

## APPENDIX D

### FISHERIES AND AQUATIC LIFE

#### D.1 Fisheries Overview

Grave Creek supports a largely native assemblage of fish comprised of ten species within four families (Table D-1). Native salmonids include bull trout, westslope cutthroat trout, and mountain whitefish. Introduced salmonids include brook trout, rainbow trout, and kokanee salmon. The large-scale sucker is the lone representative of the catostomidae family. The torrent sculpin is presumably the only member of the sculpin family occurring in the focus area. The redbside shiner and northern pikeminnow represent the minnow family (cyprinidae). Map 12 provides distribution data for several key fish species in the Grave Creek Watershed.

Classified as a bull trout core area (Montana Bull Trout Scientific Group, 1996b), Grave Creek is the major bull trout spawning tributary in Montana's portion of Lake Koocanusa (USFS, 2000). Threats to resident and migratory life forms of bull trout in the drainage include habitat degradation, introduced fish species, rural residential development, forestry, water diversions, and agricultural land uses (Montana Bull Trout Scientific Group, 1996b).

<b>Table D-1: Native and Introduced Fish Species Sampled Inhabiting Grave Creek.</b>
<b>Native Species</b>
Bull trout ( <i>Salvelinus confluentus</i> )
Westslope cutthroat trout ( <i>Oncorhynchus clarki lewisi</i> )
Largescale sucker ( <i>Catostomus macrocheilus</i> )
Northern pikeminnow ( <i>Ptychocheilus oregonensis</i> )
Mountain whitefish ( <i>Prosopium williamsoni</i> )
Torrent sculpin ( <i>Cottus rhotheus</i> )
Redside shiner ( <i>Richardsonius balteatus</i> )
<b>Introduced Species</b>
Rainbow trout ( <i>Oncorhynchus mykiss</i> )
Brook trout ( <i>Salvelinus fontinalis</i> )
Kokanee salmon ( <i>Oncorhynchus nerka</i> )

#### D.2 Bull Trout

The Tobacco/Grave bull trout subpopulation (stock) is a part of the larger upper Kootenai River meta-population. The Tobacco/Grave population consists of both migratory and resident life forms. Both life forms are known to inhabit or reproduce in Grave Creek and the following tributaries: Lewis, Blue Sky, Clarence, Stahl, and Williams creeks. Both Stahl and Williams Creeks have in-stream falls that are fish passage barriers (USFS, 2000). Table D-2 includes species indicator classifications for the Tobacco/Grave bull trout subpopulation (stock).

**Table D-2: Bull Trout Species Indicators for the Tobacco/Grave Subpopulation (USFS, 2000).**

Indicator Metric	Condition
Subpopulation Size	FAR
Growth and Survival	FAR
Life History Diversity and Connectivity	FAR
Persistence and Genetic Integrity	FAR

FAR = Functioning at Risk

### D.2.1 Bull Trout Spawning Redd Results

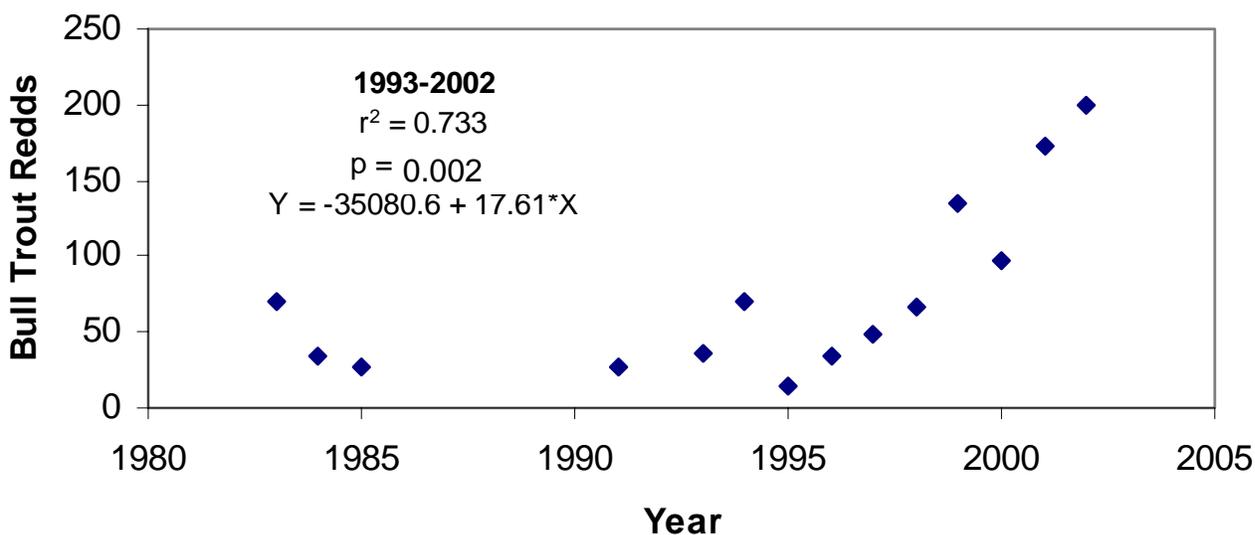
MFWP maintains a spawning redd database for Grave Creek. The number of spawning redds in the watershed have significantly increased since 1995 (MFWP, unpublished data) (Table D-3). MFWP completed redd counts in the Grave Creek drainage (including Blue Sky, Clarence, Williams, and Lewis creeks) from 1983 through 1985, and then from 1993 through 2002. The annual redd count survey is completed from the Grave Creek confluence with the Tobacco River upstream to near the mouth of Lewis Creek (approximately 9 miles). Grave Creek becomes intermittent upstream of the Lewis Creek confluence. Most redds in Grave Creek were located upstream from the mouth of Clarence Creek to the confluence with Lewis Creek. Counts have been completed in Clarence Creek and Blue Sky Creek since 1996.

Bull trout have exhibited a positive trend in spawning abundance in Grave Creek since 1983 (Figure D-1;  $r^2 = 0.73$ ;  $p = 0.002$ ) (MFWP, unpublished data). Counts in Clarence Creek have been consistently increasing since 2001 relative to the rest of the Grave Creek Watershed. Blue Sky has exhibited a less consistent trend over the same period (MFWP, unpublished data). Redd count results indicated a significant increase in the number of bull trout spawning redds in Grave Creek over the 11-year period. The number of spawning bull trout in Grave Creek may be responding to the State of Montana's more restrictive bull trout fishing regulations that occurred in the 1990s; the removal of the Glen Lakes Irrigation District (GLID) diversion dam that was jointly executed by GLID and US Fish & Wildlife Service in 2000; or larger scale regional factors influencing Lake Koocanusa. From 1983 to 2000 (pre-dam removal period), an average of 55 redds were counted. From 2001 to 2003 (post-dam removal period), an average of 206 redds were counted in the survey areas.

**Table D-3: Survey Year and Spawning Redd Count Results for Grave Creek and Two Primary Tributaries. MFWP, Unpublished Data.**

Year Surveyed	Total	Main Stem Grave Creek	Clarence Creek	Blue Sky Creek	Miles Surveyed
1983	70				17
1984	35				17
1985	27				9
1986					
1987					

<b>Table D-3: Survey Year and Spawning Redd Count Results for Grave Creek and Two Primary Tributaries. MFWP, Unpublished Data.</b>					
Year Surveyed	Total	Main Stem Grave Creek	Clarence Creek	Blue Sky Creek	Miles Surveyed
1988					
1989					
1990					
1991	27				15
1992					
1993	36				17.1
1994	71				11.5
1995	15				9
1996	35	24	5	6	17
1997	49	42	6	1	9
1998	66	52	13	1	9
1999	134	85	39	10	9
2000	97	87	9	1	9
2001	173	131	29	13	9
2002	199	156	38	5	9
2003	245	173	52	20	9



**Figure D-1: Bull Trout Spawning Redd Counts in the Grave Creek Drainage Between 1983 and 2003.**

Long-term monitoring of bull trout redd numbers can be an important and useful tool to assess bull trout population trends (Rieman and McIntyre, 1993). Based on annual redd counts in Grave Creek, and spring gill net catch rates in Koocanusa Reservoir, adult bull trout abundance within Koocanusa Reservoir has increased over the past 8 to 10 years. Based on spawning redd counts in Grave Creek and a ratio of 1.55 fish per redd (Baxter and Westover, 2000), approximately 380 spawning bull trout may have used Grave Creek in 2003. These data indicate that most of the criteria established by the USFWS

(2002) for the Lake Kooconusa core area are currently being met by the Grave Creek and Wigwam River bull trout spawning populations.

## D.2.2 Juvenile Fish Population Estimates

Juvenile bull trout surveys have been completed in the Grave Creek Demonstration Restoration Project downstream of Clarence Creek, and in main stem Grave Creek near Blue Sky Creek. Juvenile bull trout were most abundant in the lower Grave Creek sampling section (upstream of Clarence Creek) in 2001; westslope cutthroat trout were the most abundant salmonid species sampled in 2000; and rainbow trout was the most abundant salmonid species observed in 2002 (MFWP, unpublished data).

Juvenile bull trout population estimates have been consistent over the period of record for the Grave Creek sampling reach near Blue Sky Creek (MFWP, unpublished data). Total juvenile bull trout estimates have ranged from 116 fish to 186 fish from 1997 to 2004 (Table D-4). Juvenile bull trout densities have increased slightly over the period of record although the trend is not significant (MFWP, unpublished data).

Year	Total Estimate	Area (m <sup>2</sup> )	Density (#/m <sup>2</sup> )
1997	158 (146 - 171)	1628	9.7 (9.0 - 10.5)
1998	186 (177 - 196)	1628	11.4 (10.9 - 12.0)
1999	139 (114 - 166)	1628	8.5 (7.0 - 10.2)
2000	160 (143 - 177)	1628	9.8 (8.8 - 10.9)
2001	165 (147 - 183)	1421	11.6 (10.3 - 12.9)
2002	116 (103 - 132)	1361	8.5 (7.6 - 9.7)
2003	156 (147 - 166)	999	15.6 (14.7 - 16.6)
2004	153 (149 - 159)	1148	13.3 (13.0 - 13.8)

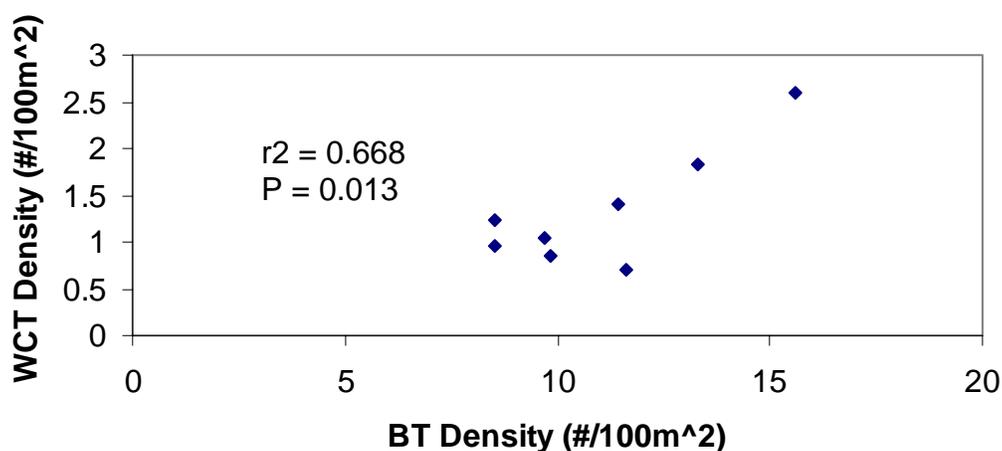
MFWP maintained a screw trap in the GLID irrigation canal in 2002 and 2003 to detect fish entrainment by the ditch. The fish screen was designed to limit movement of fish 4 inches and larger into the ditch from Grave Creek. Entrainment of fish less than 4 inches in length was deemed acceptable during the design of the fish screen. Because the screw trap samples almost the entire width of the channel, the number of fish caught by the trap likely represents a high percentage of the individuals actually entrained by the canal. In 2002, 178 bull trout and 3 westslope cutthroat trout were captured in the screw trap and in 2003, 355 bull trout, 3 westslope cutthroat trout, and 4 mountain whitefish were captured in the screw trap and returned to main stem Grave Creek (Jim Dunnigan, MFWP, personal communication, 2004).

## D.3 Westslope Cutthroat Trout

Juvenile westslope cutthroat trout (WCT) have been monitored in the main stem Grave Creek sampling reach near Blue Sky Creek. The monitoring period of record spans from

1997 to 2004. Juvenile WCT densities are approximately 1 order of magnitude lower than bull trout densities in the survey reach. Although WCT densities have increased slightly over the period of record, the trend is not significant (MFWP, unpublished data).

The juvenile bull trout and juvenile WCT data suggest that juvenile bull trout abundance is positively and significantly correlated ( $r^2 = 0.668$ ,  $p$ -value = 0.013) to juvenile WCT densities in the survey reach (Figure D-2) (MFWP, unpublished data).



**Figure D-2: Comparison of Juvenile Bull Trout and Westslope Cutthroat Trout Densities for the Main Stem Grave Creek Sampling Reach Near Blue Sky Creek.**

#### D.4 Species of Special Concern

According to the Montana Natural Heritage Program (MNHP) the term "species of special concern" includes taxa that are rare, endemic, disjunct, declining, threatened or endangered throughout their range or in Montana, vulnerable to extirpation from Montana, or in need of further research. The term also encompasses species that have a special designation by organizations or land management agencies in Montana, including: Bureau of Land Management; U.S. Forest Service; and U.S. Fish and Wildlife Service. Taxa are evaluated and ranked by the MNHP on the basis of their global (range-wide) status, and their statewide status according to a standardized procedure used by all NHPs. These ranks are used to determine protection and data collection priorities, and are revised as new information becomes available. For each level of distribution, global and state, species are assigned a numeric rank ranging from 1 (critically imperiled, vulnerable to extinction) to 5 (demonstrably secure, though potentially rare in some portions of range). The numeric ranking signifies the species' relative endangerment and is based primarily on the number of occurrences of that species globally or within the state. However, other information such as date of collection, degree of habitat threat, geographic distribution patterns and population size and trends is considered when assigning a rank. The occurrences listed below are suggestions, not absolute criteria (MNHP, 2003). In the Grave Creek Watershed, westslope cutthroat trout is listed as a State of Montana species of special concern with

a Global ranking of G4T3 (apparently secure, subspecific taxon). The westslope cutthroat trout State ranking is S2 (imperiled because of rarity, vulnerable to extinction throughout its range). Bull trout have a Global ranking of G3 (very rare and local throughout range) and a State ranking of S2 (imperiled because of rarity, vulnerable to extinction throughout range) (MNHP, 2003). Bull trout are also federally listed as threatened by the U.S. Fish & Wildlife Service, and were classified as a sensitive species by the U.S. Forest Service prior to the federally threatened designation (MNHP, 2003).

The U.S. Fish and Wildlife Service listed the Columbia River population of bull trout as a threatened species on June 10, 1998 (63 FR 31647), and have subsequently determined that the Kootenai River Recovery Unit forms part of the range within the Columbia River Population segment (USFWS, 2002). The USFWS recovery plan makes the distinction between primary and secondary core bull trout areas based mostly on size, connectedness, and complexity of the watershed and the degree of natural population isolation. The two primary core areas in the Kootenai River Recovery Unit include Lake Kooconusa and the Kootenai River/Kootenay Lake complex that begins downstream of Libby Dam to Kootenay Lake. The two secondary core areas are Bull Lake and Sophie Lake. The recovery plan has set four general recovery criteria.

1. Distribution criteria will be met when the total number of identified local populations (currently number 10 in the United States waters) has been maintained or increased and local populations remain broadly distributed in all four existing core areas.
2. Abundance criteria will be met when the primary Lake Kooconusa and Kootenai River/Kootenay Lake core areas are each documented to host at least five local populations (including British Columbia tributaries) with 100 adults in each and each of these primary core areas contains at least 1000 adult bull trout. The Grave Creek bull trout population counts toward one of the five local populations.

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

1. 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.
2. 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.

Meeting the above fishery goals does not equate to meeting all of Montana State Water Quality Standards. Each individual waterbody and its habitat potential must be evaluated in the context of historical land uses and the application of appropriate management practices for existing land uses.

Four additional threatened wildlife species may occur within Grave Creek drainage (Table D-6). A healthy Grave Creek fishery could have a positive influence on one or more of these species.

**Table D-6: Threatened Wildlife Species Potentially Inhabiting the Grave Creek Drainage.**

Species	Global Ranking	State Ranking	USFWS Designation
Bald Eagle	G4	S3B, S3N	T
Canada Lynx	C5	S3	T
Gray Wolf	G4	S3	T
Grizzly Bear	G4T3T4	S3	T

## D.5 Aquatic Macroinvertebrates

Aquatic macroinvertebrate surveys were completed during early September 2002 and late September 2003 on Grave Creek as part of a monitoring program before and after the demonstration project completed in the fall of 2002 downstream from Vukonich Bridge. Species Richness, Ephemeroptera, Plecoptera, and Tricoptera (EPT) richness, and the Montana Biotic index were computed for the collected samples. Based on standard MDEQ criteria, the results show good macroinvertebrate health in four riffles and one pool prior to restoration and good health in three riffles and one pool after restoration work. One post restoration riffle sample did not obtain an adequate population for analysis, possibly due to difficult sampling conditions (Jim Dunnigan, MFWP, personal communication, 2004). Overall, macroinvertebrate data is lacking throughout the watershed and is identified as a monitoring need in Section 9.0.