Chapter 4

State(s): Montana and Idaho

Recovery Unit Name: Kootenai River

Region 1
U S Fish and Wildlife Service
Portland, Oregon

DISCLAIMER PAGE

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EXECUTIVE SUMMARY

CURRENT SPECIES STATUS

The U.S. Fish and Wildlife Service issued a final rule listing the Columbia River population of bull trout as a threatened species on June 10, 1998 (63 FR 31647). The Kootenai River Recovery Unit forms part of the range of the Columbia River population segment. The Kootenai River Recovery Unit is unique in its international configuration, and recovery will require strong international cooperative efforts. Within the Kootenai River Recovery Unit, the historic distribution of bull trout is relatively intact. But abundance of bull trout in portions of the watershed has been reduced, and remaining populations are fragmented. The Kootenai River Recovery Unit includes 4 core areas and about 10 currently identified local populations.

HABITAT REQUIREMENTS AND LIMITING FACTORS

Libby Dam has been one of the most important factors affecting bull trout in the Kootenai River Recovery Unit. The completion of the dam in 1972 severed the migratory corridor between the upper Kootenai River watershed (Montana and British Columbia) and the lower Kootenai River basin in northern Idaho, which drains into Kootenay Lake in British Columbia. The dam blocks all upstream migration and essentially bisects the United States portion of the Kootenai River drainage into two reaches. The upstream reservoir section of Lake Koocanusa is isolated from a downstream riverine reach. The habitat in the riverine reach is dramatically altered as a result of Libby Dam and is characterized by unnatural flow patterns, water temperatures, and water quality parameters. These changes, combined with other impacts to the lower river habitat, led to chronic reproductive failure of Kootenai River white sturgeon (known to have historically inhabited the drainage only downstream of Kootenai Falls). In 1994, it was listed as an endangered species. Native burbot populations in the Kootenai River have also collapsed.

Forestry practices also rank as a high risk to bull trout in the Kootenai River Recovery Unit, largely because forestry is the dominant land use in the

basin. Virtually all drainages supporting bull trout in the Kootenai River Recovery Unit are managed timberlands. Although current forestry practices have improved, 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.

The Kootenai River drainage has a history of mining on both sides of the international border. Libby, Montana, and many other communities in the Kootenai River valley were located at their present sites due to mining interests. Several mines have caused site-specific impacts on local populations of bull trout, but widespread negative impacts to water quality (such as those occurring in the Clark Fork Recovery Unit) due to mining have not occurred in the Kootenai River drainage. There are several active and proposed mining operations in the watershed, some of large dimension.

Fisheries management risks include poaching, introduction of nonnative species, and growing angler use of both the lake and river. Lake Koocanusa is currently the most heavily fished lake or reservoir in western Montana. Illegal harvest of bull trout has been well documented in the Kootenai River Recovery Unit and is considered a high risk because of the traditional focus on well-known and limited spawning areas. Introduced species are widespread throughout the drainage, and the proliferation of brook trout is currently thought to present the greatest nonnative species risk to bull trout, because of the threat of hybridization. Angler misidentification of species and incidental take by anglers due to hooking mortality is a growing concern.

RECOVERY OBJECTIVES

The goal of the Bull Trout Recovery Plan is to **ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed across the species native range, so that the species can be delisted**. Specifically, the Kootenai River Recovery Unit Team adopted the goal of a **net increase in bull trout abundance in this recovery unit (as measured by standards the recovery team develops), with restored distribution of any extirpated populations that the recovery unit team identifies as necessary to recovery.**

RECOVERY CRITERIA

In order to assess progress toward the Kootenai River Recovery Unit objective, the recovery unit team adopted the following recovery criteria. The assumption was made that no core area is viable with a population of less than 100 adults because of the inherent stochastic and genetic risks associated with populations lower than that. The recovery criteria are applied on a core area-by-core area basis.

In this recovery unit, a distinction has been made between two types of core areas—primary and secondary—based mostly on the size, connectedness, and complexity of the watershed and the degree of natural population isolation. Lake Koocanusa and the Kootenai River/Kootenay Lake complex downstream of Libby Dam are the two primary core areas. Bull Lake and Sophie Lake are the two secondary core areas.

1. **Distribution criteria will be met when the total number of identified local populations (currently numbering 10 in United States waters) has been maintained or increased, and local populations remain broadly distributed in all 4 existing core areas**.

2. **Abundance criteria will be met when the primary Lake Koocanusa and Kootenai River/Kootenay Lake core areas are each documented to host at least 5 local populations (including British Columbia**

tributaries) with 100 adults in each, and each of these primary core areas contains at least 1,000 adult bull trout.

The abundance criteria for the Bull Lake and Sophie Lake secondary core areas will be met when each core area supports at least 1 local population of bull trout containing 100 or more adult fish.

3. **Trend criteria will be met when the overall bull trout population in the Kootenai River Recovery Unit is accepted, under contemporary standards of the time, as stable or increasing, based on at least 10 years of monitoring data**.

4. **Connectivity criteria will be met when dam operational issues are satisfactorily addressed at Libby Dam (as identified through U.S. Fish and Wildlife Service Biological Opinions) and when over half of the existing passage barriers identified as inhibiting bull trout migration on smaller streams within the Kootenai River Recovery Unit have been remedied.**

ACTIONS NEEDED

Recovery for bull trout will entail reducing threats to the long-term persistence of populations and their habitats, ensuring the security of multiple interacting groups of bull trout, and providing them habitat and access to conditions that allow for the expression of various life history forms. Specific tasks falling within seven categories are discussed in Chapter 1.

ESTIMATED COST OF RECOVERY

Total cost of bull trout recovery in the Kootenai River Recovery Unit is estimated at $17 million, spread over a 25-year recovery period. Total cost includes estimates of expenditures by local, Tribal, State, and Federal governments and by private business and individuals. These costs are attributed to bull trout conservation but other aquatic species will also benefit. Cost estimates are not provided for tasks which are normal agency responsibilities under existing authorities.

ESTIMATED DATE OF RECOVERY

Time required to achieve recovery depends on bull trout status, factors affecting bull trout, implementation and effectiveness of recovery tasks, and responses to recovery tasks. In the Kootenai River Recovery Unit, the current status of bull trout is better than in many other portions of the range, but a tremendous amount of work remains to be done to restore impaired habitat, reconnect habitat, and eliminate threats from nonnative species. Three to five bull trout generations (15 to 25 years), or possibly longer, may be necessary before identified threats to the species can be significantly reduced and bull trout can be considered eligible for delisting.

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INTRODUCTION

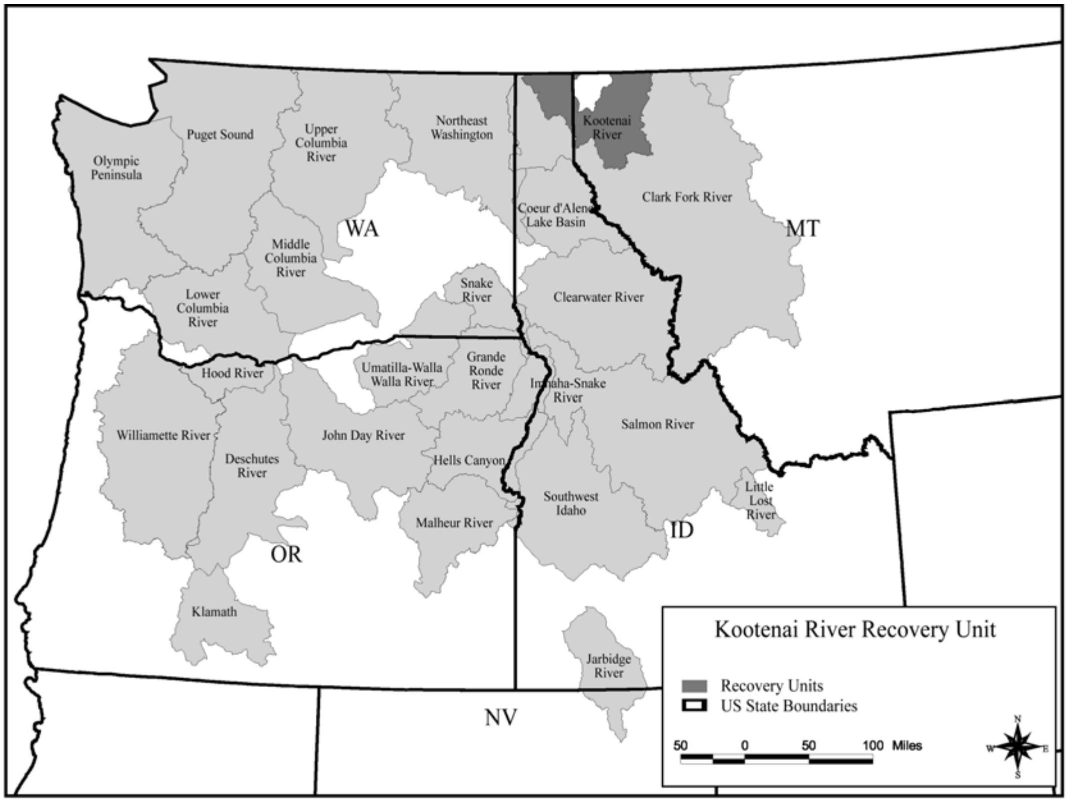
Recovery Unit Designation

The Kootenai River is 1 of 22 recovery units designated for bull trout in the Columbia River basin (Figure 1). The Kootenai River has a unique international flow pattern. From the headwaters, entirely in British Columbia, the Kootenai River (spelled "Kootenay" in Canada) flows south into the United States in northwestern Montana. The stream turns abruptly west into northern Idaho and then north again to return to British Columbia, where it eventually joins with the upper Columbia River system. A simple schematic to visualize is a horseshoe, with the right arm the British Columbia headwaters, the bottom of the horseshoe in northwestern Montana and northern Idaho, and the left arm in the lower Kootenai River and Kootenay Lake in British Columbia (Figure 2).

The Kootenai River watershed was historically isolated from two-way fish passage with the Columbia River by Bonnington Falls, a major fish barrier located on the Kootenay River in British Columbia. The falls are just a few kilometers upstream of the confluence with the Columbia River, on the reach of the river downstream of Kootenay Lake. A second major series of falls, Kootenai Falls, are located in northwest Montana some 22 River kilometers (13.7 River Miles) upstream of the Idaho border. The historical importance of Kootenai Falls as a barrier to fish movement is unknown, although recent radio telemetry information indicates that this series of falls is traversed by adult bull trout at certain flows.

The Kootenai River Recovery Unit Chapter of the Bull Trout Recovery Plan focuses on the portions of the Kootenai River watershed within the United States. But due to the international configuration of the basin, strong transboundary coordination is necessary for recovery to occur.

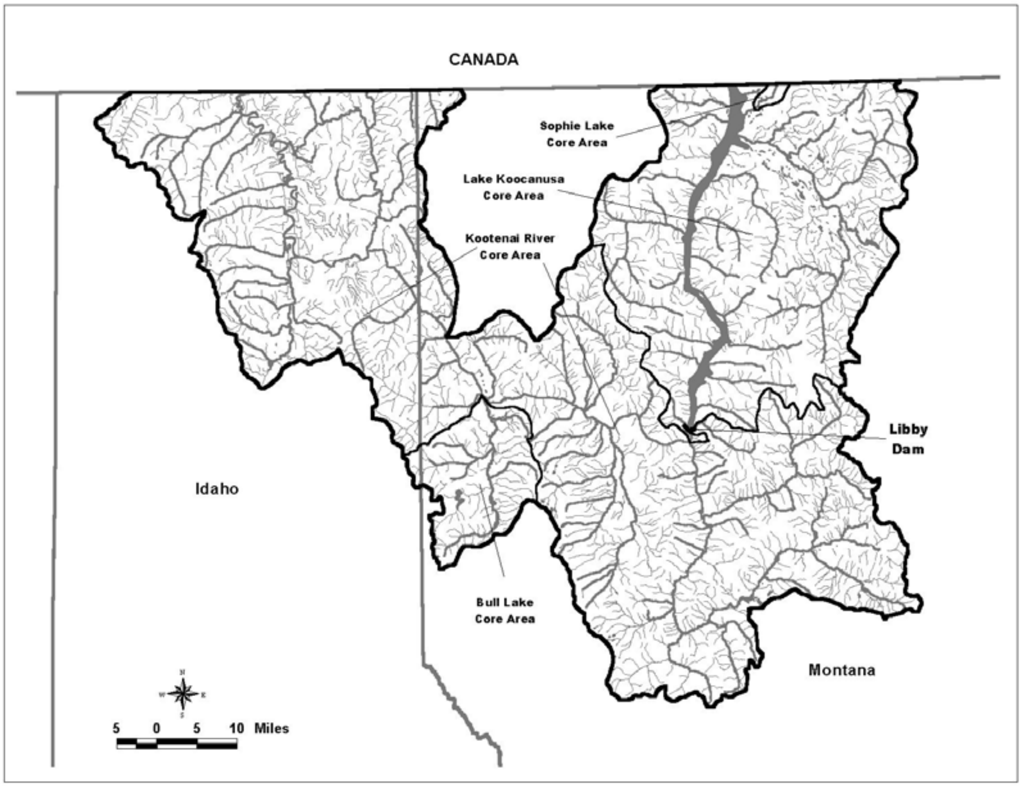
Figure 1. Bull trout recovery units in the United States. The Kootenai River Recovery Unit is highlighted.



Geographic Description

Over two-thirds of the Kootenai River drainage lies within the Province of British Columbia, Canada. The Kootenai River is the second largest tributary to the Columbia River and has an average annual flow of 400.5 cubic meters per second (14,150 cubic feet per second), as measured near the Montana/Idaho border (USGS 1999). The total drainage area of the Kootenai River within the recovery unit boundaries in the United States is about 36,000 square kilometers (14,000 square miles), about 80 percent of which is in Montana and 20 percent in Idaho.

Figure 2. Map of core areas in the Kootenai River Recovery Unit.



The climate in northwestern Montana and northern Idaho is dominated by maritime weather patterns, characteristic of much of the Pacific Northwest. Generally, cloudy, cool, and wet weather occurs in winter, often with steady, soaking rains and wet snows. In fall and winter, the area is often (every 6 to 10 years) influenced by “rain on snow” events that sometimes result in higher stream flows than occur during spring runoff (PBTTAT 1998). Precipitation within the basin ranges from 35 centimeters (14 inches) to over 305 centimeters (120 inches) at the highest elevations, with the average for the area being about 76 centimeters (30 inches). About 70 percent of the annual precipitation falls as snow.

The Kootenai River basin remains sparsely populated. Fewer than 100,000 people live within the drainage upstream of Kootenay Lake. About 90 percent of the Kootenai watershed is coniferous forest. A small amount is agricultural land, used mainly for pasture and forage production (Marotz *et al.* 1988). The forest products industry is the dominant industrial activity in the

Kootenai River basin. About 80 percent of the commercial timberland in the Kootenai River drainage within the United States is owned and managed by the Federal government (Kootenai and Idaho Panhandle National Forests).

The river originates in Kootenay National Park (near Banff, British Columbia) and enters Lake Koocanusa 68 kilometers (42 miles) north of the Montana border, at an elevation of about 704 meters (2,310 feet) mean sea level. Libby Dam, which created Lake Koocanusa in 1972, is located 27 kilometers (17 miles) upstream of Libby, Montana (MBTSG 1996a). Downstream of the dam, the river turns northwest and crosses the Montana/Idaho border near Troy, Montana, at the lowest elevation point in Montana (555 meters [1,820 feet] mean sea level). The river continues northwest across the Idaho panhandle and leaves the United States, reentering British Columbia just upstream of Kootenay Lake, at an elevation of 533 meters (1,750 feet) mean sea level.

Lake Koocanusa (Libby Reservoir) was created under an International Columbia River Treaty between the United States and Canada for cooperative water development of the Columbia River basin. The authorized purpose of Libby Dam is to provide power, flood control, navigation, and other benefits.
At full pool, Lake Koocanusa is 145 kilometers (90 miles) long and 188 square kilometers (46,500 acres) in surface size, with almost half its length in British Columbia. At minimum pool, the reservoir is 59 square kilometers (14,500 acres). Maximum depth of the reservoir is 107 meters (350 feet) (MBTSG 1996c). Partially as a result of changes caused by the dam, Kootenai River white sturgeon (known only to inhabit the drainage downstream of Kootenai Falls) have experienced chronic reproductive failure (USFWS 1999). They were listed as an endangered species in 1994. Burbot populations in the Kootenai River have also declined markedly (Paragamian *et al.* 2000). Habitat impacts and overfishing have also been contributing factors in these declines.

The lower Kootenai River (for our purposes considered to be the portion of the watershed downstream of Libby Dam in Montana and Idaho) can be divided into two subreaches with different characteristics (PBTTAT 1998). The underlying bedrock of the Kootenai River drainage downstream of Libby Dam consists primarily of belt series rock. Intrusions of igneous rock are scattered throughout the area, which has been highly influenced by glacial activity from both continental ice masses and alpine glaciation. The

Kootenai River, flowing from Libby Dam over Kootenai Falls and for a total of about 129 kilometers (80 miles) to Bonners Ferry, Idaho, is free-flowing. It is mostly constricted in a single channel located in a narrow canyon. This portion of the river has a substrate of gravel to large rubble, with some deep pools and bedrock shelves.

Downstream of the canyon, the character of the river changes dramatically. Immediately upstream of Bonners Ferry, there is a braided depositional zone extending nearly 10 kilometers (about 6 miles) (PBTTAT 1998). The lower 76 kilometers (47 miles) of the Kootenai River within the United States meanders through the fertile Kootenai River bottomlands from Bonners Ferry to the international border. The water level is influenced by the elevation of Kootenay Lake in British Columbia, resulting in a relatively flat, slow-moving river with holes up to 30.5 meters (100 feet) deep. Because the floodplain is aggressively diked to protect agricultural lands, the natural pattern and flow regime of the valley bottom streams have been impacted. Many of the tributary streams that enter the Idaho section of the Kootenai River flow from hanging valleys over bedrock controls, with steep sections and impassable barriers. River substrate is primarily sand, silt, and clay. The river continues in this fashion for another 50 kilometers (31.05 miles) in British Columbia, to its confluence with the southern arm of Kootenay Lake.

DISTRIBUTION AND ABUNDANCE

Status of Bull Trout at the Time of Listing

In the final listing rule, five subpopulations of bull trout were recognized within the Kootenai River basin (USFWS 1998). These included three portions of the mainstem system: (1) Upper, upstream of Libby Dam, (2) Middle, from Libby Dam downstream to Kootenai Falls, and (3) Lower, downstream of Kootenai Falls through Idaho to the United States/Canada border. The two disconnected subpopulations (referred to as disjunct by the Montana Bull Trout Scientific Group), in Bull Lake (MBTSG 1996b) and Sophie Lake (MBTSG 1996c), were considered separate subpopulations. At the time of listing, all Kootenai River bull trout subpopulations were considered to have unknown status and population trend, and the Sophie Lake subpopulation was considered to be at risk of stochastic extirpation due to its single spawning stream and small population size.

In the final listing rule, the greatest threats to bull trout were identified as forestry, dams, mining and associated water quality impacts, introduced species, and residential development. The magnitude of threats was rated high for the Middle Kootenai subpopulation (between Libby Dam and Kootenai Falls) and moderate for the other four subpopulations. In all five subpopulations, the threats were considered imminent.

The best scientific evidence available indicates that the subpopulation groups we described in the listing rule are each comprised of one to many local populations. This recovery chapter will address recovery actions and analysis by core areas and their local populations, rather than refer to subpopulation groups.

Current Distribution and Abundance

Bull trout are one of six native salmonid species distributed throughout the Kootenai River drainage. Other native salmonids include westslope cutthroat trout; redband trout, of which there are two strains ("Gerrards," which grow very large and are piscivorous, and "residents," which are small and inhabit headwater streams); pygmy whitefish; and mountain whitefish (see Appendix A for a complete list of fish species found in the recovery unit). Kokanee are also native to Kootenay Lake, and they spawned historically in some tributaries in Idaho, and perhaps Montana. The native salmonids share these waters with the Kootenai River population of white sturgeon, which was listed as endangered in 1994 under the Endangered Species Act.

It is not known whether Kootenai Falls was historically an upstream migration barrier to bull trout prior to the construction of Libby Dam. Speculation was that high spring flows may have allowed seasonal fish passage. Local bull trout populations in the Kootenai River downstream of Kootenai Falls were believed to include migratory adfluvial fish from Kootenay Lake in British Columbia, as well as fluvial Kootenai River fish that may have moved freely throughout the drainage. Recent evidence, collected by radio telemetry studies, indicates that bull trout can and do surmount the falls. This ability suggests that local populations of bull trout downstream of Libby Dam should all be considered one interconnected unit, and we have treated this area as one core area in this recovery plan (Figure 2). Resident bull trout may have been present historically in some drainages, and resident bull trout now occur in Libby Creek and possibly other sites.

Distribution of bull trout in the Kootenai River Recovery Unit has changed little since the listing occurred. Bull trout continue to be present in nearly all major watersheds in this recovery unit where they likely occurred historically. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), the fish are not expected to simultaneously occupy all available habitats (Rieman *et al.* 1997). Most distribution gaps probably reflect natural conditions.

In recent years, emphasis for the Kootenai River basin has been placed on documenting distribution and determining abundance through the use of redd counts. Because of the large size of the migratory fish and the geology of the streams (which generally makes the redds easy to recognize), redd counts (Spalding 1997) have been shown to provide a repeatable method of indexing spawner escapement in many streams in this recovery unit (Rieman and McIntyre 1996). However, several authors have cautioned that redd counts should not be relied upon as the sole method of population monitoring (Rieman and Myers 1997, Maxell 1999) and may, in fact, lead to erroneous conclusions about population status and trend.

Table 1 summarizes the recent status of redd count information for the four core areas in this recovery unit. Redd counts represent an unknown but substantial portion of the possible spawning population. Three of the four core areas have an established history of redd count trend information for migratory fish. Six streams in the United States and three in Canada are now being monitored, with index redd counts conducted on an annual basis. Redd counts have traditionally been conducted only for migratory fish. In some drainages, there are likely to be additional resident bull trout spawners whose redds are smaller than those of migratory fish, therefore difficult to identify. They have not been included in these totals. On the Wigwam River, five permanent monitoring sites were established in 2000 to evaluate juvenile abundance (Cope and Morris 2001), but only sporadic estimates of juvenile abundance have been obtained elsewhere in the basin.

Table 1. Summary of redd count information for migratory adults in the four bull trout core areas in the Kootenai River Recovery Unit.

Core Area Name	Drainage Basin (approx. square kilometers)	# of Local Populations Monitored	Mean Total # of Redds Counted (1996-2000)
Lake Koocanusa (Upper Kootenai)	270 (United States only)	2 (1 in Canada)	848
Kootenay Lake and River (Lower Kootenai)	1,230 (United States only)	4	165
Sophie Lake	12	0	----
Bull Lake	130	1	83

Lake Koocanusa Core Area

Adult bull trout reach large sizes in Lake Koocanusa. Researchers noted higher growth in bull trout through age four in Lake Koocanusa than for bull trout from Flathead Lake and Hungry Horse Reservoir (MBTSG 1996c). Radio telemetry studies involving 36 adult bull trout surgically implanted with tags at the Wigwam River weir in 1996 to 1998 showed that postspawning adult fish generally wintered in Lake Koocanusa in Montana (Baxter and Westover 2000). Before making the spawning run in the

Kootenay River, the fish gathered off the mouth of the Elk River during late May and early June. Between mid-June and mid-July, most were in the lower reaches of the Elk River, and by the end of July they entered the Wigwam River. Spawning peaked the last week of September, and adults were back in the Kootenay River or Lake Koocanusa by the end of October (Baxter and Westover 2000).

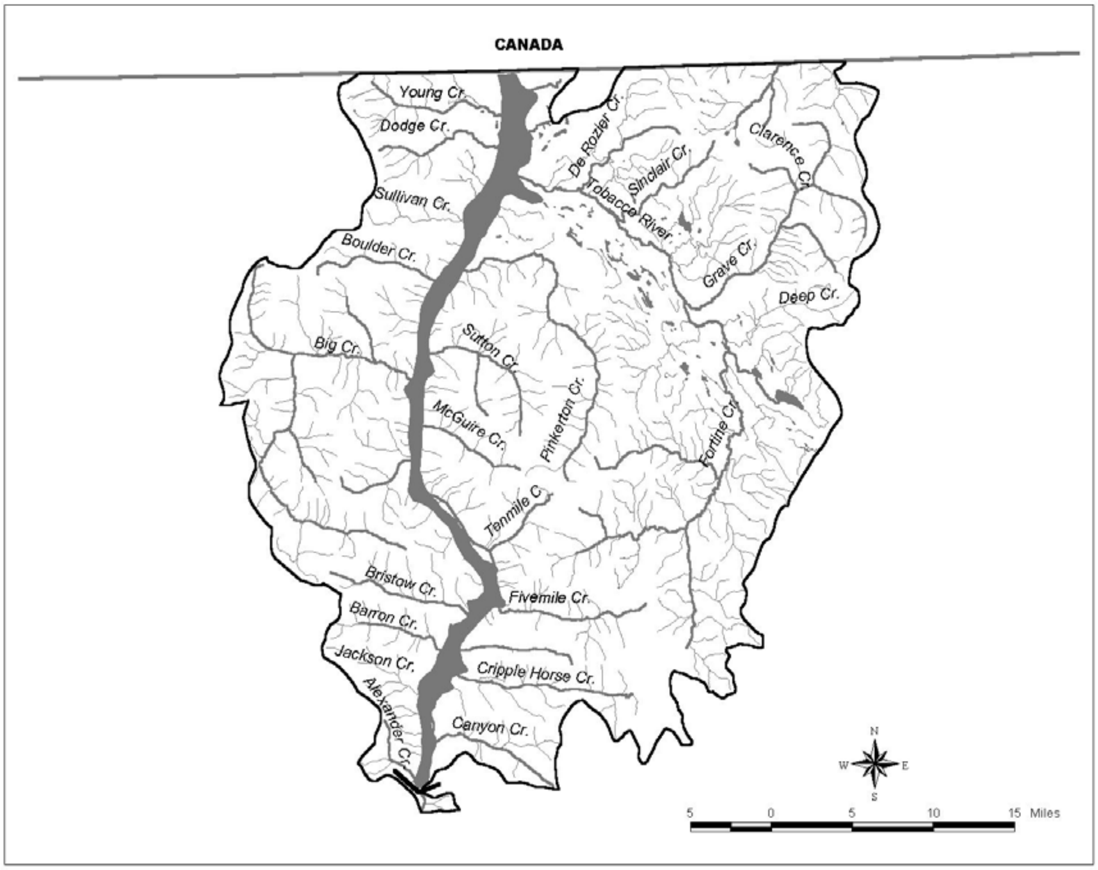
Relatively little trend data for bull trout populations is available for the upper Kootenai River drainage. Efforts to assess local population status were first initiated in the United States in 1983, but were not conducted continuously until recent years. Surveys in British Columbia's Wigwam River drainage began in 1978, but were also sporadic until recently. Gill netting trend data from Lake Koocanusa suggests that the bull trout populations may be stable or increasing.

Upstream of Libby Dam, bull trout from Lake Koocanusa also utilize the Grave Creek drainage in the United States for spawning and rearing (Figure 3). The Tobacco River provides the migration corridor between the reservoir and Grave Creek. The redd count information presently available for Grave Creek is insufficient to make conclusions regarding trends.

Redd searches have been conducted on other Lake Koocanusa tributaries in the United States, including Five Mile, Cripple Horse, Bristol, Warland, Williams, Lewis, Stahl, and Barron creeks. Field crews have not found redds, and bull trout presence in these and other United States tributaries is described as “incidental” (MBTSG 1996c).

In 1978, British Columbia Ministry of Water, Land, and Air Protection first monitored spawning bull trout in the upper Wigwam River and Bighorn (Ram) Creek, using migrant traps (Oliver 1979). Between July and October 1978, 515 adult bull trout passed upstream through the traps. During the next survey, in 1995, 247 bull trout redds were identified on the Wigwam River system in British Columbia.

Figure 3. Map of Lake Koocanusa core area showing watersheds and major features.



Since 1995, a trapping study has indicated that the numbers of bull trout that spawn in the Wigwam River are increasing. Baxter *et al.* (2000) reported the capture of between 616 and 978 adult bull trout annually during 1996 to 1999 at a weir on the Wigwam River. The weir was operated to catch migrating and post-spawning adults in the fall. Due to the location of the weir, these counts represent only a portion of the total numbers of fish using that drainage. Ground surveys conducted in 1994 to 2001 found increasing numbers of bull trout redds in the Wigwam River drainage (nearly all in British Columbia, but a few in the headwaters in Montana), with a peak count of 1,195 redds in 2000 (Baxter *et al.* 2000; Westover, *in litt.*, 2001a), exceeded again by a count of 1,496 redds in 2001 (Westover, *in litt.,* 2001b). Baxter and Westover (2000) state that the Wigwam River is arguably "the most prolific bull trout population in the species distributional range."

Spawning by migratory bull trout is also known to occur in British Columbia in several upper Kootenay River tributaries, including Gold Creek, Bull River, St. Mary River, Skookumchuck Creek, Lussier River, White River, Kikomun Creek, and Findlay Creek (B. Westover, British Columbia Ministry of Water, Land, and Air Protection, pers. comm., 2001). Numbers of fish and location of spawning activity in these drainages are currently being examined. A study is underway using radio telemetry to find other spawning concentrations and track movements (Westover, *in litt.,* 1999). In Skookumchuck Creek, 66 bull trout redds were located in 1997, 105 redds in 1998, 161 in 1999, 189 in 2000 (Baxter and Baxter 2001), and 132 in 2001 (Westover, *in litt.,* 2001b). During fall 2000, the White River was counted for the first time and 67 redds were located (Westover, *in litt.,* 2001b). More information is needed to determine whether these migratory fish are primarily fluvial or adfluvial (from Lake Koocanusa).

Five permanent juvenile bull trout monitoring sites were established in the Wigwam River basin in 2000. Bull trout represented 92.4 percent of the catch, and the mean density of juvenile bull trout was estimated to be 17.2 fish per 100 square meters, indicating a very high population density for this species (Cope and Morris 2001).

Kootenai River / Kootenay Lake Core Area

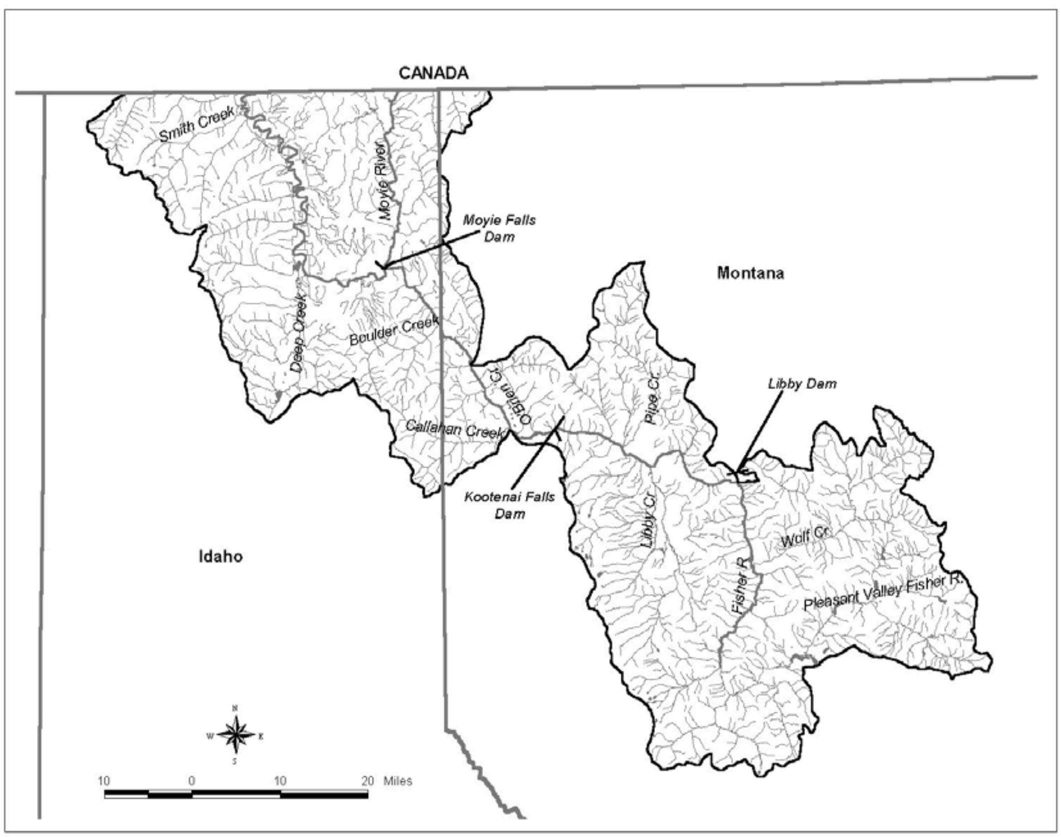
Bull trout are widely distributed through the lower Kootenai River, from Libby Dam downstream to Kootenay Lake in British Columbia. Spawning and rearing by migratory adults occur in tributaries draining portions of British Columbia, Idaho, and Montana (Figure 4). These migratory fish spend their adult lives in Kootenay Lake or the Kootenai River. Libby Dam is an impassable barrier to upstream migration.

Spawning and rearing of migratory bull trout have been documented in four tributaries of the Kootenai River between Libby Dam and Kootenai Falls (Quartz, Pipe, and Libby creeks and Fisher River; see Figure 4). These migratory fish spend their adult lives in the Kootenai River or Kootenay Lake. Tagging studies had previously confirmed that fish from above the falls sometimes moved downstream over Kootenai Falls (Marotz *et al.* 1988). As previously mentioned, recent telemetry information suggests these fish have two-way access over Kootenai Falls.

The most heavily used spawning and rearing stream for bull trout between Kootenai Falls and Libby Dam is in the Quartz Creek drainage (MBTSG 1996a). Between 1994 and 2000, this drainage supported from 47 to 105 redds annually. Most of the redds were observed in the West Fork of Quartz Creek. The remaining redds were observed in Quartz Creek downstream of the confluence with the West Fork.

Personnel from Montana Fish, Wildlife and Parks and the Kootenai National Forest have conducted inventories of bull trout spawning sites on several other

Figure 4. Map of Kootenai River/Kootenay Lake core area showing watersheds and major features.



tributaries to the Kootenai River between Libby Dam and Kootenai Falls. These include Pipe, Granite, Libby, Midas, and Dunn creeks and the Fisher River drainage. Pipe Creek (5 to 36 redds in 1991 to 2000) and Libby Creek (10 to 36 redds in 1996 to 2000) support annual bull trout spawning. Resident bull trout are also suspected to be present in tributaries to Libby Creek, such as Big Cherry Creek. During the late 1980's, several tributaries of Libby Creek were sampled, and bull trout were found in Poorman Creek and Ramsey Creek, but not in Little Cherry Creek (MBTSG 1996a).

In the Fisher River, low numbers of adult migratory bull trout have been documented (MBTSG 1996a). In 1993, redd counts were completed on 13 streams in the Fisher River drainage. A total of 13 suspected bull trout redds were observed (4 in the East Fisher River, 8 in Silver Butte Fisher River, and 1 in the Fisher River). In 1999, 18 redds were found in West Fisher Creek, and 23 were counted there in 2000. The majority of streams surveyed contained potential obstacles to fish passage (including beaver dams, log jams, and falls), and few suitable spawning sites exist due to the high gradient, the large streambed substrate, low pool/riffle ratio, and subterranean water flow.

The strongest spawning and rearing stream in the Montana portion of the Kootenai River downstream of Kootenai Falls is O'Brien Creek (MBTSG 1996b). From June to September 1992, the Montana Fish, Wildlife and Parks operated an upstream trap in O'Brien Creek. During this period, 20 adult bull trout were captured in the trap. Because of the relatively large size of adults captured (up to 76 centimeters [30 inches]), these fish were probably migrants from the Kootenai River or Kootenay Lake (MBTSG 1996b). Since 1992, spawning site inventories have been completed annually in O’Brien Creek, and 12 to 47 redds have been counted (MFWP, *in litt.,* 2002). Resident bull trout are also suspected to occur in O'Brien Creek, but have not been confirmed. Brook trout are present in O'Brien Creek, and 87 probable brook trout redds (species determination was based on size, timing, and observation of fish on redds) were recorded in 1994 (MBTSG 1996b). Brook trout hybridization with bull trout is suspected in O’Brien Creek.

During 1992, Montana Fish, Wildlife and Parks conducted redd searches in several other Montana tributaries to the Kootenai River below Kootenai Falls, including Callahan, Ruby, and Star creeks and the Yaak River. Field crews found no redds in the Yaak River, from its junction with the Kootenai River to Yaak Falls, a barrier falls located approximately 11 kilometers (7 miles) upstream (MBTSG 1996b). The channel through this area is high gradient and comprised of large substrate. The Yaak River is a large system with average discharges around 4.25 to 5.66 cubic meters per second (150 to 200 cubic feet per second) during August through October. Because of the substrate composition and the size of the stream, redds may be hard to detect. Low numbers of small bull trout were present during electrofishing surveys downstream of Yaak Falls. Additional survey work is needed to determine potential bull trout utilization of the Yaak River below the falls. Extensive sampling upstream of Yaak Falls has failed to document the presence of bull trout in the United States (MBTSG 1996b).

No redds were found in 14.5 kilometers (9 miles) of Callahan Creek surveyed during 1992 (MBTSG 1996b). This portion of Callahan Creek is a high-gradient stream with large substrate. Since only the lower 14.5 kilometers (9 miles) have been surveyed for bull trout redds, and that during a single year, we cannot conclude that spawning by migratory bull trout does not occur. Historical anecdotal information suggests that adult bull trout were illegally harvested with weirs in Callahan Creek (MBTSG 1996b). Juvenile bull trout have been observed in low numbers during electrofishing surveys. Ruby and Star creeks do not appear to be suitable for spawning, and no redds have been found, but juvenile bull trout occur in low numbers. Bull trout spawning in the mainstem Kootenai River has not been documented at this time and probably does not occur due to habitat and thermal conditions.

The Idaho Department of Fish and Game is currently conducting research on bull trout distribution and movements. Bull trout have been documented in the Idaho portion of the basin in the Kootenai and Moyie Rivers and Callahan, Curley, Deer, Deep, Fall, Caribou, Snow, Myrtle, Rock, Trout, Parker, Long Canyon, and Boundary creeks (PBTTAT 1998). Additional observations of bull trout were reported in Boulder, Caboose, and Debt creeks in Idaho, just downstream of the Montana border (Walters, *in litt.*, 2001). Typically, sightings of bull trout in Idaho waters have been limited to individual fish. Adult bull trout appear to be well distributed throughout the Kootenai River in Idaho, but at very low densities as noted in the extensive electrofishing record on the Kootenai River. Radio telemetry data indicates that some of those fish overwinter in the deep holes of the lower river (Walters, *in litt*., 2001). Five of eight adult bull trout radio-tagged in O'Brien Creek in Montana migrated downstream into Idaho following spawning.

Also, there is evidence that some bull trout sampled in Idaho are migrants from Kootenay Lake, British Columbia. At least two fish tagged in British Columbia have been relocated in Idaho, as far upstream as the Moyie River (Walters, *in litt*., 2001). Very limited information is available regarding abundance and life history attributes in these waters. The valleys of the lower Kootenai were developed for agriculture in the late 19th and early 20th century, and the habitat for bull trout was negatively impacted prior to the collection of substantive fishery data. The historic distribution and abundance of bull trout in the Idaho portion of the watershed are not well known.

In recent years, extensive fish population sampling in the Idaho waters of the Kootenai River basin has found no indication of reproducing local populations of bull trout in any Idaho tributaries (PBTTAT 1998). In the fall of 1999 and 2000, redd surveys in Idaho tributaries did not locate any confirmed spawning locations (Walters, *in litt*., 2001). Among tributaries deemed to have potential for bull trout spawning, natural barrier waterfalls limit access to only the lower portions of all but Boundary, Deep, Long Canyon, and Callahan creeks. Juvenile bull trout less than 100 millimeters (3.9 inches) long have been occasionally documented in the Kootenai River in Idaho, but may have originated from upstream sources in Montana (Walters, *in litt*., 2001).

Bull Lake and Sophie Lake Core Areas

Bull Lake, a natural lake in the headwaters of the Lake Creek drainage, is a bull trout secondary core area (Figure 5). In 1917, Troy Dam (also called Northern Lights Electric Company Dam) was constructed on Lake Creek, about 24 kilometers (15 miles) downstream of Bull Lake (MBTSG 1996b). It is believed that migration of bull trout over a natural barrier at the dam site was difficult or impossible prior to this dam. The dam is currently an upstream passage barrier. The local population(s) of bull trout in Bull Lake is unusual in that the adult spawners run downstream of Bull Lake, using

Lake Creek as a corridor to access spawning areas in Keeler Creek. This pattern of downstream spawning migration has also been observed in the Flathead River drainage (Upper Kintla Lake and Cyclone Lake) but is considered rare across the range of bull trout. Trapping of Keeler Creek in 1977 resulted in the collection of migrating adult bull trout during June to October (Marotz *et al.* 1988).

Sophie Lake contains a small and disjunct bull trout secondary core area in a closed basin (Figure 6). There is no historical record of bull trout stocking or transplant to this water, but because of the closed nature of this basin, these fish could have been artificially introduced early in the 20th century. A genetic survey may be enlightening. Though this population is currently considered to reside in a secondary core area, that classification will be reviewed. An ultimate determination of the recovery classification for this population represents a research need.

Bull trout reach maturity in Sophie Lake, with a single spawning and rearing area in Phillips Creek (MBTSG 1996c). Phillips Creek headwaters are in British Columbia, and Phillips Creek flows through private timberland that has substantial logging history and road development in the upper reaches. About 3 kilometers (2 miles) north of the United States/Canada border, Phillips Creek drops over a large (120 meters) series of falls and cascades (a complete natural barrier) and then proceeds south across the border. In the United States, the river continues south for another 5 kilometers (3.5 miles) across private land before terminating at Sophie Lake. This lake has intermittent drainage to Lake Koocanusa, which lies just 1.5 kilometers (1 mile) to the west, but the two lakes are probably not sufficiently connected for fish passage to occur. Water is withdrawn from Phillips Creek upstream of the barrier falls (in British Columbia) for power production, and Phillips Creek is heavily dewatered for irrigation purposes in both the United States and Canada. In most years, the stream is dewatered trout

Figure 5. Map of Bull Lake secondary core area showing watersheds and major features.

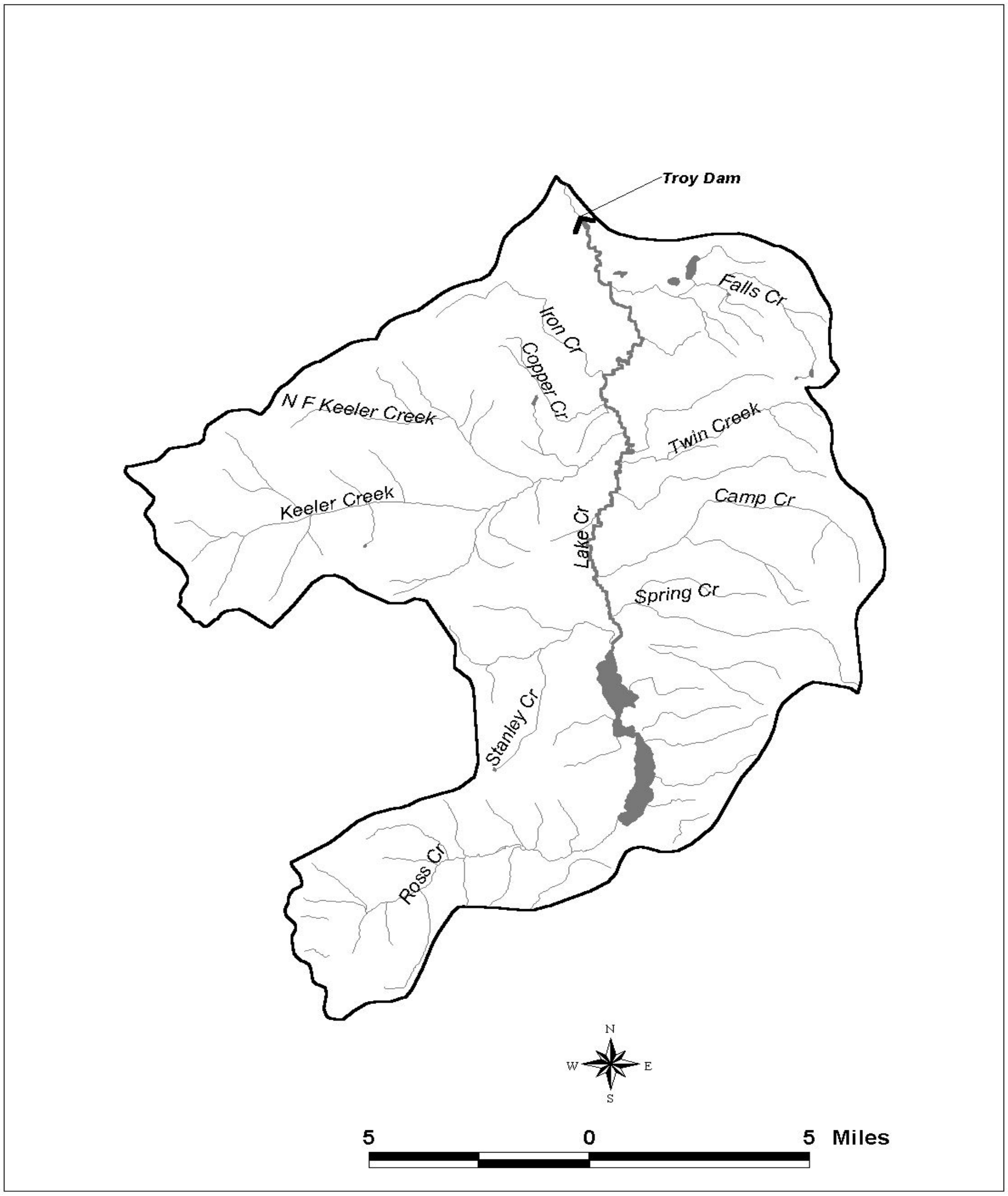
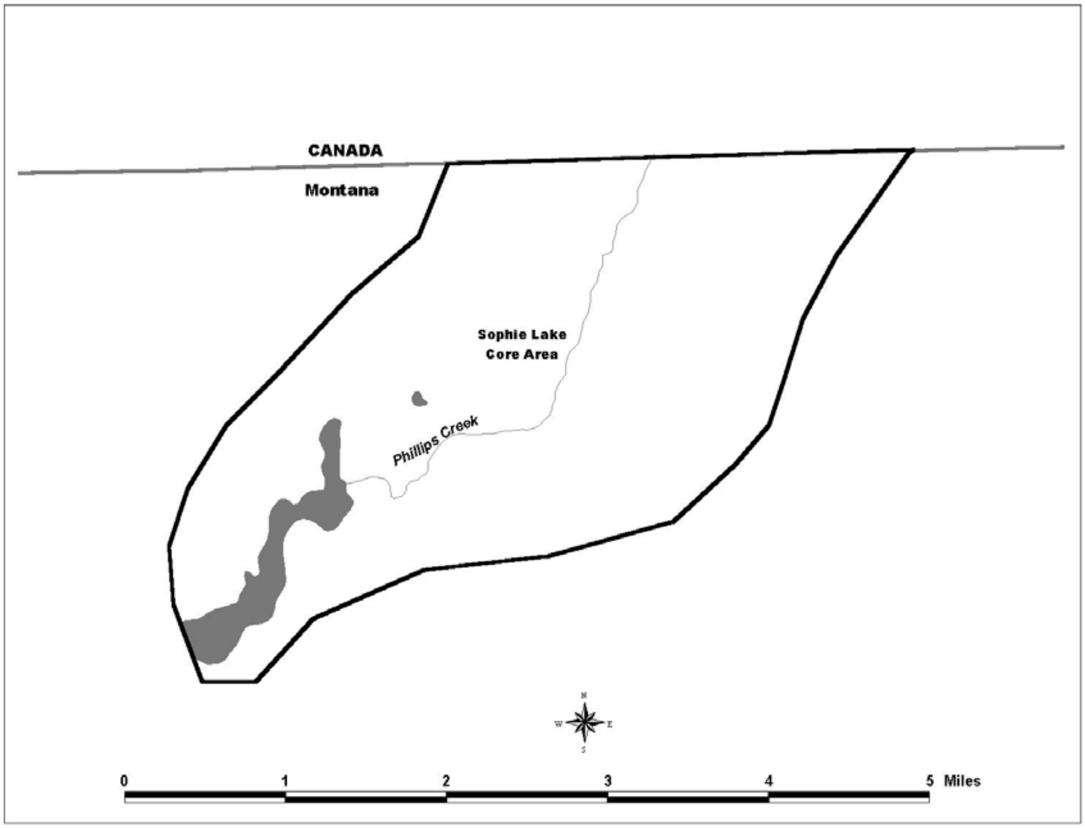


Figure 6. Map of Sophie Lake secondary core area showing watersheds and major features.



(70 to 182 millimeters) were sampled just north of the border by survey crews of the British Columbia Ministry of Water, Land, and Air Protection(Westover, *in litt*., 1999), but bull trout are not known to exist in the stream system upstream of the falls. The U.S. Fish and Wildlife Service Partners For Fish and Wildlife program is working to improve habitat in the degraded lower reaches of the stream.

Bull trout are also present in Glen Lake, but they are probably not reproducing in this system. The fish access Glen Lake as juveniles outmigrating from Grave Creek via the Glen Lake ditch (MBTSG 1996c). Bull trout that mature in Glen Lake cannot return to Grave Creek because of a migration barrier in the ditch. These fish are essentially lost from the Lake Koocanusa core area. In 2001, a project was completed to screen this ditch and improve fish passage over the dam on Grave Creek.

REASONS FOR BULL TROUT DECLINE

Dams

In Lake Koocanusa (the reservoir behind Libby Dam), drawdown limits to protect fishery resources have been advocated since at least 1987 (MBTSG 1996c). In the late 1980's and early 1990's, proposed drawdown limits were exceeded over half the years. Extreme drawdowns have been shown to have negative consequences on benthic insect production, zooplankton production, and terrestrial insect deposition (MFWP 1997). There is concern about the long-term maintenance of fisheries in Lake Koocanusa, given the continuing operational fluctuation (MFWP 1997).

Entrainment studies at Libby Dam have documented low numbers of bull trout passing through the dam, primarily in the spring. Skaar *et al.* (1996) found a total of 6 bull trout in a sample of 13,186 entrained fish captured below the dam. They estimated that the total number of fish entrained was 1.15 to 4.47 million and that the total number of bull trout could be as high as several thousand. However, since the time of that study, operations and discharge schedules have changed. Adult bull trout marked with floy tags in the Wigwam River system (upstream of Lake Koocanusa) have also been documented to pass through Libby Dam. One fish was subsequently recaptured alive in O'Brien Creek, at least 55 kilometers (34 miles) downstream of Libby Dam (Baxter and Westover 2000). Two others were found dead in the Kootenai River downstream of the dam.

In 1978, a selective withdrawal system was installed at Libby Dam (MBTSG 1996c). Selective withdrawal results in little or no thermocline formation in Lake Koocanusa. The absence of a thermocline may contribute to entrainment of fish. Currently, the fisheries sampling program is not designed to identify affects of operations on use of the reservoir by bull trout. The impact of existing dam operations on bull trout represents a major research need.

Impoundment of the Kootenai River by Libby Dam in 1972 also altered the aquatic environment in the river downstream of the dam. The operation of Libby Dam by the U.S. Army Corps of Engineers departs drastically from natural downriver discharge patterns on a seasonal and sometimes daily basis. After the dam was built, temperature patterns, sediment loads, and water quality were altered downstream of

Libby Dam. These alterations resulted in changes in periphyton, aquatic insects, and fish populations (MFWP 1983). Maximum discharge through the existing turbines is about 792.4 cubic meters per second (28,000 cubic feet per second). Daily peaking of flows has been identified as another issue of concern in the river downstream. Gas supersaturation, which can cause gas bubble disease in fish, is a problem when spilling occurs; but spill has not occurred in over a decade. Collectively, these changes in river ecology as a result of dam operations have had variable and largely unquantified impacts on downstream habitat for juvenile bull trout and their food supply.

Since dam construction, lack of seasonal peak flows has been allowing delta formation at the mouths of some tributaries in Montana and Idaho. These depositional areas may eventually impede upstream movement of bull trout spawners during low flows. Migrant bull trout may be especially sensitive because their fall spawning run coincides with low tributary flows and reduced water depths. A delta at the mouth of Quartz Creek is of particular concern because of that stream's importance to migratory bull trout reproduction. Studies completed in 1988 concluded that this delta did not represent a barrier, but the delta should be monitored periodically to determine whether the surface elevation is increasing (Marotz *et al.* 1988).

Troy Dam, constructed in 1917 at the mouth of Lake Creek, is an upstream fish passage barrier. The dam is located at the site of a natural waterfall suspected to have been at least a seasonal barrier to fish passage. The Bull Lake bull trout secondary core area population is isolated upstream of this barrier and is supported by spawning and rearing habitat within the Lake Creek drainage, especially in Keeler Creek.

Forestry Management Practices

Forestry practices rank as a high risk in this recovery unit, largely because forestry is the dominant land use in the basin. The risk to bull trout is elevated due to the fragmentation in the drainage caused by Libby Dam. Virtually all drainages supporting bull trout in the Kootenai River Recovery Unit are managed timberlands.

In the upper Kootenai River basin, upstream of Libby Dam, both the Grave Creek and Wigwam River drainages are largely second-growth forest, and timber harvest continues. Extensive road construction has resulted in increased water and sediment yields (MBTSG 1996c). At the present time, within the United States portion of the basin, only the headwaters of the Grave Creek drainage are protected from future timber management activities.

In the Elk River watershed in British Columbia (a tributary to the upper end of Lake Koocanusa), sediment from roads and logging sites was once so severe that water quality investigators felt that settling basins may be needed to protect the stream's water quality. New logging practices in British Columbia, conducted under the current Forest Practices Code, are much more stringent than they were 25 years ago (Westover, *in litt*., 1999). However, high-water events continue to cause sedimentation. New timber harvest and road building underway in the Wigwam River watershed are of major concern because this watershed currently provides high-quality bull trout habitat. The new activities are being monitored closely, with data to be collected on flows, suspended sediment, temperature, and ground water, both before activities begin and into the future (Westover, *in litt*., 1999).

There are extensive private timberlands in the upper Kootenai River watershed in the United States, mostly owned by Plum Creek Timber Company (formerly timberlands of Champion International). Much of this land has been heavily roaded and logged, particularly in the Fisher River drainage and the Lake and O'Brien Creek watersheds (MBTSG 1996c). These lands are now covered under the Native Fish Habitat Conservation Plan, which the U.S. Fish and Wildlife Service agreed to with Plum Creek Timber Company in 2000, and habitat for native fish is expected to improve under that agreement.

According to the Environmental Impact Statement for the Kootenai National Forest Plan, almost two-thirds of the Kootenai National Forest in Montana, particularly the west half, has problems with watershed instability. Frequent flooding and concentrated high water yields, sedimentation, and small slumps occur below clear-cuts and roads (MBTSG 1996a). The Montana Department of Health and Environmental Sciences (MDHES 1994) lists 12 streams, over 322 kilometers (200 stream miles) in the Kootenai River drainage as having impaired water quality as a result of timber harvesting.

The channel of Keeler Creek, in Montana, is in a destabilized condition because of extensive timber harvest activities and poorly constructed roads, built primarily between 1941 and 1970 (MBTSG 1996c). During that period, over 100 million board feet were clear cut from 23 square kilometers (5,780 acres). Serious flooding occurred in 1974 and 1980. The Montana Department of Health and Environmental Sciences (MDHES 1994) states that 10.9 kilometers (6.8 miles) of Keeler Creek suffers impaired water quality as a result of silvicultural activities.

A point source of sediment pollution exists on Therriault Creek Road, in the 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).

A review of the National Forest database for portions of the Kootenai River basin in Idaho (PBTTAT 1998) revealed that in watersheds important to bull trout, road density averaged 1.5 kilometers per square kilometer (2.4 miles per square mile), with roads covering 1.7 kilometers per square kilometer (2.8 miles per square mile) of riparian area and with 1.1 road crossings per kilometer of stream. A total of 16 percent of the watersheds had been logged. Zaroban *et al.* (1997) found that Idaho Forest Practice Act rules were implemented 97 percent of the time, and when applied, they were 99 percent effective at preventing pollutants from reaching a stream (PBTTAT 1998). However, in half the timber sales reviewed, sediment was still being delivered to streams.

Current forestry practices are less damaging than past practices were, 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 (MBTSG 1996c).

<u>Livestock Grazing</u>

While there may be site-specific impacts, aquatic habitat degradation due to improper livestock grazing is not considered a widespread problem in this recovery unit, in either the United States or British Columbia. Where localized impacts occur, these should be addressed.

Agricultural Practices

The Montana Department of Health and Environmental Sciences (MDHES 1994) lists six streams (135 kilometers [84 miles]) in the upper Kootenai River watershed in Montana as having impaired water quality as a result of agriculture.

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 flow conditions. The Glen Lake Ditch has lacked any functional fish screening, and bull trout moving downstream were historically lost into this irrigation ditch, some ending up in Glen Lake (MBTSG 1996c). In 2001, a project to stabilize the structure, screen the ditch, and improve fish passage over the dam was completed. The diversion still results in some dewatering of the mainstem of Grave Creek in certain years. Dewatered streams in the upper Kootenai River drainage include Grave, Phillips, Sinclair, and Therriault creeks—a total of 22.5 kilometers (14 miles) of streams (MFWP 1991).

In the Idaho portions of the Kootenai River valley, channel straightening, diking, and creation of drainage ditches have grossly modified and/or eliminated some of the lower tributary and mainstem river habitat (PBTTAT 1998; USFWS 1999). Practices that contribute to decreased water quality and/or temperature increases in the lower river corridor could hinder fish use of this river as a migratory corridor and rearing habitat. A problematic diversion on Boundary Creek in Idaho is being screened to eliminate the entrainment of juvenile and adult bull trout. Additional diversion issues may exist on Long Canyon Creek.

Agricultural practices have not had major impacts in the upper Kootenay River watershed in British Columbia, as most of the lands are forested.

Transportation Networks

Railroads are located along the middle portion of the Kootenai River and along the Fisher River. The rerouting of the Great Northern Railroad in the late 1960's shortened the stream channels of the Fisher River, Wolf Creek, and Fortine Creek by over 3 kilometers (0.6 miles) (MBTSG 1996a). Major portions of the lower 16 kilometers (10 miles) of the Fisher River and most of Wolf Creek were channelized.

On portions of Pleasant Valley Fisher River, the main Fisher River, and Swamp Creek east of Libby, there are straightened and riprapped channels along U.S. Highway 2. This highway also parallels the Kootenai River further west. The potential for negative impacts to bull trout to occur as a result of migration barriers, spills, weed suppression, fire suppression, and road maintenance is high (MBTSG 1996a).

Transportation corridors also occur along portions of the drainage in British Columbia, but their overall impact to habitat on the Kootenai River system has not been extensive.

Mining

Annual discharges from the Cominco, Ltd. phosphate plant in Kimberly, British Columbia, exceeded 7,257,472 kilograms (8,000 tons) of phosphorous in the middle to late 1960's (MBTSG 1996c). Pollution abatement measures were installed in 1975, and the plant eventually closed in 1987. Phosphorus levels in Lake Koocanusa are now much lower. High fluoride levels also existed in the Kootenai River prior to the early 1970's.

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. Marys River (MBTSG 1996c). This discharge negatively affected fish and aquatic life in the these tributaries, as well as in the Kootenay River itself. Wastewater treatment facilities were installed in 1979, significantly decreasing the quantity of heavy metals reaching the Kootenay River (Kootenai River Network 2000). The Sullivan Mine is scheduled to close in the next few years (Westover, *in litt*., 1999).

Five open pit coal mines occur in the Elk River drainage in British Columbia. The major water quality problems associated with these coal fields are nitrogen residuals from bulk explosives and increased delivery of suspended sediment to the Elk River and its tributaries. In recent years, better runoff collection systems have been installed, along with settling ponds, and chemical flocculents are selectively used at the mines. Under permit stipulations, suspended sediment concentrations in effluents are not to exceed 50 milligrams per liter (50 parts per million) (MBTSG 1996c). Impacts are likely to continue on a localized scale. In 1995, it was discovered that selenium was being released from the weathering of large accumulations of waste rock at the mines (McDonald and Strosher 1998). To date, studies on trout embryos from sites near the mines have found none of the toxic effects often associated with bioaccumulated selenium (Kennedy *et al.* 2000). Additional concerns have been expressed over presence of heavy metals. The mines are located over 96.6 kilometers (60 miles) from the Kootenay River, in the Elk River drainage upstream of a passage barrier at Elko. Overall, current mine impacts to bull trout in the upper Kootenai River may not be significant, but the potential for future problems remains.

Historically, mining was much more active in the Kootenai River drainage than it is today. Underground mining began in the Kootenai River basin in the late 1800's, and large-scale surface mining flourished beginning in the late 1960's. Some small private mining operations continue in the Lake Creek drainage and in Canada. Lake and Stanley creeks (a total of 25 kilometers or 15.4 stream miles) suffer from impaired water quality as a result of mining activities (MDHES 1994). Water quality impairment in Lake Creek is the result of a copper and silver mine, mill, and tailings impoundment owned by ASARCO, Inc. (MBTSG 1996b). This facility is not presently in operation, and operations are not likely to resume due to limited ore reserves at the site.

Acid mine drainage from the Snowshoe Mine in the Libby Creek drainage has affected trout populations in 5 kilometers (3 miles) of Snowshoe Creek and 24 kilometers (15 miles) of Big Cherry Creek for over 70 years (MBTSG 1996a). Efforts are currently underway to reclaim this site, but other abandoned mines need similar attention (MBTSG 1996a). Historic mining operations in the Fisher River drainage have contributed to channel degradation. A total of 40 kilometers (25 miles) of Big Cherry, Libby, and Snowshoe creeks suffer from impaired water quality as a result of mining activities (MDHES 1994). Several other drainages in the basin have historical impacts from small mining operations.

In Idaho, Boulder Creek and Blue Joe Creek have a legacy of water- quality and habitat degradation problems from mining activity (PBTTAT 1998). Blue Joe Creek experiences episodes of toxic runoff from the Continental Mine.

A large copper and silver mine complex has been proposed in the Libby Creek watershed, with potential impacts on Little Cherry Creek, which may contain a local population of genetically pure native redband trout (MBTSG 1996a). This Noranda proposal is not currently active; it will require consultation for potential impacts to bull trout under section 7 of the Endangered Species Act if it is revived. Because of risks from historic mines and proposed future mines, the historic/current and restoration risks of mining are rated as high in the Kootenai River drainage.

Residential Development

Many of the streams in this area, particularly in the lower Kootenai River basin, flow through private land. The human population in areas around Eureka, Libby, and Troy, Montana; around Bonners Ferry, Idaho; and in portions of southern British Columbia is increasing, resulting in increased housing development along streams. Development exacerbates temperature problems, increases nutrient loads, decreases bank stability, alters instream and riparian habitat, and changes hydrologic response of affected watersheds. Because of the proximity of this development to stream channels and adjacent to bull trout spawning and rearing habitat, rural residential development is considered to be a risk. The location of the development and not the magnitude is of primary concern at this time for bull trout recovery.

Fisheries Management

Illegal harvest has been well documented in this recovery unit and is considered a high risk to bull trout recovery because of the well-known and limited spawning areas (MBTSG 1996a, 1996b, 1996c). Poaching activity peaks during summer months when fish are in the tributaries and can be easily taken (Long 1997). Using interviews with convicted poachers in northwest Montana (and northern Idaho), researchers estimated that an average of 22 bull trout per week were harvested from a portion of the Kootenai River in recent years, with additional fish mortally injured but not retrieved (Long 1997). An angler survey on the Elk and Wigwam Rivers in British Columbia estimated that 28 bull trout were illegally taken from these waters in summer 1998 (Westover 1999).

In the late 1960's and early 1970's, just prior to completion of Libby Dam, several tributaries to Lake Koocanusa were treated with toxicants to remove rainbow trout and restore westslope cutthroat trout. These tributaries included Young, Big, Five Mile, Sullivan, and Clarence creeks (MBTSG 1996c). At the time of treatment only Clarence Creek was known to support bull trout.

Brook trout are present in many bull trout spawning and rearing streams in the Kootenai River Recovery Unit. A 25 percent hybridization rate with brook trout was detected from a sample of 24 bull trout collected in the Kootenai River between Kootenai Falls and Libby Dam (MBTSG 1996a). Brook trout are present throughout the upper Kootenay River drainage in British Columbia, although their numbers are generally low and they do not occur in the Wigwam River system. Most brook trout are found in warmer, more heavily impacted streams (Westover, *in litt*., 1999).

Other introduced fish species found in the Kootenai River drainage include coastal rainbow trout (the kamloops/redband trout are native in the lower Kootenai), Yellowstone cutthroat, kokanee salmon (in Lake Koocanusa), lake trout, northern pike, yellow perch, smallmouth bass, largemouth bass, black bullhead, and pumpkinseed sunfish. *Mysis relicta* (opossum shrimp) have also been introduced into lakes in the drainage. Brown trout were collected in Lake Creek in 1994 and in the Kootenai River downstream of Kootenai Falls in 1998 and 2000. These are the first recorded occurrences of brown trout in the Kootenai River drainage in Montana.

Predation or competition by largemouth bass, northern pike, or other cool or warmwater species could have negative impacts in localized situations. The presence of kokanee salmon in Lake Koocanusa and in the Kootenai River downstream may benefit bull trout by providing a food source for subadult and adult fish (MBTSG 1996c).

Historically, few private fish ponds existed in the upper Kootenai River drainage. Several unlicensed ponds are known to be present in the Grave Creek drainage (MBTSG 1996c). The Lincoln County Conservation District has received numerous requests for private pond construction permits during the past few years. Many applicants for private pond permits request authorization to stock brook trout. Requests for private fish pond permits are likely to continue to increase along with local human population growth (MBTSG 1996c). Proliferation of private ponds presents a risk to bull trout recovery efforts. In the upper Kootenai River drainage in British Columbia, private fish farms are permitted to raise only rainbow trout and they must be in self-contained artificial ponds on their own property.

Extensive gravel mining occurred when Highway 93 was reconstructed near Eureka. The pits created by this mining have now filled with water, potentially creating habitat for nonnative fish species such as perch and northern pike (MBTSG 1996c). There is a concern that this newly created habitat may exacerbate the spread of some introduced species.

Most nonnative species currently present were intentionally introduced through agency stocking in the last century. Such stocking of brook trout, coastal rainbow trout, and Kamloops rainbow has occurred in the upper Kootenai River drainage (extending the range of the latter, which are native in Kootenay Lake). The kokanee salmon population in Lake Koocanusa resulted from an accidental release of fish from a hatchery in British Columbia in the 1970's (MBTSG 1996c). Presently, coastal rainbow trout are planted only in isolated lakes. All other fish plants in the United States, with the exception of Lake Koocanusa, are with westslope cutthroat trout, which are native to the Kootenai River.

There have been continuing problems across northwest Montana with illegal fish introductions. Illegal introductions have occurred in at least 28 waters in the Kootenai River drainage (Vashro, *in litt.,* 2000), most of which involved warm- or coolwater species (pike, perch, bass, bluegill, bullhead) and most of which occurred or were only detected in the past 10 years. Two northern pike have been gill netted in Lake Koocanusa (Westover, *in litt*., 1999). Illegal fish stocking is reportedly a problem on both sides of the border (Westover, *in litt*., 1999). A lake trout was documented for the first time in an angler catch from Kootenay Lake in fall 1999 (Westover, pers. comm., 2001). As with other large lakes, the potential for establishment of a reproducing lake trout population in Kootenay Lake is cause for concern (Donald and Alger 1993; Fredenberg 2000).

Stocking programs on either side of the international border have the potential to negatively impact Kootenai River bull trout if the introduced species emigrate and become established. The Province of British Columbia stocks brook trout only in landlocked lakes in the upper Kootenai River drainage (Westover, *in litt*., 1999). High-elevation lakes are stocked with westslope cutthroat trout. Some low-elevation lakes in the lower Kootenay River drainage are stocked with rainbow trout. Fisheries management programs in Canada are outside our jurisdiction, but close communication and collaboration has occurred in the past and must be continued.

In recent years, the fisheries management emphasis in the United States portion of Lake Koocanusa has switched from westslope cutthroat trout to Kamloops rainbow trout (MBTSG 1996c). Lake Koocanusa is being stocked with Kamloops rainbow trout in United States waters in hopes of providing a trophy fishery sustained by the kokanee salmon forage base, circumstances similar to those occurring naturally downstream in Kootenay Lake. The extent of interactions between Kamloops and bull trout, two large, piscivorous species, are unknown. However, anecdotal evidence from Kootenay Lake, British Columbia, and Lake Pend Oreille, Idaho, indicates they are compatible in the presence of an abundant kokanee forage base. Anglers in British Columbia have reported catching hatchery-reared rainbow trout (Westover, *in litt*., 1999), and the potential impacts of these plants on remaining westslope cutthroat trout need to be further evaluated.

Angling techniques that are effective on Kamloops rainbow trout are likely to also be effective on bull trout, raising concerns about incidental capture and hooking mortality if a demand for a Kamloops fishery in Lake Koocanusa is created (MBTSG 1996c). Drainages that receive high fishing pressure are more likely to experience hooking mortality loss, especially when anglers target larger fish. Based on mail surveys, estimated fishing pressure in Lake Koocanusa was 29,224 angler days in 1993 (MFWP 1994), but by 1999 fishing pressure had nearly doubled to an estimated 57,493 angler days (MFWP 2000); the lake is the most heavily used lake in western Montana.

Currently, in British Columbia, anglers are allowed to harvest one bull trout per day from Kootenay Lake and Lake Koocanusa (Westover 1999). Bull trout caught in most tributaries to these waters must be released. Between April 1 and October 31, anglers are allowed to keep one trophy bull trout (over 70 centimeters [27.6 inches]) per day in the lower Elk River and one bull trout per day from the Kootenay River. There is also a summer bait ban and a year-round single barbless hook restriction in these rivers. Parnell (1997) estimated only 23 bull trout were harvested from the Canadian portion of Lake Koocanusa in nearly 27,000 angler days between June 1 and September 21, 1996. This low rate of harvest is not believed to present a problem for bull trout recovery.

Kootenay Lake, British Columbia, has been supplemented with commercial fertilizer since 1992, following an intensive investigation that concluded such a program would partially compensate for declining productivity in the fishery due to the loss of nutrients. Declining nutrient loads were correlated with lower in-lake nutrient concentrations, chlorophyll *a* concentrations, and macrozooplankton densities and with a dramatic decline in kokanee salmon stocks (Thompson 1999). Nutrients were applied at the north end of the lake, and the response of the food web was monitored. Models predicted that increased zooplankton production resulting from fertilization might be shunted into increased abundance of *Mysis relicta*. In fact, *Mysis relicta* abundance decreased during the experiment. Kokanee abundance increased fourfold, and populations of Gerrard rainbow trout also increased. Thompson (1999) was unable to obtain an estimate of bull trout abundance in Kootenay Lake, but stated that tributary surveys found as many as 200 bull trout (presumably adult spawners) in some tributaries and suggests that the bull trout population may be increasing in a trajectory similar to Gerrard rainbow as a result of improved forage (especially kokanee). Olmsted *et al.* (2001) estimated over 500 adult bull trout from Kootenay Lake congregated annually in 1995 to 1997 below Duncan

Dam, a structure blocking upstream access to spawning areas in the upper Duncan River. British Columbia Hydro successfully passed most of those fish over the dam.

The harvest of bull trout is no longer legal in the Kootenai River drainage in the United States. However, there is still some risk to bull trout from incidental hooking and handling mortality. A fishery for large rainbow trout is becoming more popular in the Kootenai River, and many of the techniques used by those anglers are also effective on bull trout. The Kootenai River in Montana received an estimated 37,491 angler days of fishing pressure in 1999, up from 25,213 angler days in 1991 (MFWP 1992, 2000).

For Bull and Sophie lakes, anglers have expressed strong support for attempts to improve the fishery with nonnative fish. Largemouth bass are well established in Bull Lake, and their interaction with bull trout is unknown (MBTSG 1996b). Northern pike and bluegill were illegally introduced in Sophie Lake in the past decade and have become well established (Vashro, *in litt*., 2000). The northern pike population appears to have grown dramatically in recent years.

Lake trout are present in Spar Lake, which is a closed basin lake (MBTSG 1996b) located adjacent to Bull Lake and in the same drainage. Northern pike are present in some other valley lakes and in backwater areas of the Kootenai River. Both lake trout and northern pike are potential predators on, and competitors with, juvenile bull trout. Although their distribution in the drainage is presently limited, lake trout, if they become established in the Kootenai River/Kootenay Lake system, could pose a major threat to bull trout. Interactions of bull trout with many other introduced species are presently unknown. Future sport fishery management directed at improved recreational fishing for introduced species has the potential to conflict with the goal of restoring bull trout in portions of this drainage (MBTSG 1996c).

<u>Isolation and Habitat Fragmentation</u>

There are two components to the risk from environmental instability. First is the likelihood that a catastrophic event could occur. Second is the risk to bull trout if such an event occurred. The Kootenai River drainage is at a relatively high risk from environmental instability due to climate, geology, and aspect (MBTSG 1996a, 1996b, 1996c; PBTTAT 1998). This area receives high annual precipitation and frequent rain-on-snow events. Rain-on-snow is a common term used to describe cloudy weather periods when warm winds and rain combine to produce rapid snowmelt. These events generally occur during early to midwinter periods. Much of the bull trout spawning and rearing habitat in the Kootenai River drainage is in watersheds with unstable soils and steep slopes. Extensive bedload aggradation combined with low flow conditions can result in dewatering. Seasonal loss of surface flow is evident within aggraded reaches of the Libby, Callahan, and Keeler Creek watersheds (MBTSG 1996a, 1996b). Several landslides have occurred in the Wigwam River drainage (Westover, *in litt*., 1999), sometimes extending entirely across the river downstream of Lodgepole Creek in British Columbia. A poorly timed or extremely large slide could potentially block spawning access to this critical tributary.

Rieman and McIntyre (1993) concluded that temperature is a critical habitat variable for bull trout. Temperatures in excess of 15 degrees Celsius (59 degrees Fahrenheit) are thought to limit bull trout distribution in many systems (Fraley and Shepard 1989; Brown 1992). In Libby Creek, summer water temperatures as high as 22 degrees Celsius (72 degrees Fahrenheit) and 27 degrees Celsius (81 degrees Fahrenheit) were recorded during 1992 and 1994, respectively (MBTSG 1996a). The Fisher River is also known to have elevated water temperatures (MBTSG 1996a).

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. Summer maximum water temperatures in Fortine Creek greatly exceed those recorded in Grave Creek, which drains high-elevation lands along the Whitefish Divide. Grave Creek is the only bull trout spawning and rearing habitat for this core area that is situated entirely in the United States, and the Tobacco River provides the migratory corridor linking it to Lake Koocanusa. Concerns exist that the migratory corridor of the Tobacco River may be compromised by the thermal input of Fortine Creek (MBTSG 1996c).

Water temperatures are probably limiting to bull trout in many Idaho tributaries (PBTTAT 1998), particularly those in watersheds that have natural barriers that block access to the upper drainage (*e.g.*, Moyie River). All are low-elevation streams, and many may not have been hospitable for bull trout, even historically.

If a local population is small enough, variations in survival can cause a declining population for a period long enough that it can be extirpated (Rieman and McIntyre 1993). The local bull trout population in Bull Lake is estimated at several hundred fish or fewer (MBTSG 1996b). Sophie Lake covers only about 81 hectares (200 acres), and bull trout spawn and rear only in Phillips Creek (MBTSG 1996c). The number of adult bull trout is probably fewer than 100 fish. Both of these secondary core areas are at high risk due to their small size, isolation, and restricted habitat.

ONGOING RECOVERY UNIT CONSERVATION MEASURES

Over most of the last decade, significant planning efforts to restore and recover bull trout have been initiated, and many on-the-ground activities that were specifically designed to benefit bull trout and other native salmonids within the Kootenai River Recovery Unit have been implemented. Ultimately, the measure by which these efforts should be judged is the degree to which they have produced positive response in adult abundance and security of local bull trout populations. However, because most of these efforts are relatively young, and would not be expected to produce measurable population response for perhaps several bull trout generations, it is premature to judge the success of most of those programs. Following is a brief summary of the existing and ongoing conservation activities, by jurisdiction:

State of Idaho

The Idaho Department of Fish and Game developed a management plan for bull trout in 1993 (Conley 1993), and the State of Idaho approved a strategy for the conservation of bull trout in July 1996 (Batt 1996). The overall approach is to accomplish bull trout recovery by enlisting the support of existing groups established by Idaho legislation, *i.e.*, watershed advisory groups and basin advisory groups that were formed to strengthen water quality protection and improve compliance with the Clean Water Act through locally developed, site-specific programs.

Under this process, the Kootenai River was designated as 1 of 59 key watersheds in the State of Idaho. The Panhandle Basin Bull Trout Technical Advisory Team produced a working draft of the Kootenai River basin bull trout problem assessment in December 1998, but has not met since that time. The existing draft contains background information, but few specific recovery actions.
The process for the Idaho basin advisory group and the watershed advisory group, as it pertains to bull trout planning, is currently on hold, pending further direction from the Governor's staff.

<u>State of Montana</u>

Beginning in 1990, the State of Montana initiated several bull trout planning activities. The State also increased law enforcement efforts and habitat restoration and habitat monitoring actions. In 1993, the Governor of Montana appointed the Bull Trout Restoration Team to produce a plan that maintains, protects, and increases bull trout populations. The team appointed a scientific group to provide the restoration planning effort with technical expertise.

The scientific group wrote 11 basin-specific status reports and 3 technical, peer-reviewed papers; the latter concerned the role of hatcheries (MBTSG 1996d), suppression of nonnative fish species (MBTSG 1996c), and a strategy for land management (MBTSG 1998). A draft restoration plan that defined and identified strategies for ensuring the long-term persistence of bull trout in Montana was released for public comment in September 1998 (MBTRT 1998). In June 2000, the final restoration plan was issued (MBTRT 2000). The plan synthesizes the scientific reports and provides recommendations for achieving bull trout restoration in western Montana. It focuses activities on 12 restoration and conservation areas and was designed to complement and be consistent with this Bull Trout Recovery Plan. The Montana restoration plan relies on voluntary actions, keyed by watershed groups, but has no legislative or legal authority beyond existing State law. Implementation of the Montana restoration plan is expected to mesh with implementation of this recovery plan.

A multitude of habitat restoration projects, such as removing fish passage barriers, screening irrigation diversions, fencing riparian areas, restoring stream areas, and monitoring habitat, have been completed or are underway in Montana (Graham and Clinch, *in litt*., 1999). Angling regulations have become more restrictive than in the past, brook trout are no longer stocked, and ongoing genetic studies are being conducted. In addition, as in Idaho, these activities are being carried out cooperatively by a broad group of State, Federal, and Tribal agencies and private entities with multiple sources of public and private funding.

Several significant funding sources with money available for bull trout restoration have been developed in Montana. The Montana Future Fisheries Improvement Program awards approximately $750,000 annually for projects that restore or enhance habitat for wild fish, with preference given to those projects that emphasize native species. House Bill 647, passed in the 1999 Montana Legislature, roughly doubled the annual funding for such projects with specific directives to benefit bull trout and cutthroat trout. The State of Montana also receives approximately $1 million annually from Bonneville Power Administration, through the Northwest Power Planning Council, for native fish restoration work. Collectively, these and other funding sources provide a solid foundation upon which to implement many of the actions described in the narrative portion of this recovery plan.

Federal Activities

In addition to standard land and water management guidelines and the Endangered Species Act guidelines that apply to Federal actions in the Columbia River basin (see Chapter 1), there have been several significant Federal efforts with specific implications to bull trout in the Kootenai River Recovery Unit. The U.S. Fish and Wildlife Service has negotiated a Habitat Conservation Plan with Plum Creek Timber Company. This Habitat Conservation Plan includes bull trout and other native salmonids on about 6,500 square kilometers (over 1.6 million acres) of corporate lands, a portion of which are within the Kootenai River Recovery Unit. A Final Environmental Impact Statement was published in September 2000, and the Habitat Conservation Plan was signed in December 2000. Successful implementation of the Habitat Conservation Plan will result in additional conservation of private timberland and improved grazing management practices, including reducing impacts of future actions and remediating existing problems to benefit bull trout.

In 2000, impoundment and operation of Libby Dam on the Kootenai River was included in the formal Endangered Species Act section 7 consultation for the Columbia River Power System. Included in the Biological Opinion were evaluation of factors pertaining to the recovery of the endangered Kootenai River white sturgeon, as well as downstream salmon and steelhead stocks (USFWS 2000). Under the section on Reasonable and Prudent Measures, the Biological Opinion calls for the following at Libby Dam:

> Implement operational constraints [that are] intended to minimize adverse effects of rapid and severe flow fluctuations on bull trout, including year-round minimum flows and ramping rates, seasonal water management, conducting studies to monitor the adequacy of the constraints, and providing for modification of the operational constraints depending on study results (USFWS 2000).

The objective of this measure is to minimize take of bull trout resulting from dam operations (USFWS 2000). The Biological Opinion includes specific flow targets and ramping rates and mandates implementation of VARQ (or variable-flow flood-control) operations to better balance reservoir refill and downstream flow regimes. If implemented, the changes are expected to benefit bull trout and other native fishes, especially Kootenai River white sturgeon (USFWS 2000). Flow regimes from Libby Dam will probably continue to be modified in the future through adaptive management changes.

The Northwest Power Act, in part requiring mitigation for past and present impacts to fish and wildlife from Federal hydropower dams such as Libby Dam, has been successfully used to direct Bonneville Power Administration funds to a series of fisheries recovery actions in western Montana, northern Idaho, and, to a lesser extent, in British Columbia. These projects will benefit bull trout and other salmonids. With the Endangered Species Act listings of bull trout and Kootenai River white sturgeon, a larger portion of those funds are now being spent on actions directly related to recovery for those species.

The U.S. Fish and Wildlife Service has established several staff positions in western Montana under the Partners for Fish and Wildlife Program. Most of the new staff's effort has been directed at developing partnership opportunities and directing Federal funds toward cooperative habitat restoration, water development, and easement programs to benefit native fish in prescribed focus areas. The Kootenai River drainage in Montana is one of the focus areas. Examples of the benefits of this effort include the program currently underway to restore habitat and reduce entrainment loss in the Grave Creek drainage.

Canadian Government Activities

The Province of British Columbia has dedicated resources to the protection of the Kootenay River drainage, including research and management efforts to protect the upper Kootenay River bull trout spawning and rearing habitat for migratory fish from Lake Koocanusa, and efforts to reverse the decline of the fishery downstream in Kootenay Lake. The Province is actively managing and evaluating the bull trout populations and spawning runs from Lake Koocanusa into the upper portions of the Kootenai River drainage. The Province has also implemented and enforced stricter angling regulations to accommodate United States concerns and they continue to cooperate in recovery planning efforts. For example, in 1995, British Columbia angling regulations were changed to eliminate legal harvest of bull trout and to allow only catch and release for streams in the entire Elk River drainage, including the Wigwam River system (Westover, pers. comm., 2001).

STRATEGY FOR RECOVERY

A core area represents the closest approximation of a biologically functioning unit for bull trout. The combination of core habitat (*i.e.*, habitat that could supply all elements for the long-term security of bull trout, including for both spawning and rearing, as well as for foraging, migrating, and overwintering) and a core population (*i.e.*, bull trout inhabiting core habitat) constitutes the basic core area upon which to gauge recovery within a recovery unit.

When we apply the core area concept to the Kootenai River Recovery Unit (Table 2), core areas are most easily delineated for adfluvial populations in Lake Koocanusa, Bull Lake, and Sophie Lake (*e.g.*, typically the lake where adults reside and the interconnected watershed upstream, although Bull Lake presents an exception). For the migratory population of the Kootenai River, evidence indicates connectivity exists within the system from Libby Dam all the way downstream to Kootenay Lake; hence, this area represents a single core area.

Table 2. List of local populations (in bold) by core area, in the Kootenai River Recovery Unit. Streams designated by (mc) are migratory corridors only, and are not considered to host their own local population.

CORE AREA	LOCAL POPULATION
Lake Koocanusa	Kootenai River (mc) **Wigwam River** (BC and MT) Tobacco River (mc) **Grave Creek** BC tributaries - Unspecified[1]
Sophie Lake	**Phillips Creek** upstream of Sophie Lake

[1] Distribution and abundance of local populations of bull trout in most watersheds in Idaho is poorly known at this time. For Idaho tributaries that are unspecified, no redds were observed in searches conducted in 1999 or 2000, and juvenile bull trout have rarely been encountered during electrofishing surveys. Continued survey may indicate the need for substantial changes to this list of local populations.

Table 2. List of local populations (in bold) by core area, in the Kootenai River Recovery Unit. Streams designated by (mc) are migratory corridors only, and are not considered to host their own local population.

CORE AREA	LOCAL POPULATION
Kootenai River (MT/ID/BC) and Kootenay Lake (BC)	Kootenai River (mc) **Fisher River** **Libby Creek** **Pipe Creek** **Quartz Creek** **O'Brien Creek** **Callahan Creek** ID tributaries - Unspecified BC tributaries - Unspecified
Bull Lake	Lake Creek (mc downstream) **Keeler Creek**

Recovery Goals and Objectives

The goal of the Bull Trout Recovery Plan is to **ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed throughout the species native range. Specifically, the Kootenai River Recovery Unit Team adopted the goal of a net increase in bull trout abundance in this recovery unit (as measured by standards the recovery team develops), with restored distribution of any extirpated populations that the recovery unit team identified as necessary to recovery**. In order to recover bull trout in the Kootenai River, the following objectives need to be met:

- Maintain current distribution of bull trout and restore distribution in previously occupied areas within the Kootenai River Recovery Unit.

- Maintain stable or increasing trends in abundance of bull trout in the Kootenai River Recovery Unit.

- Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.

- Conserve genetic diversity and provide opportunity for genetic exchange.

A primary concern is the need for a more formal working relationship between Montana, Idaho, and British Columbia in addressing bull trout restoration in the Kootenai River drainage. Because the local bull trout populations in this drainage are comprised mostly of migratory fish, often originating in Canada, coordination with these jurisdictions is essential to achieve recovery. This point cannot be overemphasized.

Bull trout are distributed among at least 10 local populations within 4 core areas of the Kootenai River Recovery Unit located wholly or partly in the United States (see Table 2). Spawning and rearing habitat for many (probably most) of the local populations of bull trout in the Kootenai River drainage is in British Columbia and so outside the jurisdiction of this recovery plan. Local populations in Canada are currently being studied, and at least three are being monitored. As more distribution and genetic information is developed, the number of local populations identified is likely to increase. In the Kootenai River Recovery Unit within the United States, the historical distribution of bull trout is not well documented, but is believed to be relatively intact. There are no areas at this time where reestablishment of extirpated local populations is recommended. Rather, the emphasis is being placed on securing the existing distribution, increasing the abundance and connectivity of local populations, and coordinating with Canadian entities.

Recovery Criteria

In order to assess progress toward the objectives, the recovery unit team adopted recovery criteria, described below. Numerical standards used to determine the recovered abundance of bull trout in the Kootenai River Recovery Unit are presented in Table 3.

Of the 4 core areas identified in the Kootenai River Recovery Unit, only the 2 main populations have the potential to reach the level of 1,000 spawning adults proposed by Rieman and Allendorf (2001) as a cautious management goal for long-term maintenance of genetic variation in a core area population. Using in part the analysis of Rieman and Allendorf (2001), the recovery unit team assumed that a core area cannot maintain genetic viability (even for the short term) with spawning populations of fewer than about 100 adults. There are inherent stochastic as well as genetic risks associated with low population levels. Rieman and Allendorf (2001) concluded that a cautious interpretation would require approximately 100 adults, spawning each year, to minimize the risk of inbreeding. Numerical criteria we present for replication of populations and adult abundance (Table 3) are estimates of the minimum population levels required for recovery based on current knowledge. As data are collected and trends are more clearly documented, these numbers should be refined for application as recovery criteria.

As per the objectives identified in Chapter 1, the intent within this recovery unit is to maximize likelihood of persistence. This intent will be achieved, in part, by seeking to perpetuate the current distribution and maintaining or increasing abundance of all local bull trout populations that are currently identified or will be identified in the future in the Kootenai River Recovery Unit (Table 2). Numerical summary of the recovery criteria is presented in Table 3. In this recovery unit, a distinction was made between two types of core areas, a distinction based mostly on the size, connectedness, and complexity of the watersheds.

Primary Core Areas: Primary core areas are typically located in watersheds of major river systems, often contain large lakes or reservoirs, and have migratory corridors that usually extend 50 to100 kilometers (31 to 62 miles) or more. Each primary core area includes several identified local populations of bull trout. In recovered condition, a primary core area is expected to support at least 5 local populations with 100 or more spawning adults and contain 1,000 or more adult bull trout. Lake Koocanusa and the Kootenai River/Kootenay Lake complex have been designated as primary core areas, representing recovered status in the Kootenai River Recovery Unit

Table 3. Numeric standards necessary to recover abundance of bull trout in primary and secondary core areas of the Kootenai River Recovery Unit of the Columbia River drainage.

CORE AREAS	**Existing Number (Estimated)** **Local Populations (United States)**	**Existing Number (Estimated)** **Local Populations with > 100 (United States)**	**Recovered Minimum Number** **Local Populations with > 100 (United States)**	**Recovered Minimum Number** **Core Area Total Adult Abundance**
Lake Koocanusa[2]	2	2	2	1,000
Kootenai River/ Kootenay Lake	6	1-4	5	1,000
Bull Lake	1	1	1	100
Sophie Lake	1	0	1	100

Secondary Core Areas: Secondary core areas are based in smaller watersheds and typically contain adfluvial populations of bull trout that are naturally isolated and have restricted spawning and rearing habitat extending only a few kilometers. This spawning and rearing habitat is normally upstream of the lake. As has been noted, Bull Lake is an exception, with most of the spawning and rearing occurring primarily in Keeler Creek downstream of the lake. Secondary core areas in the Kootenai River Recovery Unit are Bull Lake and Sophie Lake. They each include one identified local population of bull trout. Neither Bull Lake nor Sophie Lake is in a watershed of sufficient size and complexity to accommodate the 5 or more local populations of bull trout required to meet the abundance criteria (defined above) for primary core areas. The conditions isolating Bull Lake and Sophie Lake are natural, and it is believed that

2 At least 3 local populations in the Lake Koocanusa core area, with 100 or more adults in each, are thought to exist wholly or partly in Canada. Pending additional evaluation, that number could increase. While the populations are outside the United States (except for the Wigwam River), they must be considered the primary source of recruitment to Lake Koocanusa, therefore contribute to adult abundance in the core area.

in most such situations bull trout have existed for thousands of years and despite numbers that may have seldom exceeded 100 adult fish.

The distinction between primary and secondary core areas is made not to infer a different level of importance for recovery purposes, but to indicate that a different set of standards are needed for recovery criteria, in particular for addressing abundance. The bull trout in the Bull Lake core area are known to express a unique phenotypic trait (*i.e.*, downstream spawning), and bull trout in the closed basin of Sophie Lake also represent a unique resource in the Kootenai River Recovery Unit. Perpetuating both populations is a high priority in this recovery unit.

For the portions of these watersheds in Montana, the primary core areas are functionally equivalent to the Restoration/Conservation Areas designated by the Montana Bull Trout Restoration Team (MBTRT 2000). The secondary core areas generally represent the waters referred to as "disjunct" by the Montana Bull Trout Scientific Group.

Achieving the following recovery criteria, including increased monitoring and evaluation, will require the cooperative efforts of State, Federal, and Tribal resource management agencies; government and private landowners and water users; conservation organizations; and other interested parties. These recovery criteria will only be achieved through the reduction of threats to bull trout, in part as a result of implementing tasks identified in the recovery measures narrative of this recovery plan, as well as by taking advantage of other new conservation and recovery opportunities as they arise. The Kootenai River Recovery Unit will be considered recovered (*i.e.*, the threat of extinction removed) when the following specific criteria are met:

1. **Distribution criteria will be met when the total number of identified local populations (currently numbering 10 in United States waters) has been maintained or increased, and local populations remain broadly distributed in all four existing core areas (Table 2).** This criteria must be applied with enough flexibility to allow for adaptive changes in the list of local populations (both additions and subtractions), based on best available science, as the body of knowledge concerning population and genetic inventory grows.

The distribution criteria cannot be met if major gaps develop in the current distribution of bull trout in the core areas of the Kootenai River Recovery Unit within the United States. Reconnecting fragmented habitat, as well as documenting new or previously undescribed local populations, should allow the distribution of bull trout to increase as recovery progresses. We recognize that stochastic events or deterministic processes already occurring could negatively affect distribution in some cases. The significance of such losses in distribution in ultimately determining whether or not distribution criteria have been met needs to be judged on a case-by-case basis. Maintaining the distribution of bull trout in the British Columbia portion of these watersheds is equally essential, though not covered under the jurisdiction of this plan.

2a. **Abundance criteria will be met in the primary Lake Koocanusa and Kootenai River/Kootenay Lake core areas when each are documented to host at least 5 local populations (including British Columbia tributaries) with 100 adults in each, and each of these primary core areas contains at least 1,000 adult bull trout.**

The abundance criteria for the Bull Lake and Sophie Lake secondary core areas will be met when each core area supports at least 1 local population of bull trout containing 100 or more adult fish.

In the United States waters of the Lake Koocanusa core area, only Grave Creek (and tributaries) and the upper portion of the Wigwam River (lower portion is in British Columbia) support bull trout spawning. Redd counts in Grave Creek ranged from 35 to 134 in 1996 through 2000, indicating a local population of at least 100 spawning adults. This population is the only local 1 capable of reaching that standard of 100 spawning adults in the United States. The Wigwam River supports a few bull trout redds in the upper (*i.e.*, United States) stream reach (6 in 1998 and 21 in 1999), but depends on migration through Canadian tributaries. For recovery purposes, the Wigwam River is considered one local population regardless of political jurisdiction. Redd counts in the Wigwam River in British Columbia ranged from 524 to 1,496 in 1996 through 2001 (Westover, *in litt*., 2001a, 2001b), indicating that the total population of adult bull trout in Lake Koocanusa is well over 1,000 adults and is probably increasing. Significant spawning runs occur in Skookumchuck Creek and other British Columbia tributaries, but they are largely unquantified. To satisfy abundance criteria, continuing international cooperation will be necessary to verify that additional local populations with 100 or more adults exist in other British Columbia tributaries.

In the Kootenai river portion of the Kootenai River /Kootenay Lake core area, there are currently six identified local populations of bull trout, all in Montana (Table 2). Redd counts indicate that the local population exceeds 100 adults in the strongest population, which is in Quartz Creek, where 47 to 105 redds were counted annually since 1996. In Pipe Creek (17 to 36), Libby Creek (10 to 36), and O'Brien Creek (12 to 47), adult numbers may be approaching the level of 100 fish. But to verify the status of these local populations, additional information is needed to determine spawning frequency (annual vs. intermittent) and the number of adults per redd. Redd counts are incomplete for other watersheds, such as the Fisher River and Callahan Creek, but those streams have the potential to support local populations with over 100 spawning adult bull trout. At this time, it is believed that this core area is comprised primarily of fluvial fish, with perhaps a minor component of adfluvial migrants from Kootenay Lake. With expanded monitoring and additional removal of threats, this core area could probably meet recovered abundance criteria.

There is no evidence that spawning populations of bull trout in other portions of the Kootenay Lake watershed in British Columbia (such as those that pass through the Duncan Dam) interact with the Kootenai River populations (Olmsted *et al.* 2001). At this time, we will not evaluate those populations nor include them under this recovery plan because the lake and spawning tributaries are entirely in Canada. However, conditions in Kootenay Lake that affect all populations of bull trout are important to the potential for recovery of bull trout in this core area in the United States.

The abundance criteria for primary core areas of 5 local populations, each with 100 spawning adults and 1,000 or more adult fish, is designed to protect genetic integrity and to reduce chances of stochastic extirpation by replicating local populations in these core areas. Much of the spawning and rearing habitat for these core areas, particularly for Lake Koocanusa, is in British Columbia. The location makes satisfying the recovery criteria somewhat problematic since the Endangered Species Act protections for bull trout do not apply in Canada. However, it is important that these core areas be treated as continuous ecosystems, despite political boundaries. To expect full recovery to occur in these two core areas without strong international cooperation is not realistic. As more information becomes available, the default criteria for each primary core area should be evaluated and may be adjusted to reflect that new information. We emphasize that these criteria must be adaptive if we are to fully protect and restore bull trout in this recovery unit.

2b. **The abundance criteria for the Bull Lake and Sophie Lake secondary core areas will be met when each core area supports at least 1 local population of bull trout containing 100 or more adult fish.**

It is questionable whether Sophie Lake and its tributary, Phillips Creek, have sufficient habitat available to meet this criteria, even in a recovered condition. This situation must be factored into the ultimate evaluation of whether or not the criteria have been attained.

For the Bull Lake core area, redd counts of Keeler Creek (1996 to 2000) were from 59 to 99 redds each year, indicating that the recovery criteria is being met. For the Sophie Lake core area, no redd count data are available. Monitoring will need to be a priority if the criteria are to be achieved.

3. **Trend criteria will be met when the overall bull trout population in the Kootenai River Recovery Unit is accepted, under contemporary standards of the time, as stable or increasing, based on at least 10 years of monitoring data**.

For the Lake Koocanusa core area, this criteria includes all local populations spawning in the United States or British Columbia. For the Kootenai River/Kootenay Lake core area, this criteria includes only the Kootenai River populations. The reason for the differential treatment is that in the latter case many of the Kootenay Lake bull trout spend their entire life cycle in Canada, while in the case of Lake Koocanusa it is believed most of the fish spend at least part of their life cycle in United States waters.

4. **Connectivity criteria will be met when dam operational issues are satisfactorily addressed at Libby Dam (as identified through U.S. Fish and Wildlife Service Biological Opinions) and when over half of the existing passage barriers identified as inhibiting bull trout migration on smaller streams within the Kootenai River Recovery Unit have been remedied.**

In the Kootenai River Recovery Unit, substantial gains in reconnecting fragmented habitat may be achieved by restoring passage over and around many of the barriers that are typically located on smaller streams, including water diversions, road crossings, and culverts. These barriers are not listed individually in the recovery criteria. In fact, many have not been identified, but there is a recovery task directed at doing so in the first 5 years of implementation of this plan. These passage barriers may collectively be very important to recovery. Substantial progress must be made in providing passage over at least half of these sites, consistent with the protection of upstream populations of westslope cutthroat trout and other native fishes, in order to meet the bull trout recovery criteria for connectivity.

A delisting determination can only be made on a “listable entity.” Listable entities include species, subspecies, or distinct population segments of any species or vertebrate fish or wildlife that interbreeds when mature. Criteria for applying the definition of distinct population segment are found in the joint U.S. Fish and Wildlife Service and National Marine Fisheries Service “Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act” (61 FR 4722). Currently, the rules that listed the Klamath River, Columbia River, Jarbidge River, Coastal Puget-Sound, and St. Mary-Belly River bull trout as threatened, establish those populations as distinct population segments. Subsets of those populations would have to be shown to meet the definition of distinct population segment before the U.S. Fish and Wildlife Service could propose delisting those populations or groups of populations. Reclassifying the Kootenai River, or a group of headwater streams including the Kootenai river, as a separate distinct population segment may be appropriate given that recent genetic evidence suggests that these waters may meet criteria for distinctness.

RECOVERY MEASURES NARRATIVE

The recovery measures narrative consists of a hierarchical listing of actions following a standard template in this chapter and all other chapters of the Bull Trout Recovery Plan. The first- and second-tier entries are identical among all chapters and represent general recovery tasks under which specific tasks appear as third-tier entries, where appropriate. Third-tier entries are tasks specific to the Kootenai River Recovery Unit, appear in the Implementation Schedule following this section of the chapter, and are identified by three numerals separated by periods. Second-tier tasks that do not include specific third-tier actions are either 1) programmatic activities that are applicable across the range of the species (see Chapter 1) and appear in *italicized font* or 2) tasks that may not be sufficiently developed to apply to this recovery unit at this time and appear *in an italicized font that is shaded (as seen here).* These tasks are included to preserve consistency in task numbering among recovery unit chapters and to assist in generating information during the comment period for the draft, a period during which additional tasks may be developed.

The Kootenai River Recovery Unit Chapter should be updated or revised as recovery tasks are accomplished or as environmental conditions change and monitoring results or additional information become available. The Kootenai River Recovery Unit team should meet annually to review annual monitoring reports and summaries and to make recommendations to the U.S. Fish and Wildlife Service.

1 Protect, restore, and maintain suitable habitat conditions for bull trout.

1.1 Maintain or improve water quality in bull trout core areas or potential core habitat.

1.1.1 Reduce general sediment sources. Stabilize roads, crossings, and other sources of sediment delivery. Potential sites include **Idaho**: Boundary Creek (Idaho and British Columbia), Callahan Creek (Idaho and Montana), Deep Creek, and Long Canyon Creek; **Montana:** Fisher River, Fortine Creek, Grave Creek and tributaries. (Blue Sky, Clarence, and Lewis creeks), Keeler Creek, Libby Creek, O'Brien Creek, Quartz Creek, and Wigwam River (Montana and British Columbia).

1.1.2 Upgrade problem roads. Pave, upgrade, or relocate portions of major access roads, including those along Fisher River, Grave Creek, and Libby Creek in **Montana**, to reduce impacts from sediment and remedy extensive floodplain encroachment and channel alterations.

1.1.3 Clean up mine waste. Control mining runoff by removing or stabilizing mine tailings and waste rock formerly deposited in the stream channel and floodplain of **Idaho:** Blue Joe Creek, and Boulder Creek and of **Montana:** Lake Creek, Libby Creek, and Stanley Creek. Evaluate and monitor additional concerns about potential sediment and leaching from Canadian mines (British Columbia) and about Montenore Mine activities on Libby Creek (Montana).

1.1.4 Support habitat protection and monitoring in British Columbia. Work collaboratively with British Columbia Ministry of Water, Land, and Air Protection and other Canadian governmental and nongovernmental entities to ensure bull trout habitat is protected and enhanced in the Kootenai River watershed upstream of Lake Koocanusa and in Kootenay Lake and its tributaries downstream of the United States. Continue habitat and fishery monitoring efforts (*e.g.*, redd counts in Wigwam River and Skookumchuck Creek; catch and harvest surveys in Kootenay Lake, Kootenay River, and Elk River.)

1.1.5 Restore Boundary Creek. Reclaim unstable and currently inaccessible forest access road up Boundary Creek (Idaho) and evaluate potential to restore access via other, more stable routes.

1.1.6 Conduct Fisher River assessment. Conduct thorough sediment source and channel stability survey (watershed analysis) in the Fisher River (Montana) watershed and implement corrective actions.

1.1.7 Monitor Wigwam River timber harvest. Evaluate, monitor, and comment as appropriate to British Columbia and United States authorities on the Crestbrook Forest Industries (TEMBEC) Timber Harvest Plan in the Wigwam River drainage. Concerns include potential sedimentation and effects on watershed integrity from timber harvest, roads and crossings, and increased (controlled) access to the most important bull trout spawning stream in the upper Kootenai River watershed.

1.1.8 Assess and minimize threats from Skookumchuck pulp mill landfill closure. Support British Columbia efforts to ensure that the hazardous materials buried in this landfill are sufficiently isolated from the floodplain to ensure minimal risk to the river and aquatic habitat.

1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.

1.2.1 Eliminate entrainment in diversions. Identify potential loss of fish in diversions and screen water diversions and irrigation ditches identified as high priority by watershed groups (*e.g.*, Glen Lake Irrigation Diversion on Grave Creek [Montana] and Boundary Creek [Idaho]).

1.2.2 Provide fish passage around diversions. Install appropriate fish passage structures around diversions on bull trout streams and/or remove related migration barriers in **Montana:** Grave Creek, O'Brien Creek (Troy Diversion), and Quartz Creek (near

FS Rd. 399); **Idaho:** Boundary Creek, Myrtle Creek, and others as identified.

1.2.3 Eliminate culvert barriers. Monitor road crossings for blockages to upstream passage and replace existing culverts that impede passage in **Idaho:** Caboose Creek (railroad), Cow Creek, Debt Creek (railroad), and others as necessary.

1.2.4 Improve instream flows. Restore connectivity and opportunities for migration by securing or improving instream flows and acquiring water rights from willing sellers; priority streams identified to date in **Montana:** Callahan Creek, Keeler Creek (upper), Libby Creek, and O'Brien Creek; **Idaho:** Boundary Creek.

1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions.

1.3.1 Conduct watershed problem assessments. Identify site-specific threats (problem assessment) that may be limiting bull trout in watersheds not already evaluated. Examples include **Idaho:** Boundary Creek (Idaho and British Columbia), Callahan Creek (Idaho and Montana), Deep Creek, and Moyie River; **Montana:** Fortine Creek (thermal); Blue Sky, Clarence, and Lewis creeks in the Grave Creek drainage; North Fork Keeler Creek and O'Brien Creek

1.3.2 Revegetate denuded riparian areas. Revegetate to restore shade and canopy, riparian cover, and native vegetation in streams where investigation indicates such actions are likely to benefit native fish. Priority watersheds may include **Idaho:** Boundary Creek (Idaho and British Columbia), Deep Creek, Kootenai River, Long Canyon Creek, Parker Creek, and Trout Creek;

Montana: Callahan Creek, Fisher River, Libby Creek, O'Brien Creek, Pipe Creek, and Quartz Creek.

1.3.3 Improve grazing practices. Reduce negative effects of grazing with improved grazing management or riparian fencing where investigation indicates such actions are likely to benefit native fish. Priority watersheds may include **Idaho:** Boundary Creek (Idaho and British Columbia), Deep Creek, Long Canyon Creek, Parker Creek, and Trout Creek; **Montana:** Grave Creek (lower drainage) and Libby Creek.

1.3.4 Restore stream channels. Conduct stream channel restoration activities where investigation indicates such actions are likely to benefit native fish. Priority watersheds may include **Idaho:** Boulder Creek, Boundary Creek (Idaho and British Columbia), Cow Creek, Katka Creek, Myrtle Creek, Parker Creek, and Smith Creek; **Montana:** Fisher River, Grave Creek, Libby Creek, and Pipe Creek.

1.3.5 Improve instream habitat. Increase or improve instream habitat by restoring recruitment of large woody debris, pool development, or other appropriate components in streams where investigation indicates such actions are likely to benefit native fish. Priority watersheds may include **Idaho:** Boundary Creek (Idaho and British Columbia), Deep Creek, Fisher Creek, Long Canyon Creek, Myrtle Creek, Parker Creek, Smith Creek, and Trout Creek; **Montana:** Fisher River, Pipe Creek, and Quartz Creek.

1.3.6 Minimize potential stream channel degradation. Ensure that negative effects to bull trout of ongoing flood control activities (*e.g.*, channel clearing on Libby, Pipe, and Quartz creeks in Montana and dredging) are minimized or eliminated.

1.4 Operate dams to minimize negative effects on bull trout.

1.4.1 Protect Lake Koocanusa habitat. Review Lake Koocanusa operational concerns (*e.g.*, water level manipulation) and support operating recommendations that provide enforceable drawdown limits and refill guidelines through Federal consultation (USFWS 2000). The VARQ flood-control model should be implemented by water managers to provide comprehensive, long-term, balanced, and predictable allocation of water resources from Lake Koocanusa that will limit the duration and frequency of deep reservoir drawdowns, improve reservoir refill probability, and produce a more naturally shaped dam discharge pattern downstream (USFWS 2000). Once implemented, these strategies must be evaluated to determine the effects on bull trout recovery.

1.4.2 Optimize outflow patterns from Libby Dam. Integrate reservoir operations with the extremely complex demands for downstream flow releases in a fashion that restores a more naturally shaped dam discharge pattern (both seasonally and daily) and accommodates sufficient instream flows for threatened and endangered fishes (bull trout, Kootenai River white sturgeon, and Kootenai River burbot [petitioned]). Emphasis should be placed on cooperation and communications between potentially conflicting missions and mandates of Federal agencies (*e.g.*, Bonneville Power Administration, Corps Of Engineers, U.S. Fish and Wildlife Service, and National Marine Fisheries Service).

1.4.3 Provide flushing flows. Encourage seasonal peak flows downstream of Libby Dam in at least some years, coordinated with Kootenai River white sturgeon recovery needs, that simulate natural conditions to physically maintain habitat (*i.e.*, prevent delta formation, which may cause migratory blockages at the mouths of tributaries). Existing problems occur in **Idaho:** Caboose, Star, and Debt creeks; **Montana:** Callahan, Libby, O'Brien, Pipe, and Quartz creeks.

1.4.4 Avoid gas supersaturation. Manage spill at Libby Dam to minimize gas supersaturation, which causes conditions detrimental to bull trout and other species.

1.4.5 Examine loss of connectivity of bull trout at Libby Dam. Evaluate the significance of bull trout that are isolated between Libby Dam and Kootenai Falls and the potential impact of the loss of connectivity due to Libby Dam to the health of bull trout populations in the system.

1.4.6 Monitor kokanee entrainment through Libby Dam. Continue monitoring kokanee entrainment through Libby Dam and assess the potential importance of this supplemental food source for downstream bull trout.

1.5 Identify upland conditions negatively affecting bull trout habitats and implement tasks to restore appropriate functions.

1.5.1 Monitor and mitigate fire effects, where necessary. Monitor effects from wild fires and pursue habitat restoration actions where warranted.

2 Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.

2.1 Develop, implement, and enforce public and private fish stocking policies to reduce stocking of nonnative fishes that affect bull trout.

2.1.1 Upgrade fish hatchery practices. Evaluate all fish stocking programs and private and public hatchery practices to minimize the risk of further inadvertent introduction of nonnative species to the Kootenai River drainage.

2.1.2 Prevent introductions of nonnative fishes from private fish ponds. Reduce threat of inadvertent introduction from private fish ponds by closely regulating existing permits (*e.g.*, Therriault, Deep, and Grave creeks) and by screening future applications.

2.2 Evaluate policies for preventing illegal transport and introduction of nonnative fishes.

2.3 Provide information to the public about ecosystem concerns of illegal introductions of nonnative fishes.

2.3.1 Discourage unauthorized fish introductions. Implement educational effort about the problems and consequences of unauthorized fish introductions. Continue assessment of predator and prey interactions in Lake Koocanusa and Kootenay Lake with emphasis on preventing illegal introductions of lake trout, walleye, brown trout, or other competing piscivores from nearby waters.

2.4 Evaluate biological, economic, and social effects of control of nonnative fishes.

2.5 Develop tasks to reduce negative effects of nonnative taxa on bull trout.

2.6 Implement control of nonnative fishes where found to be feasible and appropriate.

2.6.1 Experimentally remove established brook trout populations. Evaluate opportunities for removing brook trout from selected streams and lakes. Priority watersheds include **Idaho:** Boulder

Creek, Deep Creek, and Perkins Lake; **Montana:** Grave Creek (drainage wide), O'Brien Creek, and Pipe Creek (Loon Lake).

3 Establish fisheries management goals and objectives compatible with bull trout recovery and implement practices to achieve goals.

3.1 Develop and implement State and Tribal native fish management plans integrating adaptive research.

3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.

3.2.1 Minimize unintentional bull trout mortality. Ensure that sport angling regulations and fisheries management plans, guidelines, and policies minimize unintentional mortality of bull trout in Lake Koocanusa, the Kootenai River, and tributaries.

3.2.2 Ensure compliance with angling regulations and oversee scientific research. Ensure compliance with angling regulations and scientific collection policies and target bull trout spawning and staging areas for enforcement.

3.2.3 Implement angler education efforts. Continue to provide information to anglers about bull trout identification, special regulations, and reducing hooking mortality for bull trout caught incidentally in Lake Koocanusa and the Kootenai River watershed.

3.2.4 Solicit information from commercial guides. Develop a reporting system to collect information on bull trout caught and released by commercial fishing guides on the Kootenai River.

3.2.5 Coordinate with British Columbia. Continue close communication with British Columbia Ministry of Water, Land,

and Air Protection to carefully monitor the potential effects of tightly regulated bull trout harvest (currently documented to be low) in British Columbia waters (lower Elk River, Lake Koocanusa, and Kootenay Lake) on recovery in the United States.

3.3 Evaluate potential effects of introduced fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.

3.3.1 Evaluate site-specific conflicts with introduced sport fish. Determine site-specific level of predation and competition of bull trout with introduced sport fish and assess effects of those interactions, especially with Kamloops rainbow trout in Lake Koocanusa and largemouth bass in Bull Lake. To protect westslope cutthroat genetic purity, managers have stopped stocking rainbow trout directly into the Lake Koocanusa watershed and have agreed that any further rainbow trout plants should use sterile fish.

3.4 Evaluate effects of existing and proposed sport fishing regulations on bull trout.

3.4.1 Evaluate opportunities for regulated bull trout fisheries. Evaluate management proposals to allow carefully regulated harvest of bull trout (in Lake Koocanusa or other waters) where monitoring of the population status provides a clear record that a harvestable surplus can be maintained and that such harvest will benefit, or at least not be detrimental to, recovery goals. If allowable harvest levels can be implemented, additional sport-fishing support can be solicited for recovery goals, as well as aid for implementing other recovery tasks.

4 Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.

4.1 Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.

4.1.1 Conduct genetic inventory. To contribute to establishing a program to understand the genetic baseline and to monitor genetic changes throughout the range of bull trout (see Chapter 1 narrative), continue coordinated genetic inventory throughout recovery unit, emphasizing origin of bull trout captured from the mainstem Kootenai River between Libby Dam and Kootenay Lake.

4.1.2 Maintain long-term viability. Manage local populations (numbers and life forms) to maintain long-term viability.

4.2 Maintain existing opportunities for gene flow among bull trout populations.

4.2.1 Maintain connectivity with British Columbia. Emphasize the importance of connectivity of the British Columbia populations (spawning in British Columbia supports Lake Koocanusa, and Kootenay Lake is essential to the Kootenai River stocks) and the important factors related to maintaining that connectivity across the international border.

4.3 Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.

5 Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach that uses feedback from implemented, site-specific recovery tasks.

5.1 Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.

5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.

5.2.1 Delineate important migratory habitat. Determine movement and seasonality of use of different habitat types by adult and subadult migratory bull trout, with emphasis on the mainstem Kootenai River and Kootenay Lake.

5.2.2 Research the link between system productivity and bull trout abundance. Evaluate the effects of the nutrient sink, caused by Lake Koocanusa, on the downstream system. Monitor British Columbia efforts to restore productivity to Kootenay Lake via artificial fertilization. Emphasis should be placed on continuing to track bull trout population trends through surveys of catch and harvest in Kootenay Lake as well as other monitoring indices (*e.g.*, redd counts) of migratory fish in the upstream waters.

5.2.3 Evaluate temperature as a limiting factor. Evaluate the potential role of seasonally elevated water temperatures as a limiting factor to juvenile bull trout rearing and/or adult migration in **Idaho:** Boundary Creek (Idaho and British Columbia) and Deep Creek, Long Canyon Creek, Myrtle Creek, Parker Creek, Smith Creek, and Trout Creek; and **Montana:** Fisher River, Fortine Creek, Libby Creek, and Tobacco River.

5.2.4 Evaluate habitat-limiting factors for Bull and Sophie Lake core areas. Evaluate the isolated adfluvial bull trout populations in Sophie Lake and Bull Lake to quantify the population numbers, trends, and extent of habitat used, as well as the potential limiting factors.

5.2.5 Assess restoration potential. Evaluate the potential for restoring habitat in Kootenai River tributaries that have been channelized.

5.2.6 Identify suitable unoccupied habitat. Identify suitable unoccupied habitat, if any. Within 5 years, complete a comprehensive list of all known passage barriers blocking access to suitable habitat by upstream migrating bull trout.

5.3 Conduct evaluations of the adequacy and effectiveness of current and past best management practices in maintaining or achieving habitat conditions conducive to bull trout recovery.

5.4 Evaluate effects of diseases and parasites on bull trout and develop and implement strategies to minimize negative effects.

5.5 Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.

5.5.1 Research historical distribution and abundance. Additional information is needed on the historical distribution and abundance of bull trout in this drainage, particularly in the Idaho portions of the watershed. Such research will be useful in helping direct recovery actions.

5.5.2 Map spawning habitat. Develop a comprehensive map of primary bull trout tributary spawning reaches for focusing habitat protection and recovery efforts.

5.5.3 Research populations in Bull Lake and Sophie Lake. Evaluate the isolated adfluvial bull trout populations in Sophie and Bull lakes to determine core area status and critical limiting factors, to provide recovery actions, and to establish genetic background.

5.6 Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.

6 Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.

6.1 Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.

6.1.1 Support watershed group restoration efforts. Support collaborative efforts by local watershed groups already established in Montana and Idaho (*e.g.*, Kootenai River Network) to accomplish site-specific protection and restoration activities consistent with this recovery plan.

6.1.2 Protect habitat. Provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means. Current emphasis is on **Montana:** Fisher River, Grave Creek, and Libby Creek.

6.2 Use existing Federal authorities to conserve and restore bull trout.

6.2.1 Monitor compliance with the Biological Opinion on Federal Columbia River Power System. Monitor compliance with the U.S. Fish and Wildlife Service's Biological Opinion on the Federal Columbia River Power System relative to operation of Libby Dam.

6.2.2 Implement Plum Creek Habitat Conservation Plan. Carry out compliance monitoring and a U.S. Fish and Wildlife Service commitment to adaptive management planning under the Plum Creek Native Fish Habitat Conservation Plan, especially in the Fisher River, Pipe Creek, and O'Brien Creek watersheds (Montana).

6.2.3 Coordinate all recovery actions with appropriate British Columbia partners. The Province of British Columbia has jurisdiction over most of the spawning and rearing habitat and for much of the foraging, migrating, and overwintering habitat for bull trout in this recovery unit. Coordinating land, water, and fisheries management activities between our two countries is crucial.

6.2.4 Ensure coordination of Endangered Species Act recovery implementation. Ensure that recovery actions for other listed species (*e.g.*, salmon and Kootenai white sturgeon) are not detrimental to recovery of bull trout. Ensuring that other recovery actions are not detrimental is particularly problematic in the allocation and timing of flow releases from Federal water projects.

6.3 Enforce existing Federal and State habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.

6.3.1 Fully implement State habitat protection laws. Fully implement the Montana Streamside Management Zone Law (1993), Montana Stream Protection Act (1965), Montana Natural Streambed and Land Preservation Act (1975), Idaho Forest Practices Act (1974), Idaho Stream Channel Protection Act (1967), Idaho Lake Protection Act (1973), and Idaho Code 36-906 addressing fish passage (pre-1900) to maximize legal protection of bull trout habitat under State law and evaluate the effectiveness of these Acts in conserving bull trout habitat.

6.3.2 Encourage floodplain protection. Encourage local governments to develop, implement, and promote restrictive floodplain regulations to mitigate extensive habitat loss and stream encroachment from rural residential development throughout the Kootenai River drainage. Development exacerbates temperature problems, increases nutrient loads, decreases bank stability, alters instream and riparian habitat, and changes hydrologic response of affected watersheds.

7 *Assess the implementation of bull trout recovery by recovery units and revise recovery unit plans based on evaluations.*

IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows describes recovery task priorities, task numbers, task descriptions, duration of tasks, potential or participating responsible parties, total cost estimate and estimates for the next 5 years, if available, and comments. These tasks, when accomplished, will lead to recovery of bull trout in the coterminous United States as discussed in Part II of this recovery plan.

Parties with authority, responsibility, or expressed interest to implement a specific recovery task are identified in the Implementation Schedule. Listing a responsible party does not imply that prior approval has been given and does not require that party to participate or expend any funds. However, willing participants will benefit by demonstrating that their budget submission or funding request is for a recovery task identified in an approved recovery plan, therefore part of a coordinated recovery effort to recover bull trout. In addition, section 7 (a)(1) of the Endangered Species Act directs all Federal agencies to use their authorities to further the purposes of the Act by implementing programs for the conservation of threatened or endangered species.

Following are definitions to column headings and keys to abbreviations and acronyms used in the Implementation Schedule:

Priority No.: All priority 1 tasks are listed first, followed by priority 2 and priority 3 tasks.

Priority 1: All actions that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2: All actions that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

Priority 3: All other actions necessary to provide for full recovery (or reclassification) of the species.

Task No. & Task Description: Recovery tasks as numbered in the recovery outline. Refer to the Narrative for task descriptions.

Task Duration: Expected number of years to complete the corresponding task. Study designs can incorporate more than one task; when tasks are so combined, the time needed for task completion can be reduced.

Responsible or Participating Party: The following organizations are those with responsibility or capability to fund, authorize, or carry out the corresponding recovery task.

Canadian Government:

BCMWLAP	British Columbia Ministry of Water, Land, and Air Protection

Federal Agencies:

BPA	Bonneville Power Authority
COE	U.S. Army Corps of Engineers
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
FHA	Federal Highway Administration
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

State Agencies:

IBODS	Idaho Board of Disaster Service
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
IDWB	Idaho Water Resources Board
IDWR	Idaho Department of Water Resources

ITD	Idaho Transportation Department
IWAG	Idaho Watershed Advisory Group
MBTRT	Montana Bull Trout Restoration Team
MBTSG	Montana Bull Trout Scientific Group
MDEQ	Montana Department of Environmental Quality
MDNRC	Montana Department of Natural Resources and Conservation
MDOT	Montana Department of Transportation
MFWP	Montana Fish, Wildlife and Parks

Others:

Counties

KTOI	Kootenai Tribe of Idaho
PCTC	Plum Creek Timber Company
TU	Trout Unlimited

An asterisk (*) indicates agency or agencies that have the lead role for task implementation and coordination, though not necessarily sole responsibility.

<u>Cost Estimates</u>: Cost estimates are rough approximations and provided only for general guidance. Total costs are estimated for the duration of the task, are itemized annually for the next 5 years, and include estimates of expenditures by local, Tribal, State, and Federal governments and by private business and individuals. Cost estimates are not provided for tasks which are normal agency responsibilities under existing authorities.

Implementation Schedule for the Bull Trout Recovery Plan: Kootenai River Recovery Unit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
1	1.1.1	Reduce general sediment sources	25	**USFS**, Counties, IDEQ, IDFG, IDL, ITD, IDWAG, KTOI, MDNRC, MDOT, MFWP, NRCS, PCTC, FHA, USFWS							Ongoing[3]Ongoing administrative costs
1	1.1.4	Support habitat protection and monitoring in British Columbia	25	**BCMWLAP**, BPA, IDFG, IDWAG, KTOI, MFWP, USFS, USFWS	1,250	50	50	50	50	50	Ongoing
1	1.1.7	Monitor Wigwam River timber harvest	25	**BCMWLAP, MFWP, USFS**, Counties, USFWS	1,250	50	50	50	50	50	Ongoing

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Ongoing tasks are currently being implemented as part of normal agency responsibilities that may benefit bull trout. Because these actions are not specifically being done to address bull trout conservation, they are not included in cost estimates. Some of these efforts may be occurring at reduced funding levels and/or in only a small portion of the watershed.

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Implementation Schedule for the Bull Trout Recovery Plan: Kootenai River Recovery Unit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
1	1.2.1	Eliminate entrainment in diversions	25	**IDFG, IDWR, MDNRC, MFWP**, NRCS, USFWS	1,250	50	50	50	50	50	Ongoing
1	1.2.2	Provide fish passage around diversions	25	**IDFG, IDWR, MDNRC, MFWP**, NRCS, USFWS	1,250	50	50	50	50	50	Ongoing
1	1.2.3	Eliminate culvert barriers	25	**USFS,** Counties, IDFG, IDL, ITD, MDNRC, MDOT, PCTC, FHA	1,250	50	50	50	50	50	Ongoing
1	1.2.4	Improve instream flows	25	**IWRB, MDNRC, MFWP**, IDFG, KTOI,	Ongoing						Ongoing
1	1.3.6	Minimize potential stream channel degradation	25	**Counties, IBODS, MDNRC**, COE, IDFG, IDWAG, IDWR, ITD, KTOI, MDEQ, MDOT, MFWP	Ongoing						Ongoing management and administrative costs

Chapter 4 - Kootenai

Implementation Schedule for the Bull Trout Recovery Plan: Kootenai River Recovery Unit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
1	1.4.1	Protect Lake Koocanusa habitat	25	**BPA, COE, MFWP, USFWS**, Counties, EPA, MDEQ	Ongoing						Ongoing management costs
1	1.4.2	Optimize outflow patterns from Libby Dam	25	**BPA, COE, IDFG, MFWP, USFWS**, Counties, EPA, IDEQ, KTOI, MDEQ, NMFS	Ongoing						Ongoing through section 7 consultation
1	1.4.3	Provide flushing flows	25	**BPA, COE, IDFG, MFWP, USFWS**, Counties, EPA, IDEQ, KTOI, MDEQ, NMFS	Ongoing						Ongoing through section 7 consultation
1	1.4.5	Examine bull trout loss of connectivity at Libby Dam	25	**BPA, COE, MFWP, USFWS**	1,250	50	50	50	50	50	Ongoing
1	3.2.5	Coordinate with British Columbia	25	**BCMWLAP, IDFG, MFWP, USFWS**	250	10	10	10	10	10	Ongoing

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Implementation Schedule for the Bull Trout Recovery Plan: Kootenai River Recovery Unit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
1	3.3.1	Evaluate site-specific conflicts with introduced sport fish	10	**BCMWLAP, IDFG, MFWP, USFWS**	1,000	100	100	100	100	100	Ongoing
1	4.2.1	Maintain connectivity with British Columbia	25	**BCMWLAP, IDFG, MFWP, USFWS**, IDWAG, KTOI, USFS	250	10	10	10	10	10	Ongoing
1	5.2.4	Evaluate habitat limiting factors for Bull and Sophie Lake core areas	10	**MFWP,** USFWS	100	10	10	10	10	10	
1	5.5.3	Research populations in Bull and Sophie lakes	10	**MFWP**, USFWS	Ongoing						Related to task 5.2.4
1	6.1.2	Protect habitat	25	**IDFG, MFWP, USFWS**, BPA, IDWAG, KTOI, NRCS, PCTC, USFS	Ongoing						Ongoing

Chapter 4 - Kootenai

Implementation Schedule for the Bull Trout Recovery Plan: Kootenai River Recovery Unit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
1	6.2.1	Monitor compliance with the Biological Opinion on the Federal Columbia River Power System	25	**USFWS**, BPA, COE, IDEQ, IDFG, MDEQ, MFWP, USFS,	Ongoing						Ongoing agency and administrative costs
1	6.2.3	Coordinate all recovery actions with appropriate British Columbia partners.	25	**BCMWLAP, IDFG, MFWP, USFWS,** BPA, COE, IDEQ, MDEQ, USFS,	1,250	50	50	50	50	50	Ongoing
1	6.2.4	Ensure coordination of ESA recovery implementation	25	**NMFS, USFWS**, BPA, COE, FERC, NRCS, USFS	Ongoing						Ongoing agency and administrative costs
1	6.3.1	Fully implement State habitat protection laws	25	**IDL, MDNRC**, IDEQ, IDWR, MFWP	Ongoing						Ongoing administrative and monitoring costs

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Implementation Schedule for the Bull Trout Recovery Plan: Kootenai River Recovery Unit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
2	1.1.2	Upgrade problem roads	25	**USFS**, Counties, IDL, ITD, MDOT, PCTC	Ongoing						Ongoing administrative and planning costs
2	1.1.3	Clean up mine waste	25	**MDEQ, IDEQ**, EPA, IDL, IDWAG, MDNRC	Ongoing						Ongoing administrative costs
2	1.1.5	Restore Boundary Creek	5	**USFS**, Counties	250	50	50	50	50	50	
2	1.1.6	Conduct Fisher River assessment	10	**MFWP, PCTC, USFS**, MDNRC	Ongoing						Ongoing management and administrative costs
2	1.1.8	Assess/minimize threats from Skookumchuck pulp mill landfill closure	10	**BCMWLAP**, EPA, USFWS	250	25	25	25	25	25	Ongoing

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Implementation Schedule for the Bull Trout Recovery Plan: Kootenai River Recovery Unit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
2	1.3.1	Conduct watershed problem assessments	10	**IDFG, MFWP**, BPA, KTOI, NRCS, USFWS	Ongoing						Ongoing management and administrative costs
2	1.3.2	Revegetate denuded riparian areas	25	**USFS**, IDFG, IDL, KTOI, MFWP, NRCS, PCTC, USFWS	250	10	10	10	10	10	Ongoing
2	1.3.3	Improve grazing practices	25	**USFS**, KTOI, MDNRC, NRCS, PCTC	Ongoing						Ongoing administrative and planning costs
2	1.3.4	Restore stream channels	25	**USFS**, IDFG, KTOI, MFWP, NRCS, PCTC, USFWS	Ongoing						See related task 1.3.1
2	1.3.5	Improve instream habitat	25	**USFS**, IDFG, IDL, KTOI, MDNRC, MFWP, NRCS	Ongoing						See related task 1.3.1
2	1.4.4	Avoid gas supersaturation	10	**COE**, BPA, EPA	Ongoing						Ongoing administrative and operational costs

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Implementation Schedule for the Bull Trout Recovery Plan: Kootenai River Recovery Unit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
2	1.4.6	Monitor kokanee entrainment through Libby Dam	25	**BPA, COE, MFWP**, IDFG	Ongoing						Ongoing administrative and operational costs
2	1.5.1	Monitor and mitigate fire effects, where necessary	25	**IDL, MDNRC, USFS**	Ongoing						Ongoing administrative and planning costs
2	2.1.1	Upgrade fish hatchery practices	25	**BCMWLAP, IDFG, KTOI, MFWP**, USFWS	Ongoing						Ongoing fishery management costs
2	2.1.2	Prevent introductions of nonnative fishes from private fish ponds	25	**IDFG, MFWP**, BCMWLAP	Ongoing						Ongoing fishery management costs
2	2.3.1	Discourage unauthorized fish introductions	25	**BCMWLAP, IDFG, MFWP**, KTOI, MDNRC, TU, USFWS	Ongoing						Ongoing fishery management costs

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Implementation Schedule for the Bull Trout Recovery Plan: Kootenai River Recovery Unit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
2	2.6.1	Experimentally remove established brook trout populations	25	**IDFG, MFWP**, KTOI, USFWS	1,250	50	50	50	50	50	Ongoing
2	3.2.1	Minimize unintentional bull trout mortality	25	**BCMWLAP, IDFG, MFWP**, IDEQ, IDL, IDWR, KTOI, MDNRC	Ongoing						Ongoing fishery management costs
2	3.2.2	Ensure compliance with angling regulations and oversee scientific research	25	**BCMWLAP, IDFG, MFWP**, KTOI, USFWS	Ongoing						Ongoing fishery management costs; see related tasks 3.2.1, 3.2.3, 3.4.1
2	3.2.3	Implement angler education efforts	25	**IDFG, MFWP**, BCMWLAP, KTOI, USFWS	Ongoing						Ongoing fishery management costs; see related tasks 3.2.1, 3.2.2, 3.4.1

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Implementation Schedule for the Bull Trout Recovery Plan: Kootenai River Recovery Unit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
2	3.4.1	Evaluate opportunities for regulated bull trout fisheries	25	**BCMWLAP, IDFG, MFWP, USFWS**	Ongoing						Ongoing fishery management costs; see related tasks 3.2.1, 3.2.2, 3.2.3
2	4.1.1	Conduct genetic inventory	10	**IDFG, MFWP, USFWS**, BCMWLAP, KTOI	Ongoing						Ongoing fishery management cost; see related task 4.1.2
2	4.1.2	Maintain long-term viability	25	**IDFG, MFWP, USFWS**, BCMWLAP, KTOI	Ongoing						Ongoing fishery management cost; see related task 4.1.1
2	5.2.1	Delineate important migratory habitat	10	**IDFG, MFWP**, BCMWLAP, KTOI, USFWS	1,000	100	100	100	100	100	Ongoing
2	5.2.3	Evaluate temperature as a limiting factor	25	**EPA, IDFG, MFWP**, IDEQ, KTOI, MDEQ, USFWS	1,250	50	50	50	50	50	See related task 1.3.1

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Implementation Schedule for the Bull Trout Recovery Plan: Kootenai River Recovery Unit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
2	5.2.6	Identify suitable unoccupied habitat	5	**IDFG, MFWP, USFWS**	Ongoing						See related tasks 5.2.1, 5.2.3, 5.2.4
2	6.1.1	Support watershed group restoration efforts	25	**IDFG, MFWP, USFS, USFWS**, BCMWLAP, IDEQ, IDL, IDWAG, KTOI, MDNRC, NRCS, PCTC,	Ongoing						Ongoing administrative and CWA costs
2	6.2.2	Implement Plum Creek Habitat Conservation Plan	30	**PCTC, USFWS**	750	30	30	30	30	30	Ongoing - 30-yr. agreement
2	6.3.2	Encourage floodplain protection	25	**Counties**, IDEQ, IDFG, IDL, KTOI, MDEQ, MDNRC, MFWP, PCTC	Ongoing						Ongoing administrative and planning costs
3	3.2.4	Solicit information from commercial guides	10	**IDFG, MFWP**	Ongoing						Ongoing administrative and planning costs

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Implementation Schedule for the Bull Trout Recovery Plan: Kootenai River Recovery Unit											
Priority number	Task number	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	Year 1	Year 2	Year 3	Year 4	Year 5	
3	5.2.2	Research the link between system productivity and bull trout abundance	25	**BCMWLAP, IDFG, KTOI, MFWP**, USFWS	1,250	50	50	50	50	50	Ongoing
3	5.2.5	Assess restoration potential	10	**IDFG, MFWP**, BCMWLAP, NRCS, USFWS	Ongoing						See related tasks 1.3.1 and 1.3.4
3	5.5.1	Research historical distribution and abundance	5	**IDFG**, BCMWLAP, MFWP, USFWS	50	10	10	10	10	10	
3	5.5.2	Map spawning habitat	25	**IDFG, MFWP**							Ongoing fishery management costs; see related task 5.2.1

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APPENDIX A. Common and Scientific Names of Fishes in the Kootenai Recovery Unit

white sturgeon, *Acipenser transmontanus*	Native
northern pike, *Esox lucius*	Introduced
largescale sucker, *Catostomus macrocheilus*	Native
longnose sucker, *C. catostomus*	Native
northern pikeminnow, *Ptychocheilus oregonensis*	Native
peamouth, *Mylocheilus caurinus*	Native
redside shiner, *Richardsonius balteatus*	Native
longnose dace, *Rhinichthys cataractae*	Native
fathead minnow, *Pimephales promelas*	Introduced
kokanee, *Oncorhynchus nerka*	Introduced
rainbow or redband trout, *O. mykiss*	Native
westslope cutthroat trout, *O. clarki lewisi*	Native
Yellowstone cutthroat trout, *O. clarki bouvieri*	Introduced
brown trout, *Salmo trutta*	Introduced
brook trout, *Salvelinus fontinalis*	Introduced
bull trout, *S. confluentus*	Native
lake trout, *S. namaycush*	Introduced
mountain whitefish, *Prosopium williamsoni*	Native
pygmy whitefish, *P. coulteri*	Native
black bullhead, *Ameiurus melas*	Introduced
burbot, *Lota lota*	Introduced
pumpkinseed, *Lepomis gibbosus*	Introduced
bluegill, *L. macrochirus*	Introduced
smallmouth bass, *Micropterus dolomieu*	Introduced
largemouth bass, *M. salmoides*	Introduced
shorthead sculpin, *Cottus confusus*	Native
slimy sculpin, *C. cognatus*	Native
torrent sculpin, *C. rhotheus*	Native
yellow perch, *Perca flavescens*	Introduced

APPENDIX B. List of Chapters