land use in core area watersheds. Both the Grave Creek and Wigwam drainages are largely second growth and timber harvest is continuing. Extensive road construction has resulted in increased water and sediment yields. At the present time, within the United States portion of the basin, only the headwaters of the Grave Creek drainage is protected from future timber management activity.

A point source of sediment pollution exists on Therriault Creek Road, Tobacco River drainage, due to improper road drainage and fill slope construction along the stream channel. Edna Creek, tributary to Fortine Creek, has heavy accumulations of sediment in the stream channel (Marotz et al. 1988).

The Montana Department of Health and Environmental Sciences (MD DHES 1994) lists seven streams (nearly 95 stream miles) in the upper Kootenai drainage as having impaired water quality as a result of timber harvesting.

Monitoring in the Fording River watershed during a 1976 runoff episode from a recently harvested area revealed extremely high levels of suspended solids. In the Elk River watershed in British Columbia, sediment from roads and logging sites was so severe that water quality investigators felt that settling basins may be needed to protect the stream's water quality (Knudsen 1994).

Current forestry practices are less imperative than past practices but the risk is still high because of the existing road system, mixed land ownership, lingering results of past activities, and inconsistent application of best management practices. Results of 1994 timber sale audits suggest impacts are still occurring (MT DSL 1994). Due to the proximity of forest management activities to limited spawning and rearing areas the risks both current/historically and to restoration efforts are high. The need to coordinate with public and private entities in British Columbia cannot be overemphasized.

Recreational Development

To date, little recreational development has occurred in the upper Kootenai River drainage. A golf course is planned along the Tobacco River, which provides the migration corridor linking the Grave Creek drainage to Lake Koocanusa. Future risks may increase along with the increasing population and rural residential development.

Transportation

Existing transportation systems do not present a major risk to bull trout. Some site specific problems with weed control, fire suppression and maintenance have occurred.

Population

Life History

Migratory bull trout are the only life form known to exist in the upper Kootenai River drainage. Adults reach maturity in Lake Koocanusa or the upper Kootenay River. There is also a disjunct population in Sophie Lake. Spawning and rearing areas are located in the Grave Creek and the Wigwam River drainages. Sophie Lake fish spawn and rear in Phillips Creek. The migratory life history strategy is least susceptible to extinction (Rieman and McIntyre 1993).

Trend

There is relatively little trend data available. Efforts to assess population status were initiated in the United States during 1983. Surveys in British Columbia's Wigwam River drainage began in 1978. Additional survey work is required to adequately describe population trends in the upper Kootenai River drainage. Recent spawning site surveys in the Grave Creek drainage have resulted in a similar number of bull trout redds to what was observed during past surveys. Gill netting in Lake Koocanusa suggest the bull trout population may be stable. However, we cannot fully assess the risk due to current population trend based on existing knowledge.

Distribution/Fragmentation

This population has been fragmented due to construction of Libby Dam and the dam on the Elk River in British Columbia. Large portions of the historic range are no longer available.

Disruption of migratory corridors may lead to the loss of the migratory life form. Stocks living upstream from barriers are at an increased risk of extinction. Without more information from the Canadian portion of the drainage we are unable to assess the risk due to fragmentation.

Abundance

If a population is small enough, demographic variation can lead to declining abundance over a period 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). Without additional information we cannot assess risk due to abundance.

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 risk. There is also a FWP 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

Adult bull trout reach a large size in Lake Koocanusa. Bull trout were a minor part of the angler harvest (0.06 percent) in Lake Koocanusa based on a 1985 creel survey. The average bull trout creeled was 16 inches total length and the average catch rate was <0.01 fish per hour (Chisholm and Hamlin 1987).

The current risk from angling is low as harvest of bull trout is no longer legal in the Montana portions of this drainage. Bull trout harvest is still legal in British Columbia. However, Canadians are proposing to change to a catch and release regulation for bull trout in the near future. There is still some risk to bull trout from incidental hooking and handling mortality. Drainages that receive high fishing pressure are more likely to have hooking mortality problems,

especially when anglers target larger fish. Fishing pressure in Lake Koocanusa was estimated to be 29,224 angler days in 1993 based on mail surveys (FWP 1994). A fishery for large rainbow is becoming more popular in Lake Koocanusa and pressure will likely increase. However, risks to bull trout restoration from angling are not expected to be high.

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 bull trout 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

Because the upper Kootenai River drainage has been an isolated system for only a short period of time (25 years) there remains uncertainty as to what factors will be necessary to maintain a healthy bull trout population. Due to the existing uncertainties and data needs the following restoration goal should be considered interim pending further study and better coordination with British Columbia.

The restoration goal for bull trout in the upper Kootenai River restoration area is to:

1. Maintain a self-sustaining population dominated by the migratory life form;
2. Maintain a stable or increasing trend in spawning escapement (redd counts) for three generations (15 years);
3. Maintain the population genetic structure;
4. Stabilize and improve habitat in core areas. Initial efforts should focus on documenting current distribution and abundance so core areas can be reevaluated;
5. Adopt the Integrated Rule Curves for operation of Libby Dam and adhere to the 90-110 foot recommended drawdown limit until this occurs.

Coordination with British Columbia will be necessary to accomplish restoration goals.

SOURCES OF UNCERTAINTY, DATA NEEDS

Migratory Population

Better documentation of abundance and distribution of the migratory population is required. A basin-wide redd survey is needed to develop index streams in order to monitor the population. In addition, we need more information about migration patterns. Coordination with British Columbia will be vital to any basin-wide effort.

Disjunct Populations

We need information on the life history and population size of the Sophie Lake population. We need more information on Glen Lake, the Glen Lake ditch and the impact this diversion is having on bull trout in Grave Creek. Is this an introduced population?

Resident Fish

There are numerous uncertainties about the habitat needs of resident fish and whether or not streams and rivers in this restoration area are suitable for sustaining resident bull trout populations. In addition, we do not understand the mechanisms by which migratory life forms undergo transition to resident forms or how long this transition may take. The presence of resident bull trout has not been confirmed in the upper Kootenai River drainage. Also, it is not clear if there are fluvial fish (those that spawn and rear in tributaries and then migrate to the Kootenay River, without entering Lake Koocanusa) in this population.

Fisheries Management

The apparent conflict between fisheries management objectives for native species and those for recreational fisheries need to be evaluated. Where those conflicts are real, regulations and management programs may need to be reevaluated and/or adjusted to clearly establish priorities.

Introduced Species

Is suppression and/or removal of introduced species, especially brook trout, possible in this restoration area? Is it desirable or socially acceptable? Can bull trout continue to coexist with brook trout? How can we limit further introductions? Can anglers accurately distinguish between bull trout and brook trout? These are all important questions related to bull trout that will require future planning and coordination. We need more information about the degree of hybridization that is occurring with brook trout, and the genetic risk it presents.

Human Development

Human development in the Kootenai River drainage is expected to have negative effects on bull trout. We need to evaluate which factors related to this activity (pollution, habitat loss, poaching) are most likely to affect bull trout and take steps to ensure that bull trout needs are considered in planning future development.

Reservoir Management

A sampling program designed to identify effects of dam operation on the fishery in Lake Koocanusa is needed. Determining whether the integrated rule curves (IRC's) may be favoring other fish species over bull trout presents a major research need.

LITERATURE CITED

Bjornn, T.C. 1961. Harvest, age structure, and growth of game fish populations from Priest and Upper Priest Lakes. Transactions American Fisheries Society 100:423-438.

Boas, F. 1918. Kutenai Tales. Bureau of Ethnology, Bulletin 59. cited in:Smith, A.H. 1984. Kutenai Indian subsistence and settlement patterns. U.S. Army Corps of Engineers, Seattle District, North Pacific Division.

Brown, C.J.D. 1971. Fishes of Montana. Big Sky Books, Bozeman, Montana.

Brown, L.G. 1992. Draft management guide for the bull trout *Salvelinus confluentus* (Suckley) on the Wenatchee National Forest. Washington Department of Wildlife, Wenatchee, Washington.

Chisholm, I. and P. Hamlin. 1987. Libby Reservoir angler creel census: May 13 - October 31, 1987. Interim report. Montana Fish Wildlife & Parks, Kalispell, Montana. Prepared for Bonneville Power Administration, Portland, Oregon.

Chisholm, I., M.E. Hensler, B. Hansen, and D. Skaar. 1989. Quantification of Libby Reservoir levels needed to maintain or enhance reservoir fisheries. Methods and data summary, 1983 - 1987. Montana Fish, Wildlife & Parks, Kalispell, Montana. Prepared for Bonneville Power Administration, Portland, Oregon.

FWP Montana Fish, Wildlife & Parks. 1992. Dewatered Streams List (revised). Helena, Montana.

FWP Montana Fish, Wildlife & Parks. 1993. Fisheries losses attributable to reservoir drawdown in excess of limits stated in the Columbia basin fish and wildlife program: Hungry Horse and Libby Dams. - Draft Report. Kalispell, Montana.

FWP Montana Fish, Wildlife & Parks. 1994. Montana statewide angling pressure 1993. Helena, Montana.

Fraley, J.J and B.B. Shepard. 1989. Life history, ecology, and population status of migratory bull trout (*Salvelinus confluentus*) in the Flathead Lake and River system, Montana. Northwest Science. 63:133-143.

Knudsen, K. 1994. Water quality status report. Kootenay (Kootenai) River basin, British Columbia, Montana, and Idaho. Prepared for the Kootenai River Network, Helena, Montana.

Leary, R.F., F.W. Allendorf, and K.L. Knudsen. 1983. Consistently high meristic counts in natural hybrids between brook trout and bull trout. Systematic Zoology. 32: 369-376.

Marotz, B., B. Hansen, S. Tralles. 1988. Instream flows needed for successful migration, spawning, and rearing of rainbow and westslope cutthroat trout in selected tributaries of the Kootenai River. Final Report. Montana Fish, Wildlife & Parks, Kalispell, Montana.

MT DSL Montana Department of State Lands. 1994. Montana Forestry Best Management Practices Implementation Monitoring, the 1994 Forestry BMP Audit. Final Report. Missoula, Montana.

MT DHES Montana Department of Health and Environmental Sciences. 1994. Montana Water Quality 1994. The Montana 305(b) Report. Water Quality Division, Helena, Montana.

Ray, V. 1942. Cultural element distribution XXII: Plateau. Anthrological Records. 8:99-258. University of California, Berkeley.

Rieman, B.E. and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. United States Department of Agriculture Forest Service, Intermountain Research Station, General Technical Report INT-302, Ogden, Utah.

Schaeffer, C.E. 1940. The subsistence quest of the Kutenai. Unpublished Ph.D. Dissertation, Depart. of Anthropology, University of Pennsylvania, Philadelphia. cited in: Smith, A.H. 1984. Kutenai Indian subsistence and settlement patterns. U.S. Army Corps of Engineers, Seattle District, North Pacific Division.

Smith, A.H. 1984. Kutenai Indian subsistence and settlement patterns. U.S. Army Corps of Engineers, Seattle District, North Pacific Division.

Suckley, G. 1861. Annals Lyceum Natural History, New York. VII:309.

Turney-High, H.H. 1941. Ethnography of the Kutenai. American Anthropological Association Memoirs No. 56.

USGS U.S. Geological Survey. 1993. Water Resources Data Montana Water Year 1993. Water Data Report MT-93-1, Helena, Montana.

APPENDIX A

ACRONYMS

FWP	Montana Fish, Wildlife, and Parks
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

LIST OF CONTRIBUTORS

The Montana Bull Trout Scientific Group:

Committee Chair: Chris Clancy, Fisheries Biologist, Montana Fish, Wildlife, and Parks
Gary Decker, Hydrologist, Bitterroot National Forest
Les Evarts, Fisheries Biologist, Confederated Salish & Kootenai Tribes
Wade Fredenberg, Fisheries Biologist, U.S. Fish and Wildlife Service
Chris Frissell, Research Assistant Professor, University of Montana
Robb Leary, Research Specialist, University of Montana
Brian Sanborn, Fisheries Biologist, U.S.D.A. Forest Service
Greg Watson, Fisheries Biologist, Plum Creek Timber Company
Tom Weaver, Fisheries Biologist, Montana Fish, Wildlife & Parks

Other Contributors:

Joe Huston, Montana Fish, Wildlife and Parks
Doug Perkinson, Kootenai National Forest
Lou Kuenhen, Kootenai National Forest
Mike Hensler, Montana Fish, Wildlife and Parks

Writer/Editor Assistance:

Ginger Thomas, Consultant
Liter Spence, FWP
Shelley Spalding, FWP