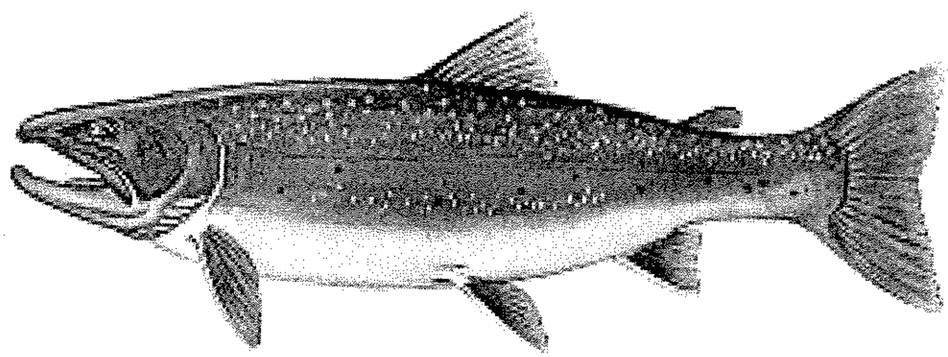
FLATHEAD RIVER DRAINAGE
BULL TROUT STATUS REPORT
(Including Flathead Lake, the North and Middle forks of the Flathead River and the Stillwater and Whitefish rivers)



August 1995

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 document addresses historic and current status and distribution, identifies major threats, and describes key watersheds for bull trout in Flathead Lake, the upper Flathead River above Flathead Lake, and the North and Middle forks of the Flathead River. Other "disjunct" populations of bull trout in the basin are also described, with key watersheds delineated.

Historically, bull trout were abundant throughout the North, Middle, and South forks of the Flathead River drainage. Prior to dam construction, all major river systems in the basin were open to migration and interconnected. Passage up the South Fork was eliminated in 1953 upon completion of Hungry Horse Dam.

Recent monitoring data, indicating declining numbers of spawners, has caused concern about the trend of Flathead Lake migratory bull trout. During 16 years of monitoring, index redd counts for Flathead Lake, which account for about 50 percent of basinwide spawning in eight monitoring streams, have averaged 313 redds. These counts have shown a steady decline since 1988. Monitoring indicates that the 1992, 1993 and 1994 spawning runs from Flathead Lake were the lowest on record, with index counts of 115-122 redds recorded in each of these three years.

Risks

These recent and sudden declines in spawning populations of bull trout, in virtually all monitored spawning streams throughout the North and Middle forks, indicate that changes in Flathead Lake and/or the mainstem of the Flathead River are the primary threat to bull trout at this time. Establishment of *Mysis relicta* and proliferation of predatory lake trout no doubt play a key role, but complex mechanisms involving bull trout prey species or behavioral interactions with lake trout may also be involved. We do not understand these mechanisms, and, if we did, we are uncertain that "treatment" is possible. Brook trout have been widely established in some bull trout spawning tributaries and rearing habitats, posing an additional threat.

A secondary threat is the high incidental catch of bull trout in the other popular lake and river fisheries (cutthroat, lake trout, etc.). Compounding that is a strong fisheries management emphasis on introduced species (lake trout, kokanee, lake whitefish). In addition, illegal harvest could be a major problem because these large migratory fish concentrate and are vulnerable to poaching activities.

Forestry issues are a third major threat. Although many tributaries are protected (Great Bear and Bob Marshall Wilderness and Glacier National Park), other drainages in the North and Middle forks have been historically impacted by increased erosion, sedimentation, and water yield as a result of timber harvest and associated roadbuilding activities. There is significant potential for more impact from these same activities.

Another risk factor, which was judged to be of less immediate significance, is the impact of rural residential development. Rural residential development is a growing threat on all private lands (forest and agricultural), especially in alluvial valleys where bull trout habitat is concentrated. This threat cannot be ignored, even though it has not historically been perceived as a problem.

Core Areas and Nodal Habitats

Core areas are drainages that historically and currently contain the strongest populations of bull trout. These habitats are key to the continued existence of bull trout in the Flathead Basin. These watersheds must be stringently protected, as they will be the primary source of fish for recolonization.

Core areas for the North Fork Flathead River drainage are Big, Coal, Whale, Trail, Red Meadow, Howell and Cabin Creek drainages. (Howell and Cabin Creek drainages are in Canada). Core areas for the Middle Fork Flathead River drainage are Nyack, Park, Ole, Bear, Long, Granite, Morrison, Schafer, Clack, Strawberry and Bowl Creek drainages.

Nodal habitats within the Flathead drainage (those containing migratory corridors, overwintering areas, and critical rearing habitat) are the North Fork Flathead River, Middle Fork Flathead River, the upper mainstem Flathead River and Flathead Lake.

In addition, there are 23 "disjunct" populations in other lakes in the Flathead drainage, with associated core areas and nodal habitat.

The Restoration Goal

The goal of bull trout restoration efforts for the migratory population in the Flathead River drainage is to maintain or restore self-sustaining populations in the core areas, protect the integrity of the population genetic structure, and enhance the migratory component of the population. Specifically, the goal is to increase bull trout spawners to attain the average redd count level of the 1980's, and to maintain this level for 15 years (3 generations) in the North Fork and Middle Fork monitoring areas; provide a long term stable or increasing trend in overall populations; and provide for spawning in all core areas. The average 1980's redd counts in the index streams were 240 in the North Fork (Whale, Trail, Coal and Big creeks) and 151 in the Middle Fork (Morrison, Granite, Lodgepole and Ole creeks). Additional goal statements need to be developed for "disjunct" populations discussed in this report.

FLATHEAD RIVER DRAINAGE BULL TROUT STATUS REPORT

INTRODUCTION

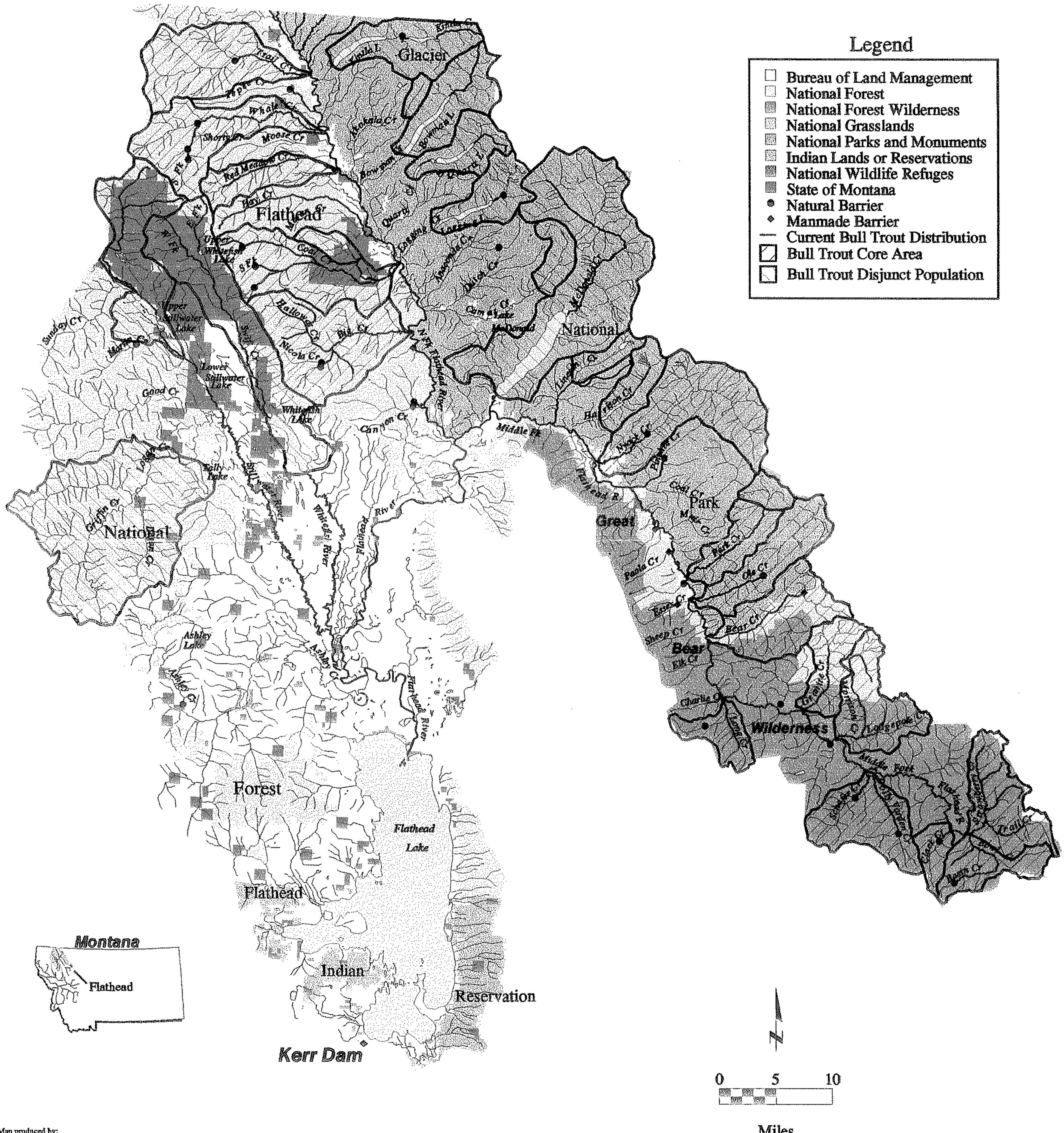
In January, 1994, the Governor of Montana established a Bull Trout Restoration Team to develop restoration plans for bull trout (*Salvelinus confluentus*) in Montana. The Restoration Team created a Scientific Group to provide guidance on technical issues related to restoration.

The Scientific Group reviewed the status of bull trout and the risks to the survival of the species in Montana. 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 and transplants in restoration were examined. Because the threats facing bull trout vary widely in western Montana, separate reports were prepared for each of twelve major restoration/conservation areas, except Rock Creek which is included in the Upper Clark Fork report. Delineation of these areas was largely based on the fragmentation of historically connected systems (Figure 1). Loss of interconnectivity results from migration barriers or other habitat changes, such as dams, altered thermal regimes or stream dewatering. Each of the twelve restoration/conservation areas presently contains core areas and nodal habitats for bull trout.

This document addresses historic and current status and distribution of bull trout, describes the major threats to its continued existence, and discerns core areas and associated nodal habitats for bull trout in the Flathead River Drainage, including Flathead Lake, the upper Flathead River above Flathead Lake, and the North and Middle forks of the Flathead River (Figure 2).

Figure 1. Bull Trout Restoration/Conservation Areas in Montana

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



Map produced by:
Jeffrey Hutten
Montana Fish, Wildlife & Parks
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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/BC11.CMP

Montana Fish, Wildlife & Parks

"Disjunct" populations of bull trout in the basin are also described. "Disjunct" populations are defined as those in headwaters lakes that appear to be self-reproducing and functionally isolated from the Flathead Lake system. In many cases, fish probably pass downstream from these "disjunct" populations into the Flathead Lake system, and in some cases upstream migration into the disjunct waters is physically possible.

The South Fork of the Flathead River drainage, the Swan River drainage, and the Flathead River drainage downstream of Flathead Lake were historically connected but are now disjunct due to dams. Due to their significance these systems will be addressed in separate reports.

The North and Middle forks of the Flathead River drainage comprise most of the remaining portion of the upper Flathead River system (Figure 1). The headwaters of the North Fork are in Canada. It flows south into the United States, bordered by Glacier National Park to the east and the Flathead National Forest to the west. The headwaters of the Middle Fork are in the Bob Marshall and Great Bear Wilderness areas. From the confluence with Bear Creek downstream to its junction with the North Fork, the Middle Fork forms the southern boundary of Glacier National Park.

From the confluence of the North and Middle forks, the Flathead River flows approximately 55 river miles to the inlet of Flathead Lake. The South Fork of the Flathead River, controlled by Hungry Horse Dam since 1953, enters the Flathead River approximately 10 river miles downstream of the confluence of the North and Middle forks. These three forks of the Flathead River have a combined drainage area of 4,464 square miles and an average annual discharge of 9,626 cfs as measured at Columbia Falls (USGS 1995).

Other major tributaries of the Flathead River include the Stillwater River and Whitefish River which drain the valley floor and mountain ranges to the west. The Whitefish River joins the Stillwater about three miles before its confluence with the Flathead River, some 22 miles upstream from Flathead Lake.

Bull trout in the Whitefish River from Whitefish Lake downstream to the confluence with the Stillwater River, and in the Stillwater River from Lower Stillwater Lake downstream to the confluence with the Flathead River, were judged by the Scientific Group to be low priority streams for restoration due to long-term degraded habitat conditions. Some research needs on the Stillwater and Whitefish rivers were identified, as there is a possibility that Flathead Lake bull trout use sloughs and backwaters in the lower portions of these rivers.

Land ownership in the entire 5.9 million acre Flathead River basin (including the South Fork, Swan, and lower Flathead) is 40 percent National Forest (including 1.1 million acres of wilderness), 10 percent Glacier National Park, 10 percent Confederated Salish and Kootenai Tribal lands, 3 percent State of Montana lands, and 31 percent private ownership (Flathead River Basin EIS 1983). Nearly 5 percent of the drainage basin lies in the headwaters of the North Fork in British Columbia.

Flathead Lake is the largest natural freshwater lake in the western United States, with a water surface area of 122,500 acres (Flathead River Basin EIS 1983). It has a mean depth of 165 ft. and a maximum depth of 370 ft. Much of the lake exceeds 65 ft. in depth except South Bay, which has a maximum depth of 33 ft. The south half of Flathead Lake lies within the Flathead Indian Reservation.

The lower Flathead River flows out of the lake in a southwest direction near the town of Polson. Kerr Dam, completed in 1938, is four river miles downstream from the original outlet of Flathead Lake and partially controls water elevation in the lake.

HISTORIC AND CURRENT STATUS OF BULL TROUT IN THE FLATHEAD RIVER DRAINAGE

Historic Distribution

Historically, bull trout were one of four native salmonid species distributed throughout the Flathead River drainage. The other native salmonids were westslope cutthroat trout (*Oncorhynchus clarki lewisi*), pygmy whitefish (*Prosopium coulteri*), and mountain whitefish (*P. williamsoni*) (Brown 1971). The Flathead Lake bull trout population had access to all three forks of the Flathead River, the Swan River, the Stillwater and Whitefish rivers, and the lower Flathead River downstream from Flathead Lake into the Clark Fork River all the way to Lake Pend Oreille in Idaho.

Bull trout were distributed widely throughout the Flathead River drainage. Some of the smaller tributary streams have waterfalls or other natural features that could have prevented bull trout colonization, but the major river systems were all open and interconnected. Evidence of the historic distribution of bull trout is summarized below.

The interconnectedness of the Flathead system has been disrupted by the construction of hydroelectric facilities. Bigfork Dam, built in 1902, blocked fish migration from Flathead Lake into the Swan River, which likely occurred but was not documented. Hungry Horse Dam, completed in 1953, blocked fish migration into nearly all of the South Fork of the Flathead River drainage. Kerr Dam, completed in 1938, blocks fish passage from the lower Flathead River into Flathead Lake. This report addresses bull trout restoration in the Flathead River system above Kerr Dam but does not include the Swan River drainage or the South Fork of the Flathead River drainage. These systems are addressed in separate reports.

Evermann (1892) reported that, in 1891, bull trout in Flathead Lake were common and were caught at certain seasons in considerable numbers by trolling.

The U.S. Forest Service reported that, in 1937-1938, bull trout were present in Big, Hay, Whale, Moose, Red Meadow, and Coal creeks in the North Fork; Sheep, Bear, Java, Deerlick, Morrison, Lodgepole, Dolly Varden, Schafer, Granite, Long, Strawberry, and Bowl creeks in the Middle Fork; and Griffin, Logan, and Good creeks in the Stillwater drainage (Flathead National Forest 1948).

Schaeffer (1940) reported that Kutenai Indians used the North Fork of the Flathead as a fishing area for both trout and char [bull trout]. Schultz (1941), in his report on fishes of Glacier National Park, reported bull trout in Kintla Lake, Upper Kintla Lake, Indian (Oil) Lake (currently named Akokala Lake), Bowman Creek, Quartz Creek, Cerulean Lake, Logging Lake, Arrow Lake, the Middle Fork of the Flathead River, McDonald Creek, McDonald Lake, Fish Creek, Coal Creek, Lincoln Lake, Harrison Lake, Park Creek, Lake Isabel, Upper Isabel Lake, and Ole Creek. Holloway (1945) reported bull trout in Bowman Creek, Kintla Creek, and the North Fork Flathead River.

Block (1955) collected bull trout in Trail Creek, Red Meadow Creek, Whale Creek, Big Creek, Hallowat Creek, Coal Creek, Kishenehn Creek, the North Fork of the Flathead River, Bowman Creek, and the lower Flathead River. Fisheries sampling conducted in 1957 by the Montana Fish and Game Department found bull trout in Bear Creek, Vinegar Creek, Granite Creek, Long Creek, and Twenty-five Mile Creek (Stefanich 1958).

Kinnie (1960) recorded bull trout in Lincoln Creek, Harrison Creek, Harrison Lake, McDonald Creek, Nyack Creek, and Ole Creek. Hanzel (1961) sampled the upper Stillwater River drainage (Fitzsimmons, Good, Sunday, and Logan Creeks) and found bull trout among the species present. Peters (1964) reported bull trout age and growth data from fish collected in Bear Creek and Moose Creek, Flathead River drainage, in 1952. However, it is possible that the

Moose Creek record is an error. Fish were collected from the Moose Creek that is located in the Bitterroot drainage during 1952 and it may be fish from this Moose Creek that Peters aged. Age and growth data for bull trout collected from Frozen Lake and Upper Whitefish Lake, collected in 1957, is also published in Peters (1964).

Morton (1968), in his review of fisheries management in Glacier Park, reported bull trout in Akokala Lake, Arrow Lake, Bowman Creek, Bowman Lake, Kintla Creek, Upper Kintla Lake, Kintla Lake, Logging Creek, Logging Lake, Trout Lake, North Fork Flathead River, Lower Quartz Lake, Middle Quartz Lake, Upper Quartz Lake, Coal Creek, Ole Creek, Park Creek, Lake Isabel, Lower Isabel Lake, Harrison Lake, Nyack Creek, Harrison Creek, Lincoln Lake, Lake Ellen Wilson, McDonald Creek, McDonald Lake, Howe Creek, Fish Lake, Snyder Creek, Avalanche Lake, and the Middle Fork of the Flathead River. Morton's report was not a field survey but, rather, a synthesis of existing published and unpublished information. References to bull trout in Fish Lake, Avalanche Lake, and Lake Ellen Wilson are now believed to have been in error (Leo Marnell, National Biological Survey, West Glacier, Mt., personal communication, 1995).

Current Distribution - Migratory Populations

Flathead Lake supports a population of large sized, migratory bull trout. These fish spawn in the tributaries of the Flathead River, primarily in the North Fork and Middle Fork drainages. The young rear in the tributaries for one to three years before migrating back to Flathead Lake (Fraley and Shepard 1989).

More data on bull trout have been collected in the North and Middle forks of the Flathead River than in any other drainage in Montana. This drainage supports one of the highest profile bull trout populations in the United States.

In general, streams entering the North Fork from the west support migratory bull trout spawning, whereas tributaries on the east (draining Glacier National Park) do not. In some cases, small size, geology, and other physical factors may play a role in making some of the east-side streams unsuitable for bull trout (e.g. Akokala, Ford, Dutch, and Anaconda creeks). Many of the tributary streams on the east side of the North Fork drainage also have large glacial lakes in their headwaters. Most of these lakes contain migratory populations of bull trout, referred to in this report as "disjunct" populations, although the streams draining these lakes frequently do not contain bull trout. These lake outlet streams tend to have relatively warmer summer and fall water temperatures that perhaps restrict upstream colonization by bull trout under current climatological conditions. In most cases, there are no physical barriers that preclude upstream or downstream migration from these lakes but, available evidence suggests gene flow from these systems probably occurs one way (downstream), if at all.

The most important Flathead spawning streams for migratory bull trout in the United States portion of the North Fork drainage are (in upstream order) Big, Hallowat, Coal, South Coal, Mathias, Red Meadow, Whale, Shorty, and Trail creeks (Figure 1). Spawning has also been documented in low frequency in Starvation Creek. Streams in Canada support approximately 25% of North Fork bull trout spawning. The most important bull trout streams in the Canadian portion of the drainage are Kishenehn, Sage, Couldrey, Howell, and Cabin creeks. Spawning has also been documented in the mainstem Flathead River (North Fork) in British Columbia.

The most important Flathead bull trout spawning streams in the Middle Fork drainage, again in upstream order, are Nyack, Park, Ole, Bear, Long, Granite, Morrison, Lodgepole, Schafer, Dolly Varden, Clack, Bowl, Trail, and Strawberry creeks. Infrequent spawning has also been documented in Charlie, Basin, Lake, Elk and Coal creeks.

Recent monitoring data indicating declining numbers of spawners has caused concern about the status of the Flathead Lake migratory bull trout. During 16 years of monitoring, the index redd count has averaged 313 redds, ranging from 115 to 600 (Tables 1 and 2). These monitoring index counts have shown a steady decline in recent years. In 1994, the North Fork index redd count was 64, 67% below the annual average for this portion of the drainage (Weaver 1994). In 1994, the total redd count in the four index streams in the Middle Fork drainage was 51 redds, 58% below the annual average. Overall, monitoring indicates that the 1992, 1993 and 1994 spawning runs from Flathead Lake were the lowest on record (Weaver 1993, 1994).

There is no obvious single reason to account for the declining numbers of spawners over the past four years. In contrast, bull trout redd counts in the Swan River drainage have increased in recent years. The 1994 Swan drainage redd count of 494 in index streams was a record high (Weaver 1994). When comparing the increasing bull trout spawning run into the Swan River from Swan Lake to the decreasing Flathead River bull trout spawning run from Flathead Lake, at least two immediate differences are obvious. First, the Swan drainage has no lake trout (*Salvelinus namaycush*) or lake whitefish (*Coregonis clupeaformis*) and, second, Hungry Horse Dam affects only the Flathead run (Weaver 1993).

Table 1. **Summary of North Fork Flathead River bull trout spawning site inventories from 1979-1994 (distances surveyed in parentheses). All stream sections monitored annually (FWP 1994a).**

YEAR\STREAM	BIG (3 mi.)	COAL (5 mi.)	WHALE (8 mi.)	TRAIL (3.5 mi.)	TOTAL
1979	10	38	35	34[a]	117
1980	20	34	45	31[a]	130
1981	18	23	98	78	217
1982	41	60	211	94	406
1983	22	61	141	56	280
1984	9	53	133	32	227
1985	9	40	94	25	168[b]
1986	12	13	90	69	184
1987	22	48	143	64	277
1988	19	52	136	62	269
1989	24	50	119	51	224
1990	25	29	109	65	228
1991	24	34	61	27	146
1992	16	7	12	26	61
1993	2	10	46	13	71
1994	11	6	32	15	64
(AVERAGE - 1979-1994)	17.8	34.9	94.1	46.4	193.1

[a] Counts may be low due to incomplete survey.
[b] High flows may have obliterated some redds.

Table 2. **Summary of Middle Fork Flathead River bull trout spawning site inventories from 1979-1994 (distances surveyed in parentheses). All stream sections monitored annually (FWP 1994a).**

YEAR\STREAM	MORRISON (11 mi.)	GRANITE (4 mi.)	LODGEPOLE (3 mi.)	OLE (4 mi.)	TOTAL
1979	25[a]	14	32	-[c]	71[a]
1980	75	34	14	19	142
1981	32[a]	14[a]	18	19	83[a]
1982	86	34	23	51	194
1983	67	31	23	35	156
1984	38	47	23	26	134
1985	99	24	20	30	173[b]
1986	52	37	42	36	167
1987	49	34	21	45	149
1988	50	32	19	59	160
1989	63	31	43	21	158
1990	24	21	12	20	77
1991	45	20	9	23	97
1992	17	16	13	16	62
1993	14	9	9	19	51
1994	21	18	6	6	51
(AVERAGE - 1979-1994)	47.3	26.0	20.4	26.6	120.3

[a] Counts may be low due to incomplete survey.
[b] High flows may have obliterated some redds.
[c] No survey

Current Distribution - Disjunct Populations

The Flathead basin, particularly in Glacier National Park and the upper portions of the Stillwater and Whitefish river drainages, has numerous lakes which contain "disjunct" bull trout populations (Table 3). The degree to which bull trout in these lakes are connected to the migratory Flathead Lake bull trout is unknown. However, it is believed that these populations are functionally isolated. More research is needed on these lakes to define their status and appropriate restoration or conservation strategies. These "disjunct" populations are discussed in the following pages, by watershed.

North Fork River

Glacier National Park has a number of lakes which contain migratory (lake maturing, tributary spawning and rearing) populations of bull trout which do not appear to freely interbreed with fish from Flathead Lake. Within Glacier National Park, the most secure bull trout lakes are Cerulean, Quartz, Middle Quartz, and Akokala Lakes. These lakes have had no exposure to introduced fishes and still contain undisturbed habitat. Bull trout co-exist with westslope cutthroat trout in these lakes (L. Marnell, pers. comm.).

Apparently, healthy bull trout populations also co-exist with cutthroat trout in Lower Quartz Lake and Trout Lake in Glacier National Park. However, there has been a recent unconfirmed report of a lake trout caught in Lower Quartz Lake which is a cause of concern (L. Marnell, pers. comm.).

Arrow Lake was known to support bull trout in the 1960's. However, no bull trout have been caught in this lake in recent surveys. There is speculation that the 1964 flood may have been a potential factor in the decline of bull trout in this lake (resulting from log-jam barriers and\or loss of spawning habitat) but the current status is unknown (L. Marnell, pers. comm.).

Bull trout in Kintla Lake in Glacier National Park are now uncommon. This lake contains lake trout, lake whitefish, and kokanee (*Oncorhynchus nerka*).

An unusual population of bull trout occurs in Upper Kintla Lake. Bull trout are the only species of fish which occur in this lake. There are no records that bull trout were stocked in the lake. Rather, it is believed they ascended barrier cascades and entered the lake, perhaps during the late stages of glacial withdrawal. These fish are genetically distinct from the fish originating from Flathead Lake that spawn in North Fork tributaries, suggesting long term isolation of the population from other bull trout. These fish are relatively unique in that they are lake outlet spawners (L. Marnell, pers. comm.).

Bull trout seem to co-exist with lake trout in Bowman and Logging lakes. Creel survey data and anecdotal reports suggest a decline of bull trout in Bowman Lake in recent years. The Logging Lake watershed is still in a healthy condition and bull trout are relatively abundant (L. Marnell, pers. comm.). There is not enough data to determine why the two species coexist in these two lakes and whether the long-term trend is stable.

Cyclone Lake is in the Coal Creek State Forest. In 1994, five redds were counted in the first 1,000 paces downstream from the outlet (T. Weaver, Montana Fish Wildlife and Parks, Kalispell, pers. comm.). This was the first time bull trout redd counts were conducted on this stream.

Frozen Lake straddles the U.S./Canadian Border in the Flathead National Forest. The bull trout population is believed to be stable but there is little available information.

Middle Fork River

There are a number of disjunct lakes in the Middle fork drainage which contain bull trout. Following is a summary of their attributes.

Upper and Lower Isabel lakes in Glacier National Park contain some unusual, brightly red-colored bull trout. In addition, they tend to be slightly smaller than the cutthroat trout which are present in these lakes. No bull trout larger than 12 inches have been collected to date. A life history study is being planned by the Park staff (L. Marnell, pers. comm.).

Harrison Lake in Glacier National Park contains bull trout along with westslope cutthroat trout, brook trout (*Salvelinus fontinalis*), and kokanee. Very little is known about the status of this bull trout population (L. Marnell, pers. comm.).

Lake McDonald contains bull trout although lake trout is the dominant species in the lake. Kokanee, lake whitefish, and an occasional rainbow trout (*Oncorhynchus mykiss*) or brook trout are also seen. Bull trout are considered to be uncommon (L. Marnell, pers. comm.). Similarly, Lincoln Lake contains a substantial brook trout population and bull trout are believed to be at low levels (L. Marnell, pers. comm.).

Fish Lake, Avalanche Lake, and Lake Ellen Wilson are listed by Morton (1968) as containing bull trout but they are not currently known to exist in these waters and the report may have been in error (L. Marnell, pers. comm.).

Stillwater and Whitefish Rivers

Today, bull trout are relatively uncommon in the Stillwater and Whitefish River drainages, probably due in large part to the extensive presence of introduced species, including brook trout, lake trout, northern pike (*Esox lucius*), and yellow perch (*Perca flavescens*). Roadbuilding, logging, and subdivision development that has occurred in the drainage has also contributed to the population decline. Historically, the Whitefish and Stillwater rivers were dammed. These dams, associated with sawmill operations, temporarily broke the connection for fish migration between Flathead Lake and the upper portions of these watersheds.

Currently, the lower portion of the Stillwater River from its mouth to Hellroaring Creek may be used as a migration corridor or rearing area for bull trout. Bull trout numbers are low, habitat for bull trout is poor, and brook trout are present.

A Forest Service report compiled in 1937 and 1938, but not distributed until after World War II (Flathead National Forest 1948), and a companion five-year fish distribution and management plan for the Somers State Fish Hatchery (West and Stubblefield 1948), refer to widespread distribution of "dolly varden" in the Stillwater and Whitefish rivers, Upper and Lower Stillwater lakes, Whitefish and Upper Whitefish lakes, Tally Lake, and Griffin, Logan, Good, Martin, and Sunday creeks in the Stillwater drainage. One report (Flathead National Forest 1948) notes that degraded habitat conditions occurred in many valley floor streams in 1937-1938 due primarily to irrigation water withdrawals. The report also cites poor results from previous fish stocking efforts, blamed on habitat conditions and an overabundance of rough fish, and concludes that most valley floor streams should not be stocked in the future.

Lower Stillwater Lake is shallow and weedy but the larger Upper Stillwater Lake provides adequate bull trout habitat. Numbers of fish were probably depressed early in this century due to habitat loss in the spawning and rearing tributaries, primarily as a result of logging, road, and railroad construction. Then, in the early 1970's northern pike were illegally introduced in both lakes and have flourished. More recently, lake trout have been discovered and bull trout in this drainage are at high risk of extinction (W. Fredenberg, U.S. Fish and Wildlife Service, Kalispell, Montana, pers. comm.). The Stillwater River and tributaries above Upper Stillwater Lake (primarily Fitzsimmons Creek), support some juvenile bull trout. A sample of 29 juvenile bull trout collected in 1993 from a site in the upper Stillwater River were all from one age class and genetic evaluation indicated the entire year class may have been progeny of a single mated pair (Kanda, Leary and Allendorf 1994).

Tally Lake is very deep (492 feet) and is connected to the lower Stillwater River via Logan Creek. Tally Lake has contained a small bull trout population in recent decades, as indicated by bull trout captured in gillnets in 1966 and 1985. *Mysis relicta*, a large freshwater shrimp, was introduced in 1975 and lake trout were stocked in 1987. Other introduced species present include rainbow and brook trout, northern pike, kokanee, and yellow perch. No bull trout were netted in surveys during 1990 or 1994 although seven redds, believed to have been constructed by bull trout, were located in Logan Creek upstream from the lake in October 1994 (T. Weaver, pers. comm.). The spawning habitat is limited due to the large size of the substrate and thermal conditions in the watershed upstream. Bull trout are unlikely to persist due to low numbers, degraded habitat, and competing species.

Whitefish Lake is particularly noteworthy because of its large size (3,350 acres) and similarities to Flathead Lake. It contains all the same species as Flathead Lake and is subject to similar pressures from human development. The watershed is heavily impacted by logging and roading. Bull trout were probably common or abundant at the turn of the century but today their numbers are very low and lake trout is the dominant predator fish species.

Upper Whitefish Lake, at the head of this watershed, is a small alpine lake with road access and heavy recreational use. It contains a small population of bull trout and is stocked with westslope cutthroat trout.

Summary

In general, relatively little is known about these "disjunct" populations but they represent an important and significant resource. Some of these populations appear to be glacial relic populations and may possess unique genetic and life history attributes that occur nowhere else in the range of bull trout. As more information becomes available, restoration goals for these populations need to be developed.

Table 3. Summary of upper Flathead River basin "disjunct" bull trout populations.

WATER NAME	PRIMARY LANDOWNER	INTRODUCED SPECIES	BULL TROUT STATUS
Kintla Lake	GNP	LT/LWF/KOK	D
Upper Kintla Lake	GNP		S
Cerulean Lake	GNP		S
Quartz (Upper) Lake	GNP		S
Middle Quartz Lake	GNP		S
Lower Quartz Lake	GNP	LT?	S?
Akokala Lake	GNP		S
Logging Lake	GNP	LT	S?
Bowman Lake	GNP	LT	D
Arrow Lake	GNP		E?
Cyclone Lake	SSF		S?
Trout Lake	GNP		S
Frozen Lake	FNF/CANADA		S?
Lower Isabel Lake	GNP		S
Upper Isabel Lake	GNP		S
Harrison Lake	GNP	EB	S?
Lake McDonald	GNP	LT/LWF/EB/KOK	D
Lincoln Lake	GNP	EB	D?
Whitefish Lake	PRIVATE	RB/LT/EB/LWF NP/YP	D
Upper Whitefish Lake	SSF		S?
Tally Lake	FNF	RB/LT/EB/NP/YP KOK	D?
Upper Stillwater L.	SSF/FNF	RB/LT/EB/NP/YP	D
Lower Stillwater L	SSF	RB/LT/EB/NP/YP	E?

(PRIMARY LANDOWNER: GNP = Glacier National Park, SSF = Stillwater State Forest, FNF = Flathead National Forest).
(INTRODUCED SPECIES: RB = rainbow trout, LT = lake trout, EB = brook trout, LWF = lake whitefish, NP = northern pike, YP = yellow perch, KOK = kokanee.)
(TREND: S = stable, D = declining, E = probably extinct, ? = lack of data or high degree of uncertainty.)

CORE AREAS AND NODAL HABITAT FOR BULL TROUT IN THE FLATHEAD RIVER DRAINAGE

Core areas are drainages that currently contain the strongest remaining populations of bull trout. These areas must receive the most stringent protection as they will be the primary source of fish for recolonization (Rieman and McIntyre 1993).

Core areas for the North Fork drainage are Big, Coal, Whale, Trail, Red Meadow, Howell and Cabin creek watersheds (Figure 1). Howell and Cabin creeks are in Canada. Core areas for the Middle Fork drainage are Nyack, Park, Ole, Bear, Long, Granite, Morrison, Schafer, Clack, Strawberry and Bowl Creek watersheds (Figure 1).

Nodal habitats include migratory corridors, overwintering areas, and critical rearing habitat. In the Flathead drainage, nodal habitats are the North Fork, Middle Fork, upper mainstem Flathead River, and Flathead Lake.

At the present time, all of the disjunct lakes (Table 3) are considered nodal habitats and their associated spawning streams are classified as core areas. As more information becomes available, it may be appropriate to remove some of these waters from the list. However, little is known about the genetic attributes of these populations and, as the Flathead Lake population is declining, they may provide a genetic reserve. Furthermore, due to the isolated and unconnected nature of these waters, bull trout in some are likely to be extirpated in the future.

Following is a list of disjunct core areas (including the entire interconnected watershed upstream) with their nodal lakes in parentheses. All are upstream of the lake except where otherwise noted:

North Fork: Kintla Creek (Kintla L.)

Kintla Creek - downstream (Upper Kintla L.)

Rainbow, Quartz creeks - downstream (Cerulean L.)

Rainbow, Quartz creeks (Upper Quartz L.)

Quartz Creek - up/down? (Middle Quartz L.)

Quartz Creek - up/down? (Lower Quartz L.)

Akokala Creek (Akokala L.)

Logging Creek (Logging L.)

Bowman Creek (Bowman L.)

Camas Creek (Arrow L.)

Cyclone Creek - downstream (Cyclone L.)

Camas Creek (Trout L.)

Unnamed inlet stream in B.C. (Frozen L.)

Middle Fork: Park Creek (Lower Isabel L.)

Park Creek - downstream? (Upper Isabel L.)

Harrison Creek (Harrison L.)

McDonald Creek (L. McDonald)

Lincoln Creek - downstream (Lincoln L.)

Stillwater: Swift & W. Fk. Swift Creek (Whitefish L.)

E. Fk. Swift Creek (Upper Whitefish L.)

Logan Creek (Tally L.)

Fitzsimmons Creek and upper portion of Stillwater R. (Upper and Lower Stillwater L. and Stillwater River nodal)

RISKS TO BULL TROUT IN THE FLATHEAD RIVER DRAINAGE

The risks to bull trout in the Flathead River drainage are listed in Table 4. In most cases (except where noted), risks were not assessed for disjunct populations. The risks were evaluated by the Scientific Group based on the degree to which each risk was presumed to contribute to past and current status of the species (designated as HISTORIC/CURRENT in the table) and the threat the risk factor poses to future restoration of the fish (designated as RESTORATION in the table).

Environmental Instability (Risk Factors)

Drought, Landslide/Geology, Flood/Rain on Snow, Fire

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

In the interconnected portions of the upper Flathead system, the risk to bull trout from environmental instability is low due to the migratory nature of these fish. If a natural or man-caused event causes bull trout to be eradicated from a small portion of the basin, other fish from within the drainage may colonize the vacant habitat. For "disjunct" populations, the risks of catastrophic events are much higher since the isolation factor and restricted habitat make survival and/or recolonization less likely.

Introduced Species

Bull trout co-exist with 23 other species of fish in Flathead Lake, only ten of which are native. Introduced species found in the basin that may be in conflict with bull trout include lake

Table 4. **Summary of risks to bull trout. (* = high risk in Flathead; ** = very high risk to recovery)**

RISK	HISTORIC/CURRENT	RESTORATION
Environmental Instability		
Drought		
Landslide/Geology		
Flood/Rain on Ssnow		
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		

and brook trout, northern pike, largemouth bass (*Micropterus salmoides*), lake whitefish, and yellow perch. *Mysis relicta*, an introduced freshwater invertebrate that feeds on zooplankton, is also widespread within the drainage.

Private Ponds

Stocking of private ponds with introduced fish has not been a large problem in the past. However, with more people moving to the area and an increasing demand for private ponds, there is a risk that these ponds may be a source of introduced fish. Although there is a requirement that private ponds be licensed by Montana Fish, Wildlife and Parks before they are stocked with fish, many people are unaware of, or circumvent, the law. Fish stocking into ponds creates a high potential for them to spread to adjacent or nearby streams. The concern is that brook trout, or other species, may spread from ponds into waters where they do not presently exist.

In addition, the cumulative impact of numerous ponds within a drainage may have an impact on water quality. Another current area of concern is the potential for whirling disease to be spread through the stocking of private ponds.

Legal Introductions (very high risk)

In the past, agencies have stocked a variety of introduced species in the drainage, including lake trout, lake whitefish, kokanee, *Mysis*, and others. These fish and invertebrates established self-sustaining populations in Flathead Lake. It is the legacy of past stocking practices that poses a significant threat to the survival of bull trout today.

An early Forest Service report (Flathead National Forest 1948) described fishery conditions in the Flathead Basin in 1937 and 1938. It noted:

"At the present time it seems advisable to confine the stocking to native species except in isolated places where introduced species are firmly established."

And, in another reference from the same document:

"The introduction of exotic species in the past has resulted in unfavorable biological balances in some cases, particularly in Flathead Lake."

Finally, quoting again:

"In a few isolated examples an introduced species has established itself and produced better fishing than existed before its' planting. The reverse is true, however, in the majority of cases."

Mysis were stocked in Whitefish, Tally, and Ashley lakes in the Flathead drainage in 1968 and in Swan and Holland lakes in the Swan drainage (which runs into Flathead Lake) in 1975 (Rumsey 1988). They apparently drifted into Flathead Lake and were first collected there in the fall of 1981 (Leathe and Graham 1982). The apparently inadvertent introduction of *Mysis* into Flathead Lake resulted in major changes in the food web of the lake, including the loss of kokanee salmon and an increase in lake trout numbers (Spencer et al. 1991). Lake trout are believed to be one of the most important factors causing the recent decline of bull trout in the Flathead Lake system. Marnell (1985) mentioned the introduction of lake trout as a possible factor contributing to the decline of bull trout in some lakes in Glacier National Park. The introduction of lake trout and/or brook trout is suspected of playing a role in the extirpation of bull trout from seven lakes in southern Canada (Donald 1994).

Donald and Alger (1993), in their study of 34 Rocky Mountain lakes in Montana, Alberta, and British Columbia, concluded that lake trout can limit the distribution and abundance of bull trout in mountain lakes. They stated that lacustrine populations of bull trout usually cannot be maintained if lake trout are introduced. Evidence that lake trout is the dominant species include 1.) displacement of indigenous bull trout populations by introduced lake trout; 2.)

unsuccessful "natural" colonization by bull trout of suitable low-elevation lakes that support lake trout; and 3.) relatively high mortality of sympatric bull trout populations. Allopatric and sympatric bull trout and lake trout had substantial niche overlap with respect to food utilization and growth, which suggests that competition may contribute to the disjunct distribution of these species (Donald and Alger 1993).

Ironically, Donald and Alger (1993) mentioned Flathead Lake as an exception to their thesis that bull trout cannot be maintained if lake trout are introduced (the recent decline in bull trout redd counts was not cited in their paper). Although lake trout and bull trout have co-existed in Flathead Lake since the introduction of lake trout in 1905, there have been major food web changes in the lake since the establishment of *Mysis* in the early 1980's. In the late 1980's, lake trout populations expanded in Flathead Lake. Subadult lake trout began to appear in the river systems connected to Flathead Lake. Their presence has been documented as far upstream as Bear Creek on the Middle Fork of the Flathead and the Canadian border on the North Fork of the Flathead. Downstream of Flathead Lake, lake trout have been found in the Clark Fork and Jocko rivers.

Lake trout prey on young bull trout entering Flathead Lake. A 1991 survey of 23 lake trout stomachs from the Flathead River produced eight westslope cutthroat trout and one juvenile bull trout (J. Vashro, Montana Fish, Wildlife, and Parks, Kalispell, Montana, pers. comm.). Several juvenile bull trout have been found in lake trout stomachs collected in gillnet surveys of Flathead Lake (T. Weaver, pers. comm.).

Brook trout are known to hybridize with bull trout and their offspring are generally sterile (Leary et al. 1983). The available data suggest that hybridization between brook trout and bull trout can be an unstable situation resulting in decline or replacement of bull trout (Leary et al. 1983). Brook trout pose a threat to bull trout in some tributaries of the Middle Fork of the Flathead River, although hybridization has not been documented to date. Brook trout have not been found in tributaries of the North Fork of the Flathead River.

Illegal Introductions

The problems created by illegal fish introductions are the same as those discussed above under agency stocking. The difference is that these illegal efforts are not subjected to any environmental analysis, are almost always detrimental, and generally involve warmwater species (bass, perch, pike, walleye) and\or nongame species (minnows, suckers, carp, bullheads). In part, the agency stocking efforts of the past have contributed to this problem by providing closer sources of many of these species for transplant stock. This problem occurs mainly in lakes and is currently out of control in the Flathead basin. Montana Fish, Wildlife and Parks has documented at least 50 illegal introductions in the state in the past five years, and, despite stepped up educational and enforcement efforts the problem has not abated.

Fisheries Management (very high risk)

Fisheries management activities in the Flathead Basin have always emphasized native species (bull trout and westslope cutthroat). Over decades, the erosion of these native populations has resulted in increasingly restrictive regulations and the coinciding rise in introduced species (particularly lake trout and northern pike) has led to a regulatory environment that has attempted to provide quality angling opportunities for both native and introduced species. The Scientific Group feels that this "have your cake and eat it too" approach has harmed native species and will continue to be detrimental to bull trout recovery. A case in point is the existing lake trout limit on Flathead Lake which is designed to maintain a trophy lake trout population despite sharp declines in bull trout numbers. While fishing regulation changes are unlikely to have major impacts on bull trout recovery, they nevertheless play an important role in establishing program priorities. In addition, the hook and release mortality of bull trout as a result of heavy fishing pressure on lake trout in Flathead Lake and the Flathead River is of concern.

Barriers

Culverts

Overall, culverts are not a significant problem in this drainage. However, there are culverts on Tunnel and Paola creeks (Middle Fork drainage) that are barriers to bull trout. Anecdotal information suggests migratory bull trout used these streams prior to installation of the culverts.

Diversions

There are relatively few irrigation diversions in this portion of Montana. Most of the irrigation water is withdrawn through the use of pumps, so diversions are not a major problem for bull trout.

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 river systems, including the Flathead (Fraley and Shepard 1989).

The outlet streams from the lakes in Glacier National Park are naturally too warm in the summer for bull trout. The valley portions of the Stillwater and Whitefish rivers are also too warm. It is unknown whether the current thermal regime in these rivers is entirely natural or man-caused since no data exist prior to the turn of the century.

Dams

An early Forest Service report (Flathead National Forest 1948), written prior to the construction of Hungry Horse Dam, discussed the impact of dams on the Flathead fishery: "Several detrimental factors have influenced the fish population in this region. Three dams with inadequate fish ladders have curtailed normal spawning operations in the area. The Bigfork power dam on the Swan River is of importance in this respect. Two dams on the Stillwater River are of lesser importance." Presumably, they were speaking in the latter case of the Northwest Dam on the outskirts of Kalispell, and dams at the mouth of either Lower or Upper Stillwater lakes. The Stillwater dams are no longer intact, although portions of the structures are still present.

Bigfork Dam, built in 1902, blocked bull trout migrations from Flathead Lake into the Swan River. Hungry Horse Dam blocked the migration of bull trout from Flathead Lake into the South Fork of the Flathead River starting in 1953. Together, these two facilities reduced by nearly 50% the spawning and rearing habitat available to bull trout in the Flathead drainage (Fraley et al. 1989).

Kerr Dam, constructed at the outlet of Flathead Lake in 1938, blocked upstream fish passage from the lower Flathead River into Flathead Lake. In early biological surveys conducted by Evermann and Jenkins in 1891 and Gorham and Woolman in 1892, it was noted that the falls downstream from Flathead Lake were not fish barriers (Gilbert and Evermann 1895). They noted the "falls" in the Flathead River near the outlet of Flathead Lake:

> ". . . consist simply of a series of rapids, which do not interfere in the least with the free movement of fish. From this point down Flathead river possesses no falls or obstructions of any kind, and there is none in Clarke Fork until near Lake Pend d'Oreille."

There seems to be little threat that new dams will be built in this area in the future.

Habitat

Rural Residential Development (high risk)

The impact of an increasing human population will become important to bull trout recovery. An increasing human population leads to increased potential for lake eutrophication (nutrient enrichment). Over the past decade, water quality has been declining in Flathead Lake. Recent evidence indicates that this downward trend may be leveling off or even reversing at some lake sampling stations. Unmanaged growth and increased development pose a serious threat to water quality in the basin (MT DHES 1994).

Some residential development is also ongoing in the tributaries used by spawning bull trout in the North and Middle Fork drainages. Domestic sewage from these developments and changes to stream morphology caused by building in the floodplain could reduce habitat quality in the tributaries. A high level of awareness of water quality issues in the basin is cause for optimism that these impacts can be limited.

Rural residential development is a growing threat on all private forested and agricultural lands, especially in alluvial valleys where bull trout habitat is concentrated, and cannot be ignored even though it has not historically been perceived as a problem.

Mining

At the present time, mining is not impacting bull trout in the Flathead River drainage. However, there is a large coal deposit in the North Fork drainage in Canada. If the deposit is mined, as was proposed in the 1970's, there would be a potential loss of ten percent of the migratory bull trout spawning stock in Flathead Lake (Fraley et al 1989). Water quality impacts could be experienced downstream as well. Because the coal is in Canada, the United States has relatively little control over mine plans, except under the authority of the International Joint Commission.

Exploratory oil and gas development has been sporadic in the basin, but continues to occur. Location and full development of a large deposit would undoubtedly have a negative impact through both habitat degradation and the associated additional human use and development.

Grazing

The overall risk to bull trout from livestock grazing in this area is low. There are only a limited number of public allotments and most of the privately grazed livestock is on the valley floor, where spawning and rearing seldom occur. The Stillwater and Whitefish watersheds are most heavily affected.

Agriculture (water quantity and quality)

In this portion of Montana, agriculture primarily impacts water quality in the lower reaches of the Flathead River, Ashley Creek, and the Stillwater River. The Montana Department of Health and Environmental Sciences state that 128 miles of streams in the Flathead watershed suffer impaired water quality as a result of agricultural activities (MT DHES 1994). Montana Fish, Wildlife, and Parks has identified 19 miles of streams that are chronically dewatered and 90 miles of streams that are periodically dewatered as a result of irrigation withdrawals (FWP 1992). The impacts of agriculture on bull trout may have been more significant historically than they are at the present time. Current impacts to bull trout are believed to be low.

Dam Operations

Cold water releases from Hungry Horse Dam impact bull trout by reducing Flathead River productivity and food supply for bull trout. There is speculation that artificially cooled river temperatures may be allowing lake trout to migrate into the river system where they prey on, or compete with, juvenile bull trout. A selective withdrawal system is being installed on Hungry Horse Dam which will allow water to be drawn from different levels of the reservoir, allowing for some control of downstream water temperatures. This system is expected to be operational in 1996.

Hungry Horse Dam also causes flow fluctuations in the Flathead River which cause sloughing of stream banks and increased sediment loads, reducing the quality of riverine bull trout habitat.

Kerr Dam has modified the hydrograph of Flathead Lake, resulting in a longer full pool period in the summer months followed by a more rapid drawdown in the winter. This has impacted fisheries in the lake by increasing shoreline erosion in both the lake and the lower end of the mainstem Flathead River where it enters the lake.

Forestry (very high risk)

Past forestry practices (road construction, log skidding, riparian tree harvest, clearcutting, splash dams) were often damaging to watershed conditions and are a major contributing cause of the decline of bull trout. The effects on habitat of these practices include increased sediment in streams, increased peak flows, hydrograph and thermal modifications, loss of in-stream woody debris and channel stability, and increased access to anglers and poachers. Although the heaviest timber harvest occurred in the 1960's and 1970's, past forest practices are still impacting bull trout because of the remaining road systems, increased water yields, and increased efficiency of water delivery to the streams resulting in changes in the timing of the runoff.

Current forestry practices are more progressive but the risk is still high because of the existing road systems, mixed land ownership, forestry practices on private lands, and the lingering results of past forestry activities. Impaired water quality as a result of silvicultural activities has been identified in 202 miles of 17 streams in the drainage (MT DHES 1994).

Recreational Development

Recreational development can impact bull trout because it frequently occurs along water bodies that support bull trout. Golf courses often impact riparian areas, causing bank erosion and reduced water quality. Ski area development is expanding into the headwater areas of important bull trout spawning streams. Downhill ski areas create permanent clear cuts which have the potential to increase sediment loads and water yields, and to change hydrologic patterns.

Transportation

Highways and railroads have impacted bull trout in a few areas, most significantly on Bear Creek in the Middle Fork. This stream has been heavily channelized and often receives foreign substances from train derailments. There is potential for a spill of toxic materials to have a catastrophic impact on this stream and on the Middle Fork and mainstem Flathead River downstream.

Population

While both migratory and resident bull trout life history forms may occur in the Flathead system, this status report focuses on the migratory fish, the dominant form in the drainage at this time.

Trend (high risk)

The overall trend is declining. (See discussion of current status).

Distribution/Fragmentation

In spite of barriers on the South Fork Flathead, lower Flathead, and Swan rivers which have cut off portions of the watershed, the remaining upper Flathead (North and Middle forks) is one of the last drainages that still has good interconnected-ness between spawning and rearing habitat for migratory fish.

There are large genetic differences between populations spawning in the North Fork and the Middle Fork tributaries that should not be disrupted (Kanda, Leary, and Allendorf 1994).

Abundance (high risk)

Abundance of bull trout in the Flathead has declined significantly since 1990. From 1981-1989 the estimate of spawning adults was 3,000-5,000 fish. The estimate for the past three years is less than 1,000 adults.

Monitoring/ Sampling Loss

This is not believed to be a significant risk factor for bull trout in this drainage. However, as the population continues to decline, there is increased research emphasis and the number and type of permits to conduct invasive sampling such as electrofishing must be evaluated.

Angling

In the past, angler harvest of bull trout was significant. Based on harvest and escapement figures in 1981, anglers may have taken up to 40% of the adult bull trout that entered the river that year (Fraley et al 1989).

Angling regulations for bull trout in the Flathead have been gradually tightened over the past 40 years. The earliest regulations allowed an aggregate limit of 15 trout but imposed an 18-inch minimum size limit on bull trout. Spawning stream closures first occurred in 1953 in the North Fork and 1962 in the Middle Fork. In 1985, bull trout were assigned a separate limit of one fish and the minimum length was dropped. Since July 6, 1992 it has been illegal to harvest bull trout in the portion of the Flathead drainage discussed in this report.

However, Flathead Lake and River still receive substantial angling pressure. Approximately 47,000 angler days per year are expended on the lake (Evarts et al. 1994, FWP 1994b) and 20,000 angler days per year on the Flathead River mainstem upstream from the lake (FWP 1994b). In addition, an estimated 5,500 angler days are expended annually on the Middle Fork and 6,900 angler days annually on the North Fork (FWP 1994b). With this much fishing pressure, some hooking mortality is inevitable, as are problems with misidentification (mistaking bull trout for lake trout or brook trout).

Illegal Harvest

Illegal harvest of bull trout in northwest Montana has been an ongoing problem for at least 50 years. Long (1994) inter-viewed poachers in northwest Montana and learned about their fishing habits and success rate. He estimated that, on average, 22 bull trout were killed per week per poacher during three months, July - September. Out of the nine poachers interviewed, seven felt that poaching could have a major impact on reducing bull trout numbers. The numbers of fish harvested per poacher were much higher than expected and pointed out the danger illegal harvest posed to bull trout populations, especially because of its declining status.

Summary of Risk Factors

Some of the earlier described risks to bull trout in the Flathead River drainage are little changed in the past half-century. The recommendations in the 1937-1938 Flathead Forest study (Flathead National Forest 1948) included:

1.) Improved passage over dams.
2.) Screening of irrigation ditches.
3.) Stocking native species only.
4.) Trapping and disposal of rough fish.
5.) Increased law enforcement.
6.) Decreased limits.
7.) More wild fish spawning stations.
8.) Limited stream improvement work.
9.) Larger hatcheries.
10.) Consider the advisability of terminating kokanee plants in Flathead Lake.

While attitudes have changed markedly in relation to hatcheries and rough fish, other strategies are very similar to those we are considering today.

These recent and sudden declines in spawning populations of bull trout, in virtually all monitored spawning streams throughout the North and Middle forks, indicate that changes in Flathead Lake and/or the mainstem of the Flathead River are the primary threat to bull trout at this time. Establishment of *Mysis relicta* and proliferation of predatory lake trout no doubt play a key role, but complex mechanisms involving bull trout prey species or behavioral interactions with lake trout may also be involved. We do not understand these mechanisms, and, if we did, we are uncertain that "treatment" is possible. Brook trout have been widely established in some bull trout spawning tributaries and rearing habitats, posing an additional threat.

A secondary threat is the high incidental catch of bull trout in the other popular lake and river fisheries (cutthroat, lake trout, etc.). Compounding that is a strong fisheries management emphasis on introduced species (lake trout, kokanee, lake whitefish). In addition, illegal harvest could be a major problem because these large migratory fish concentrate and are vulnerable to poaching activities.

Forestry issues are a third major threat. Although many tributaries are protected (Great Bear and Bob Marshall Wilderness and Glacier National Park), other drainages in the North and Middle forks have been historically impacted by increased erosion, sedimentation, and water yield as a result of timber harvest and associated roadbuilding activities. There is significant potential for more impact from these same activities.

Another risk factor, which was judged to be of less immediate significance, is the impact of rural residential development. Rural residential development is a growing threat on all private lands (forest and agricultural), especially in alluvial valleys where bull trout habitat is concentrated. This threat cannot be ignored, even though it has not historically been perceived as a problem.

RESTORATION GOAL

The goal of bull trout restoration efforts for the migratory population in the Flathead River drainage is to maintain or restore self-sustaining populations in the core areas, protect the integrity of the population genetic structure, and enhance the migratory component of the population. Specifically, the goal is to increase bull trout spawners to attain the average redd count level of the 1980's, and to maintain this level for 15 years (3 generations) in the North Fork and Middle Fork monitoring areas; provide a long term stable or increasing trend in overall populations; and provide for spawning in all core areas. The average 1980's redd counts in the index streams were 240 in the North Fork (Whale, Trail, Coal and Big creeks) and 151 in the Middle Fork (Morrison, Granite, Lodgepole, and Ole creeks). Additional goal statements need to be developed for "disjunct" populations discussed in this report.

SOURCES OF UNCERTAINTY, DATA NEEDS

Contingency Planning

There is a need to address the worst case scenario if bull trout numbers continue to decline. We need a contingency plan that may require transplanting or taking some fish into the hatchery for a genetic reserve (see the Scientific Group Issue Paper - "The Role of Hatcheries and Fish Transplants in Bull Trout Recovery").

Resident Fish

There are numerous uncertainties about the habitat needs of resident and migratory fish and whether or not Flathead basin streams and rivers 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, and how long this transition may take.

Distribution

We need to considerably expand the information available on the status of bull trout in the "disjunct" populations. We need to know the status and trend for each of these 23 populations and evaluate the population genetic structure of these fish. We also would greatly benefit from a better understanding of the importance of these populations and their downstream corridors to the migratory Flathead population. Finally, we need to evaluate the primary threats to each of the "disjunct" populations and establish maintenance and/or restoration goals.

Lower River Systems (nodal habitat)

Research should be conducted on bull trout utilization of the mainstem Flathead, Stillwater and Whitefish rivers. We do not have a very good understanding of the importance of these lower rivers and associated sloughs and backwaters to various life stages of bull trout. In addition, predatory interactions in these areas are a major concern.

Food Webs

We need to better understand food web interactions in Flathead Lake.

Hydropower

The impact of hydropower operations of Hungry Horse, Bigfork, and Kerr dams are not well understood.

Human Development

Human development in the valley is anticipated 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 insure that bull trout concerns are considered in planning future development.

Introduced Species

Is suppression and/or removal of introduced species, especially lake trout, *Mysis*, and brook trout, possible in the Flathead system? Is it desirable or socially acceptable? Can bull trout continue to coexist with these species? How can we limit further introductions? Can anglers accurately distinguish between bull trout, lake trout, and brook trout? These are all important questions related to bull trout that will require future planning and coordination.

Land Management

The effectiveness of current Best Management Practices (BMP's) and the Streamside Management Zone (SMZ) law in protecting bull trout habitat need to be evaluated.

Hydrologic Conditions

We need to quantify the relationship between "dry" and "wet" years and bull trout spawning success and/or juvenile survival.

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.

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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

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