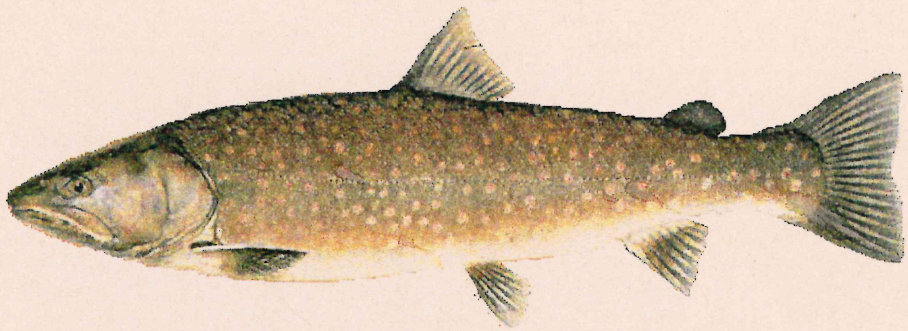
Blackfoot River Restoration Project:
Monitoring and Progress Report
1997-1998



Montana Fish, Wildlife & Parks

Blackfoot River Restoration Project: Monitoring and Progress Report 1997-1998

Ronald W. Pierce and David A. Schmetterling
Montana Fish, Wildlife and Parks
Region 2 Headquarters
3201 Spurgin Road
Missoula, Montana 59804

March 1999

ABSTRACT

Since 1988, the Blackfoot River watershed has been the focus of a basin-wide private lands fishery restoration initiative, dedicated to restoring health of riparian habitats, improving wild trout fisheries and particularly improving the viability of native westslope cutthroat trout (*Oncorhynchus clarki lewisi*) and bull trout (*Salvelinus confluentus*) metapopulations. Cooperators have included private landowners, non-profit groups and federal and state agencies. Restoration efforts have been completed throughout the watershed but primarily on tributaries located on private agricultural lands in the lower to middle reaches of the Blackfoot River basin. Restoration tools include: reconstructing stream channels and restoring habitat features of damaged streams, developing low impact riparian livestock grazing systems and removing streamside feedlots, planting native riparian vegetation, improving stream flows, restoring fish migration corridors and enrolling private landowners in perpetual conservation easement programs.

Extensive fishery inventories and/or fish habitat evaluations have been undertaken prior to and concurrent with restoration. Fishery inventories have been completed on 56 Blackfoot River tributaries, including eight streams sampled between 1997-98 where no fisheries information previously existed. Fishery restoration efforts have been completed, or are in progress on 32 tributary streams; and project monitoring was conducted on 24 streams from 1997 to 1998. In total, these cooperative efforts have influenced approximately 250 miles of tributary streams, and 65 miles of the mainstem Blackfoot River. Fishery monitoring of these efforts shows that abundance of westslope cutthroat trout and bull trout are increasing in several restored streams. River population monitoring also shows stable to upward trending densities of fluvial native fish in the middle and lower reaches of the Blackfoot River.

Table of Contents

EXECUTIVE SUMMARY

Blackfoot River Restoration

The Blackfoot River drainage is the site of a comprehensive fishery restoration project. This project began in 1988 with the initiation of studies to identify reasons for declining fish stocks. The studies identified 1) mining impacts in the headwaters, 2) over-exploitation of fisheries, and 3) degraded tributaries as primary reasons for fishery declines. These studies specifically revealed the decline of native westslope cutthroat trout (*Oncorhynchus clarki lewisi*) and bull trout (*Salvelinus confluentus*). Both these species are listed by Montana Fish, Wildlife and Parks as "species of special concern"; bull trout receive federal protection as a Threatened species under the Endangered Species Act (ESA); westslope cutthroat trout is currently being considered for Threatened status under the ESA.

The distribution of both westslope cutthroat trout and bull trout in the Blackfoot River basin extends from extreme headwaters to large river reaches. The environment under which these fish evolved is varied: streams originate in alpine meadows, flow through subalpine forest and montane woodlands, and finally enter prairie pothole topography before joining the Blackfoot River. These fish evolved with drought, underfit streams and intermittent stream reaches and beaver wetlands. The coevolution of these fish and highly variable physical habitat resulted in complex movement, spawning and rearing behaviors. These native fish further evolved with higher quality habitat, lower sediment levels and cooler stream temperatures than are currently found in many tributaries. Bull trout and westslope cutthroat trout reproduce higher in the tributaries and rear for a longer period in tributaries before migrating to the mainstem environment than introduced rainbow (*O. mykiss*) or brown trout (*Salmo trutta*). While native salmonid migratory behavior and tributary use may insulate early life-stages from environmental extremes in the mainstem system, this life history strategy may increase their vulnerability to anthropogenic alteration of the tributaries.

While some riparian area degradation has occurred in middle reaches of the Blackfoot River, tributary degradation has been extensive at the low to mid elevations of the watershed. These deleterious alterations include habitat degradation, restricted fish passage and fish losses to irrigation canals. This degradation is being addressed throughout the watershed though individual landowner efforts in cooperation with resource agencies and private conservation groups.

In 1990, we began a basin-wide fishery restoration and resource conservation effort that focused on addressing obvious impacts to fisheries. These projects have included removing barriers to fish migration, restoring and enhancing damaged trout habitat, restoring drained wetlands, improving flows in seasonally dewatered streams, protecting critical spawning habitat, improving riparian livestock management in riparian areas, removing streamside feedlots and developing areas for off-stream livestock watering and enrolling landowners in perpetual conservation easements.

Concurrent with restoration have been continuous research and monitoring efforts related to the fishery recovery program. Special studies undertaken in 1997 and 1998 include whirling disease investigations, *Tubifex tubifex* distribution studies, fishery investigations at Milltown Dam, riparian health evaluations and radio telemetry studies focusing on the movements and habitat use of fluvial bull and westslope cutthroat trout. Fish population, aquatic habitat and temperature monitoring occur on all major stream restoration projects.

In 1998, fish population surveys continued at two long-term Blackfoot River mainstem-monitoring locations (Johnsrud and Scotty Brown Bridge sections). At the Johnsrud section, total trout densities (≥ 6.0 inches) increased 102 % between 1996 and 1998. The Scotty Brown Bridge section recorded a 16% increase for fish ≥ 6.0 inches from 1996 to 1998. The composition of the Blackfoot River fishery is beginning to support a better representation of native salmonids in both mainstem-sampling locations. In 1998, native fish (≥ 6.0 inches) comprised 14% of the fishery at the Johnsrud section, compared to 2% in 1989. In the Scotty Brown Bridge section, native fish (≥ 6.0 inches) comprised 39% of the fishery compared to 9 % in 1989.

Blackfoot River population surveys show substantial increases in the densities of fluvial westslope cutthroat trout in both survey sections. Westslope cutthroat trout densities (fish ≥ 6.0 inches) increased from 1.7 to 12.2 fish/1,000' in the Johnsrud Section and from 2.9 to 21.9 fish/1,000' in the Scotty Brown Bridge section between 1989 and 1998. Monitoring of tributary projects have recorded westslope cutthroat trout increases in segments of several tributaries including Gold Creek, Chamberlain Creek, Dunham Creek, Cottonwood Creek, Monture Creek and the North Fork Blackfoot River.

Fluvial bull trout populations, although low, appear stable in the lower river and are increasing in the middle reaches of the Blackfoot River. In 1998, bull trout densities (fish ≥ 6.0 inches) were estimated at 2.4 fish/1,000' at the Johnsrud Section and 3.5 fish/1,000' in the Scotty Brown Bridge Section of the Blackfoot River. Tributaries showing increased bull trout densities include Gold Creek, Monture Creek, Dunham Creek, the North Fork Blackfoot River. Juvenile bull trout appear to be expanding into several restoration streams; these include Rock Creek, Chamberlain Creek, Spring Creek (North Fork tributary) and East Twin Creek.

Rainbow trout inhabit approximately 8% of the Blackfoot watershed, occupying the lower Blackfoot River and reproducing in lower reaches of tributaries; however, significant numbers of juvenile rainbow trout rear in the river. Severe winter conditions have periodically caused high mortality of juvenile Blackfoot River rainbow trout. Following a major ice jam in 1996, major declines in the juvenile rainbow trout fishery were recorded although densities in the lower river have improved significantly since 1996. While improved flow conditions have helped increase densities of juvenile rainbow trout, a history of harsh environmental conditions reveal that favorable flow conditions rarely persist. Numbers of larger Blackfoot River rainbow trout are currently at low numbers. This may be due to a number of factors including 1) high mortality of young fish resulting from effects of the 1996 ice jam, 2) the presence of whirling disease in the middle reaches of the river, and 3) possible movement of fish over Milltown Dam.

Densities of juvenile brown trout tend to fluctuate in response to environmental extremes such as severe winter conditions in the Blackfoot River. Densities of brown trout ≥6.0 inches are stable to increasing, and range from 12.1 fish/1,000' in the lower river to 13.7 fish/ 1,000' in the Scotty Brown Bridge section.

Stream temperature and fish habitat studies have been completed in the watershed. In 1997 and 1998, temperature studies were completed in 21 tributaries and 5 long-term mainstem monitoring sites. These studies indicate several streams including West Twin Creek, East Twin Creek, Bear Creek, Shanley Creek, McCabe Creek maintain temperatures cool enough to support some form of bull trout use. Mainstem Blackfoot River temperatures almost annually exceed known preferred temperature ranges for bull trout in lower river reaches and between the North Fork and Nevada Creek. Stream habitat inventories were completed in 1998 at five project tributaries.

Fishery restoration efforts have been completed, or are progressing in 32 streams. To date, seasonal fish migration barriers at road crossing have modified or removed on 15 tributaries. Thirteen tributaries have received habitat restoration work. Riparian livestock management improvements have been made on 21 streams. Fish friendly irrigation techniques including fish ladders, fish screens, water leasing and other water conservation efforts have been employed on 17 streams. In total, over 300 miles of stream have been influenced by restoration efforts. In addition, one thousand-six hundred surface acres of drained wetlands have been restored or enhanced. Three thousand acres of native prairie have been restored, and three thousand acres of cropland have been restored to native prairie. Twenty five thousand acres of native prairie have been enhanced through grazing management systems. Perpetual conservation easements have been secured on approximately 85 square miles of fish and wildlife habitat of private land.

Despite significant conservation measures, the majority of anthropogenic impacts have been addressed on only 12 of 31 current restoration tributaries. Streams where restoration activities are largely completed include Johnson Creek, East Twin Creek, Bear Creek, Gold Creek, Blanchard Creek, Cottonwood Creek, Chamberlain Creek, Basin Creek, Pearson Creek, Monture Creek, and the North Fork Blackfoot River, Salmon Creek and Grentier Spring Creek. While projects have been completed on these streams, most of these stream are in various levels of riparian and fishery recovery. Future fisheries conservation will rely on rest and continued future land and water management practices sensitive to the needs of fish, including the expanded use of best-management-practices (BMP's) on private agricultural and forest lands.

INTRODUCTION

In 1988, concern over declining fish stocks in the Blackfoot River prompted basin-wide evaluations of fish populations and their habitats. Fishery evaluations reported declines throughout Blackfoot River and the lower reaches of its tributary system. These studies specifically revealed the decline of native westslope cutthroat trout (*Oncorhynchus clarki lewisi*) and bull trout (*Salvelinus confluentus*). Landscape level impacts to the fishery include: poor water quality, altered stream channels and contaminated sediments related to past mining activities; riparian degradation related to past riparian grazing practices; irrigation related impacts including reduced instream flows, poor upstream fish passage and entrainment of out-migrant fish to irrigation ditches; poor riparian timber harvest practices; and over-exploitation of the fishery. While much of the damage occurs on private lands, public lands also feature similar degradation and related fishery declines.

While upper elevations are dominated by native fish, low numbers of juvenile and adult native fish species in the mid to lower elevations of the watershed indicated recruitment sensitive populations. Fishery investigations, including the use of radio telemetry, have shown that fluvial native fish require large, interconnected systems and have specific habitat requirements over a large spatial scale for the completion of their life histories. Swanberg (1997b) found that fluvial bull trout migrate extensively to reach spawning areas. Similarly, Schmetterling (In prep) found that fluvial westslope cutthroat trout migrated over 60 miles to first and second order tributaries for spawning.

Problems in some tributaries are extensive, span multiple land ownerships and have resulted in significant fishery declines. Because of their long migrations and more extensive use of tributaries at early life stages, fluvial native fish are more subject to tributary impacts than non-native fluvial fish that seasonally inhabit the lower reaches of tributaries. Native fish populations have the potential for significant increases with tributary restoration because they are adapted to the severe environment of the Blackfoot River.

In 1990, efforts shifted from fishery and habitat inventories to restoration and project monitoring. Fishery restoration has expanded from working on individual projects to a basin-wide approach, working with multiple landowners. Since then, the restoration program has expanded beyond fishery specific issues to a broad level of landscape protection relying on expertise of several agencies and conservation groups in cooperation with private landowners. In 1992, the Blackfoot River fishery restoration effort enlisted the U. S. Fish and Wildlife Service (FWS), Partners for Fish and Wildlife Program (Partners, hereafter). The Partners initial focus was upland and wetland restoration, and a conservation easement program for wetland protection and waterfowl production. This program has since expanded to play an essential role in riparian restoration and native fish recovery efforts. Our successes have led other agencies to consider wildlife issues when designing irrigation systems. For example, the Natural Resource Conservation Service (NRCS), an agency cooperator in the Nevada Creek watershed is beginning to address fishery impacts in the design of irrigation systems.

Fishery restoration tools include significant upland and riparian and water management changes. As of 1998, fishery restoration projects were completed, or are progressing, in 32 tributary streams. Restoration tools include: reconstructing stream channels and restoring habitat features to damaged streams, developing low impact riparian livestock grazing systems and removing streamside feedlots, planting riparian vegetation, improving stream flows, restoring fish migration corridors and enrolling private landowners in conservation easement programs.

Fishery recovery efforts have led to improvements in tributary and mainstem native fish populations. Recent tributary monitoring has recorded a broad level of native fish improvement, with density or composition of native fish improving in several restored streams. Monitoring of Blackfoot River fisheries is showing substantial improvement in the densities of fluvial westslope cutthroat trout in the Johnsrud and Scotty Brown Bridge monitoring sections. Bull trout densities, although low, appear stable in the lower river and are improving in the middle reaches of the river and in three important spawning tributaries.

While broad fishery improvements have been made over the last decade, human-related impacts at landscape level continue to challenge the restoration and conservation of native fishes. Potential impacts include, mining activities, the extensive degradation of riparian areas in Nevada Creek and adjacent areas, the loss of Blackfoot River fish over Milltown dam, illegal fish introductions, exotic fish species in the basin, whirling disease, and recreational impacts to the fishery.

Blackfoot River watershed restoration projects have relied on support from state and federal agencies, conservation groups and private individuals. Agency cooperators in these restoration efforts include Montana Fish, Wildlife and Parks (FWP), U. S. Fish and Wildlife Service, Partners for Fish and Wildlife (FWS), Bureau of Land

Management (BLM), Forest Service (FS), Environmental Protection Agency (EPA), Montana Department of Environmental Quality (Water Quality Division) (DEQ), Department of Natural Resource Conservation (DNRC), Montana Department of Transportation (MDT), and the North Powell Conservation District. Conservation groups cooperating with the efforts are the Big Blackfoot Chapter of Trout Unlimited (BBCTU), National Fish and Wildlife Foundation (NFWF), Ducks Unlimited (DU), Sundance Foundation, Chutney Foundation and Orvis Company. Throughout this report, these entities will be referred to by their acronyms. Private entities involved in the restoration project include Plum Creek Timber Company (PC), Montana Power Company (MPC) and above all the many families from the ranching communities in the Nevada and Ovando valleys.

The objective of this report is to summarize the work completed between 1997 and 1998 with regard to: 1) native fish status and recent native fish recovery efforts; 2) habitat monitoring and fish habitat surveys; 3) restoration techniques used in project tributaries and fish population monitoring results for those streams; 4) identify potential fishery restoration projects for the future; and 5) outline additional studies within the watershed that relate to the Blackfoot River Restoration effort.

Study Area

The Blackfoot River, located in west-central Montana (Figure 1), flows 132 miles in a westerly direction from its source near the Continental Divide to be confluence with the Clark Fork River at Bonner, Montana. The Blackfoot River is a free flowing river to its confluence with the Clark Fork River where a hydroelectric dam has blocked upstream fish passage since its construction in 1907.

The Blackfoot River drains 2,400 square miles through a 3,700 mile stream network of which 1,900 miles are perennial streams capable of supporting fisheries. The geology of the basin is generally Precambrian Belt rock series, with localized igneous intrusions and mineralization occurring in the Garnet Mountains located along the southern portion of the watershed. The surface geology of the watershed, in general, consists of erosive glacial landforms in the central and northern portion.

Land ownership in the Blackfoot watershed is 44% National Forest, 5% BLM, 7% State of Montana, 20% Plum Creek Timber Company and 24% other private ownership. In general, public lands and significant portions of Plum Creek Timber Company properties comprise the forested mountainous areas while private lands are located in the foothills and lower valley areas.

Fish populations in the Blackfoot watershed vary greatly in term of species composition and density (Figure 2). The differing fisheries are products of habitat characteristics, recruitment sources and human influences. Westslope cutthroat trout are distributed throughout the watershed and is the most abundant trout in the upper reach of the Blackfoot River and the upper reaches of most tributary streams. Bull trout occur from the mainstem Blackfoot River to extreme headwaters of larger tributaries. Bull trout are found in larger tributaries draining mountains north of the Blackfoot River, although juvenile bull trout have been captured in several smaller tributaries they are used for rearing. Rainbow trout (*O. mykiss*) distribution is limited to the lower Blackfoot River and lower reaches of the tributaries to the lower river; this species occupies approximately 8% of the perennial streams in the Blackfoot watershed. Brown trout (*Salmo trutta*) inhabit approximately 15% of the perennial streams in Blackfoot watershed; their distribution ranges from the river into the agricultural bottomlands and foothills of watershed. Although brook trout (*Salvelinus fontinalis*) are widely distributed in the watershed, (recorded in 39 of 56 tributaries sampled since 1989), they are rarely sampled in the mainstem Blackfoot River.

Bull Trout Status

On June 5, 1998, the U.S. Fish and Wildlife Service listed bull trout populations within the Columbia River drainage as Threatened under the Endangered Species Act. Currently, a Blackfoot River bull trout restoration plan is being developed by the Montana Bull Trout Restoration Team under the general guidance of the Governor's Bull Trout Round Table. The primary goals are to restore metapopulations, conserve genetic diversity, restore and maintain connectivity within and between all restoration/conservation areas.

Figure 1. Studa area, Blackfoot River watershed.

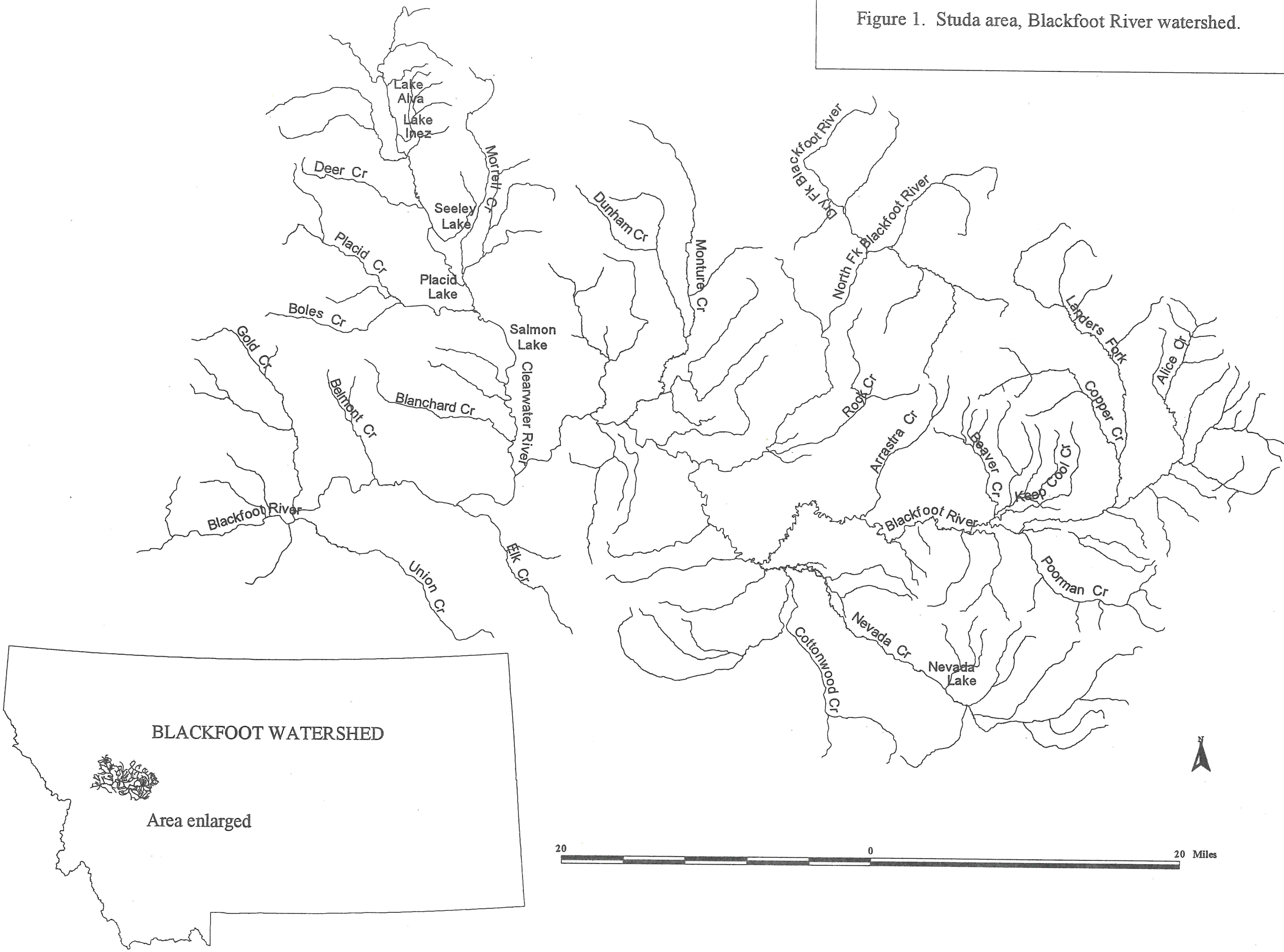
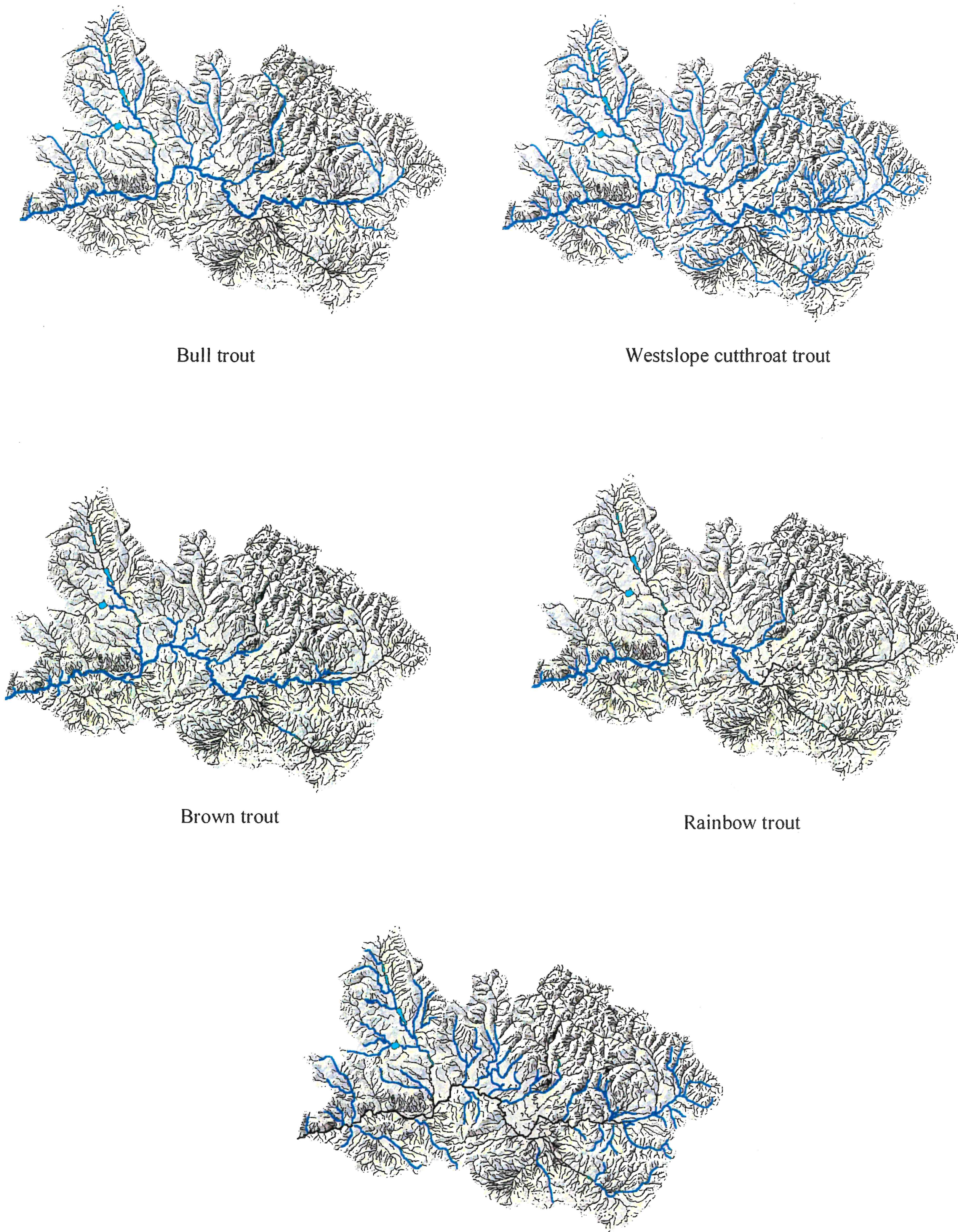


Figure 2. Trout distribution in the Blackfoot River watershed.



Bull trout

Westslope cutthroat trout

Brown trout

Rainbow trout

Brook trout

The Blackfoot River supports one of the better populations of fluvial bull trout within the range of the species (Peters 1985). Nevertheless, fishery investigations in the mid- to late 1980's indicated declining populations. Excluding the Clearwater River, fluvial bull trout currently inhabit 14 sub-watersheds in the Blackfoot Basin, and based on historical records, are extirpated from 10 drainages or approximately 110 miles of stream. Fluvial bull trout currently occupy approximately 430 river miles in the drainage, including 120 miles of mainstem river and 310 miles of tributaries. Spawning occurs in groundwater upwelling areas that represent approximately 24 of these 310 stream miles (Pierce et al. 1997).

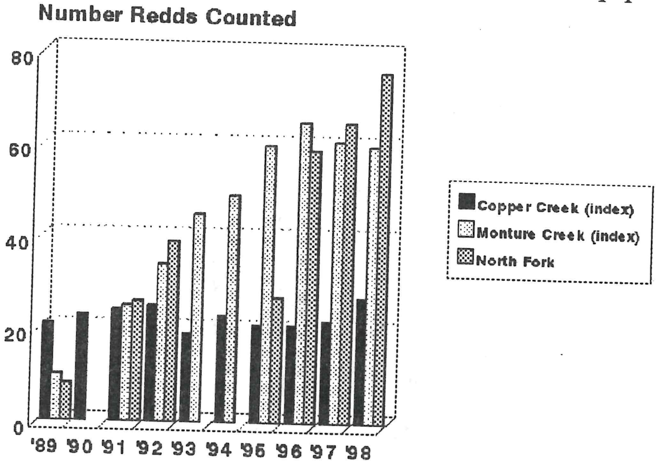


Figure 3. Bull trout redd counts for Copper Creek, Monture Creek and the North Fork Blackfoot River, 1989-1998.

In 1989, only three of 19 sampled tributaries had densities of bull trout YOY greater than one fish/100' (Peters 1990). The North Fork Blackfoot River, Monture Creek and Copper Creek contained the three largest populations of juvenile bull trout in the Blackfoot Basin. Seven watersheds to the Blackfoot River have been identified as "core" areas for the recovery of fluvial bull trout by the Montana Bull trout Scientific Group (1995). The core areas are Belmont Creek, Cottonwood, Copper, Gold and Monture Creeks, and the Landers Fork and North Fork of the Blackfoot River.

Beginning in 1990, ten of 14 streams with fluvial bull trout have received special land, water and fish management considerations. Efforts to recover bull trout have occurred in five of seven "core" area drainages, as well as several streams historically supporting bull trout. Protection and restoration of tributary habitat, restrictive angling regulations and recovery from drought conditions have increased the number of spawning bull trout in two of these streams.

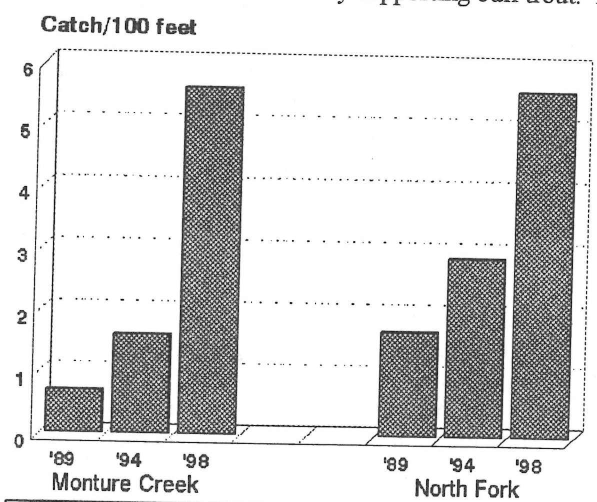


Figure 4. Total CPUE for all juvenile bull trout samples in Monture Creek and the North Fork, 19989, 1994 and 1998.

Over the ten-year period from 1989 to 1998, redd counts have increased from 10 to 61 in the index reach Monture Creek and from 7 to 76 in the North Fork Blackfoot River. While redd counts have increased in the two primary lower river spawning streams, redd counts in Copper Creek, the primary spawning stream in the upper river remained stable. (Figure 3).

In 1989, juvenile bull trout sampling sites were established in both Monture Creek and the North Fork Blackfoot River. Combining all sampling locations on Monture Creek, CPUE for juvenile bull trout was recorded at 0.7 in 1989, 1.6 in 1994, and 5.6/100' of stream in 1998. Combining all sampling locations for the North Fork Blackfoot River, CPUE was recorded at 1.7 in 1989, 2.9 in 1994, and 5.6 /100' of shoreline in 1998 (Figure 4). Likewise Dunham Creek, a tributary to Monture Creek is showing higher densities of juvenile bull trout in response to an irrigation ditch-screening project. Bull trout (>4.0 inches) densities in lower Dunham Creek have increased from 1.3 to 12.2 fish/100' of stream between 1996 and 1998.

Some juvenile bull trout seem to be dispersing into several restoration streams that historically supported bull trout. These streams include Rock Creek, Chamberlain Creek and East Twin Creek, as well as Spring Creek (tributary to the North Fork) although upstream movement above mile 0.5 is currently blocked by a culvert barrier.

Long-term monitoring of bull trout populations in the Blackfoot River indicate low numbers but a stable population in the lower Blackfoot River (Johnsrud Section); however, numbers are upward trending in both the middle section (Scotty Brown Bridge Section) of the Blackfoot River, and in the lower North Fork of the Blackfoot River (Harry Morgan Section). From 1996 to 1998, all three of these long-term monitoring sections recorded increased bull trout densities. For the Johnsrud Section of the Blackfoot River, bull trout (≥6.0") increased from 0.8 fish/1,000' to 2.4 fish/1,000' between 1996 and 1998. Likewise, bull Trout (≥6.0 inches) in the Scotty Brown Bridge section increased from 2.6 to 3.5 fish/1,000' (Figure 5) and bull trout (fish ≥12.0") in the Harry Morgan section of the North Fork Blackfoot River increased from 1.6 to 3.8 between 1996 and 1998.

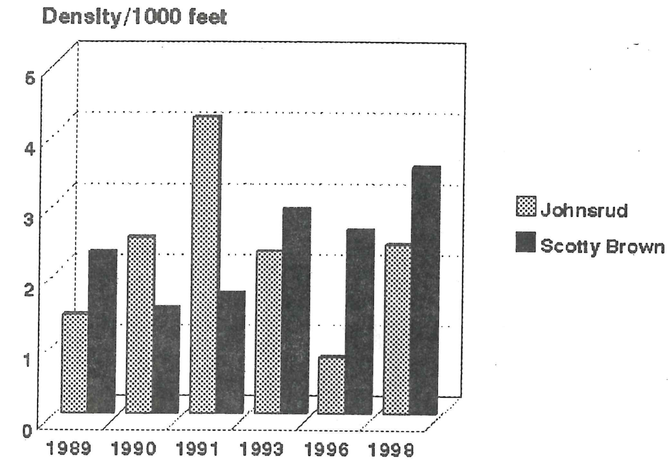


Figure 5. Estimate bull trout densities (fish≥6.0") in two sections in two sections of the Blackfoot River, 1989-1998

In 1998, a total of 225 bull trout redds were counted in 7 streams. Of this total, 187 (83%) was recorded in three streams: Monture Creek recorded 67 redds (30%); the North Fork Blackfoot River count was 76 redds (34%); and Copper Creek had 44 redds (20%). While bull trout populations are stable to increasing in these three spawning streams, populations have been lost or remain small in several tributaries. Other streams where bull trout redd counts were undertaken in 1998 include Belmont Creek (14 redds), Gold Creek (12 redds), West Fork of Gold Creek (4 redds) and Dunham Creek (8 redds). Bull trout hybridization with brook trout has been identified in at least three spawning tributaries including Gold Creek, Cottonwood Creek and Poorman Creek.

Life History characteristics

There are three bull trout life histories in the Blackfoot River watershed, resident, fluvial and adfluvial. Bull trout in the Blackfoot River are fluvial, meaning adult fish inhabit the mainstem but migrate to tributary stream for spawning. Juvenile fish generally remain in tributaries from one to four years before migrating to the mainstem of the river to mature. Fluvial bull trout currently inhabit 430 miles of water or 23% of the drainage. Adfluvial bull trout (fish that spawn and rear in tributaries and mature in lakes) occur in the Clearwater River drainage and the Cooper Lake drainage. Resident bull trout remain in tributaries in the Blackfoot River drainage for their entire life.

Telemetry studies indicate that adult bull trout from the lower portion of the drainage do not migrate to the upper portion (upstream of the North Fork), suggesting at least partial separation of the population into an upper and lower component. In addition, there are several differences between upper and lower Blackfoot River bull trout (Swanberg and Burns 1997).

In the lower Blackfoot River, adult bull trout begin upstream spawning migrations on the descending limb of the hydrograph. Spawning fish enter tributaries in June and July (Swanberg 1997b). Migrations begin in early summer when flows are high allowing bull trout to navigate through obstructions, such as beaver dams and intermittent streams which occur throughout the Blackfoot River watershed, and into upstream perennial spawning areas. Bull trout in the upper Blackfoot River begin their upstream migration in late July, later than bull trout in the lower Blackfoot River. Upper Blackfoot River fish migrate a shorter distance (Swanberg and Burns, 1997). Both groups of fish used the spawning tributaries for approximately the same length of time. During these telemetry studies, both groups of fish migrated through naturally intermittent stream reaches.

Non-spawning adult bull trout in the lower Blackfoot River will also migrate to tributary streams in the summer. These fish enter the tributaries in mid-July, later than the spawning fish, and remain in the lower portion of the tributaries. They do not approach the spawning areas of the tributaries. This behavior may have evolved to avoid seasonally warm conditions in the Blackfoot River. Soon after spawning, most Blackfoot River bull trout move down river and return to the same location they occupied in the spring. However, after spawning, several large bull trout have been recorded moving over Milltown Dam, which does not provide for upstream fish passage. Additionally, telemetry and monitoring projects have found adult and juvenile bull trout entrained in irrigation ditches.

Bull trout eggs incubate in the stream gravel over the winter and fry emerge in spring. Emergence in Montana generally occurs from March to May (Shepard et al. 1984). In some situations, juvenile bull trout seem to disperse from spawning tributaries into non-spawning tributaries. For example, bull trout spawn in the North Fork of the Blackfoot River in the area of river mile (RM) 25.0. At RM 8.0 there is a small tributary to the North Fork of the Blackfoot River, that has a small population of young-of-the-year (YOY) bull trout in lower reaches. It appears that the YOY fish are migrating downstream from the spawning area and upstream into the tributary. Other tributaries where juvenile bull trout are present, but do not support known bull trout spawning include Bear, Chamberlain, Rock, Spring (North Fork tributary) East and West Twin Creeks.

Westslope Cutthroat Trout Status

Within the last 100 years westslope cutthroat trout have declined throughout much of their historic range. Liknes (1984) and Shepard et al. (1997) estimated that westslope cutthroat trout currently inhabit only about 20% of their former range in Montana, and genetically pure populations are found in less than 10% of their current range (Liknes and Graham 1988, Shepard et al. 1997). Reasons for the decline of this subspecies of cutthroat trout include habitat loss and degradation, genetic introgression with introduced rainbow trout and Yellowstone cutthroat trout (*O. clarki bouvieri*), overharvest as well as competition (interference and exploitive) from exotics such as brook trout and brown trout (Liknes 1983, Allendorf and Leary 1988, Liknes and Graham 1988, McIntyre and Rieman 1995). This decline lead to their status as a "species of special concern" in Montana and, currently, the FWS is reviewing a petition to list this fish as a Threatened species under the Endangered Species Act.

Today westslope cutthroat trout are the dominant species in most headwater areas of tributaries to the Blackfoot River. Of 56 tributaries samples since 1989, 48 recorded the presence of westslope cutthroat trout. Westslope cutthroat trout typically decline in abundance in lower reaches of tributaries and are replaced by non-native rainbow and brown trout. In many streams this segregation appears to be controlled by longitudinal differences in the stream environment that are both natural and human-caused. Habitat degradation, species selective fishing pressure, migration barriers and losses of fish to irrigation ditches, perhaps more than interaction between species may have played the most significant role in creating this distribution (Peters 1990).

Significant restoration activity has been directed toward the recovery of westslope cutthroat trout. Current recovery goals for westslope cutthroat trout in the Blackfoot Watershed focus on reestablishing the fluvial life-history form by: 1) reducing or eliminating "controllable" sources of mortality; 2) maintaining or restoring existing spawning and rearing habitats; 3) restoring damaged habitats; and 4) reestablishing connectivity from the Blackfoot River to spawning tributaries.

Westslope cutthroat trout are dependent on high quality tributary habitat for spawning, rearing and overwintering. Free access from large river systems to headwater streams is also necessary for the fluvial life-history form. Restoration projects targeting these features have been completed on 24 tributaries. Restrictive fish regulations and natural habitat restoration in the Blackfoot have clearly resulted in increased numbers of large fluvial cutthroat trout in both long-term mainstem Blackfoot River monitoring sections, as well as several tributaries where restoration activities have occurred.

Population densities of westslope cutthroat trout (fish ≥6.0") are trending upwards at both the Johnsrud and Scotty Brown Bridge monitoring sections (Figure 6). Between 1996 and 1998, estimated densities of westslope cutthroat trout (fish ≥ 6.0") have increased from 3.7 to 12.2 fish/1,000' and from 12.6 to 21.9 fish/1,000' in the Johnsrud and Scotty Brown Bridge Sections, respectively. The majority of fish in the 1998 samples were sub-adults, age 2, 3 and 4, indicating increased recruitment from tributaries.

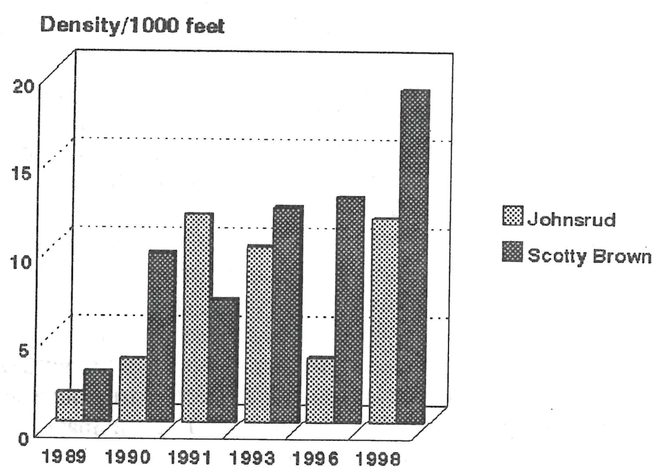


Figure 6. Estimated cutthroat trout (fish ≥6.0") densities for two sections of the Blackfoot River, 1989-1998.

Westslope cutthroat trout densities are increasing in portions of several tributaries, including the North Fork Blackfoot River, Chamberlain Creek, Dunham Creek, Gold Creek and Cottonwood Creek.

Life history characteristics

Westslope cutthroat trout have two distinct life history forms, migratory and non-migratory (residents). Migratory forms can be further broken down into fluvial and adfluvial forms (Liknes and Graham 1988, Behnke 1992). Although all these life-history forms historically occurred in their native range, migratory forms are becoming more rare than resident forms because of habitat degradation and fragmentation caused by migration barriers such as dams and irrigation diversions (McIntyre and Reiman 1995).

Fluvial westslope cutthroat trout migrate to their natal stream to spawn during peak river discharges in March through July as water temperatures approach 10°C (Liknes 1984; Shepard et al. 1984; Behnke 1992; Schmetterling, In prep). These migrations may exceed 60 miles in the Blackfoot River drainage (Schmetterling, In prep) while migrations exceeding 100 miles have been reported in other systems (Bjornn and Mallet 1964, Bjornn 1971, Shepard et al. 1984). During this spawning migration, flows in most tributaries are high and turbid and detection and quantification of their spawning ecology has been largely unsuccessful in the past. By migrating at high flows, fluvial westslope cutthroat trout are able to ascend intermittent stream reaches and other seasonal migratory barriers such as beaver dams.

Soon after spawning, adults will return to the mainstem, but not necessarily to their pre-spawning location (Schmetterling, In prep). The number of repeat spawners in a population varies but it is usually less than 25% (Behnke 1992, Shepard et al. 1984) and studies in the Blackfoot River have shown similar results (Schmetterling, In prep).

Juvenile fish will rear in tributaries for up to 3 years before migrating to the Blackfoot River to mature. In other systems, the out-migrations occur bimodal in the spring during high discharge and in the fall. Although males will mature as early as age 2 and females age 3, the majority of fluvial fish in the Blackfoot River spawn for the fist time between ages 4 and 5. Post-spawning mortality is often high (Schmetterling, In prep).

METHODS

Working with Private Landowners

Restoration efforts in the Blackfoot River watershed focus on degraded tributaries by improving riparian areas, stream connectivity and fish habitat. All projects are "cooperative solutions" between private landowners and the restoration team, and occur throughout the drainage. Restoration has focused on addressing obvious fishery impacts such as migration barriers, stream dewatering, fish losses to irrigation canals and degraded riparian areas. Addressing the source of stream degradation usually requires developing riparian/upland management options sensitive to the requirements of fish and current land uses. Within each tributary drainage, multiple landowners, disciplines and resource recovery programs contribute to the overall restoration effort. All projects incorporate the needs of the private landowners, are voluntary and are administered at the local level by a core group of agency resource specialists in cooperation with local watershed groups including the Big Blackfoot Chapter of Trout Unlimited and the North Powell Conservation District.

To begin a project, landowners are usually contacted by a fisheries and/or wildlife biologist on an informal, one-on-one basis. Landowner awareness of the habitat requirements of fish and their full participation in projects are considered crucial to the long-tern success of restoration efforts. Although many projects that repair damaged habitats have been completed in the Blackfoot River drainage, the effort is still aimed at educating landowners and is far from complete. Cost sharing for projects is arranged by project personnel. Written agreements with landowners to maintain projects are arranged with cooperators on each project and the administration of projects usually occurs through field personnel, as well as through agency programs, the North Powell Conservation District or the Fisheries and Habitat Committee of the Big Blackfoot Chapter of Trout Unlimited. Landowners are encouraged to participate in all phases of the project from problem identification to the collection of data and recovery efforts.

This cooperative effort includes contributions from range conservationists, biologists, hydrologists, engineers, water rights specialists and landowners in the design, supervision and implementation of projects. Funding comes from several sources: landowner contributions, private donations, foundation grants, state and federal agencies.

Fish Population Monitoring

Generally, fish were captured with a boat or backpack mounted electroshocker. In small streams, we used a gas-powered backpack mounted DC electro-fishing unit (Coffelt Mark 10). The anode was a hand-held, 1-foot-diameter hoop; the cathode, braided steel wire. On the North Fork of the Blackfoot River, we used an aluminum drift boat. On the Johnsrud and Scotty Brown Bridge sections of the Blackfoot River, we used an aluminum river jet boat or drift boat. A Coffelt Model VVP-15 rectifier and 5,000 watt generator were used in both boats. The hulls of both boats were used as cathodes and two booms, each with four cable droppers, served as anodes. We used direct DC current forms with output of less than 1000 watts, which is an established method to significantly reduce spinal injuries in fish associated with electrofishing. Young-of-the-year (YOY) trout were sampled in the tributaries from August to November in each year. Extra effort was used to sample stream edges and around cover to enable comparisons of densities between sampling sections. Captured fish were anaesthetized with methanesulfonate (MS-222), weighed (g) and measured (mm) for total length (TL). For this report, we converted all lengths to standard units.

Population densities were calculated using single-pass, mark-recapture, or multiple-pass-depletion methods. Generally, we used mark-recapture in rivers and depletion estimates in small streams. The single pass catch-per-unit-effort (CPUE) or "catch-rate" statistic was calculated for all electrofishing sample locations. This method calculates number of fish collected in a single electro fishing pass (or the first pass if multiple passes were made) and is adjusted either per 100' of stream, or per 100' of shoreline in the case of the North Fork Blackfoot River. Species compositions at long-term monitoring sections on Blackfoot River (Johnsrud, Scotty Brown Bridge) and North Fork (Harry Morgan) were determined from density estimates of fish ≥6.0" TL. Population densities using the mark-recapture method were estimated using Chapman's modification of the Petersen formula (Ricker 1975); confidence intervals were calculated with the Seber Formula. Population densities using the multiple-pass-depletion method were calculated using maximum likelihood estimators.

Fish trapping at Milltown Dam

In order to determine the timing and number of fish migrating to Milltown Dam we used a device already fitted on the dam as a fish trap over an eight-month period in 1998. Fish were lured into the radial gate raceway located at the tailspill of the radial gate on the downstream side of Milltown Dam with an attractant flow (Schmetterling and McEvoy, In review). The radial gate was opened for a 24-hour period prior to being checked from one to three times per week.

The radial gate rotates upward on a pivot drawing water from the bottom of the gate. During our study, the radial gate was opened 4-8", allowing an attractant flow to be approximately 50 cfs with velocities ranging from 2-4 ft/s. Maximum depth of the radial gate raceway was 2' at the end closet to the radial gate, becoming shallower downstream. Once fish were in the radial gate raceway, the radial gate was closed, trapping the fish. Immediately following the radial gate closure we collected fish to avoid escapement. Trapped fish were captured with a seine net, dip net or a backpack mounted electrofishing unit.

Bull Trout Redd Surveys

Bull trout redds were annually surveyed in Monture Creek and nearly annually in the North Fork of Blackfoot River from 1989 to 1998. Both Monture Creek and the North Fork Blackfoot River are essential restoration streams due to their native fish values. Counts were made by walking the stream bank of indexed spawning areas in late September of each year. Redd areas were identified by the "cleaned", oval shape (pit), and a mound of unconsolidated gravel (tailspill) left by the female bull trout's digging activities (Burner 1951). Only redds where a definite pit and tailspill were discernable were counted.

Telemetry

The movements and habitats used by fluvial bull and westslope cutthroat trout in the Blackfoot River was studied from 1994 to 1998 (Swanberg 1997ab, Schmetterling, In-prep). Some results from this study are presented in this report as they apply to restoration efforts. A detailed description of the methods used in this project is presented in Swanberg (1997b) and Schmetterling (In prep). Briefly, native fish were captured and implanted with transmitters in the Blackfoot River (for surgical techniques see Swanberg et al. 1999). Fish were contacted during migrations at least three times per week and less frequently at other times of year. Fish locations were maintained in a database and in GIS layers for analysis.

Between 1997 and 1998, approximately 40 fluvial westslope cutthroat trout and rainbow×cutthroat trout hybrids were captured and implanted with radio transmitters. The goal of this project was to determine timing of the seasonal movements, identify critical habitat, and gain a better understanding of their spawning ecology. The results of this project are currently in preparation (Schmetterling, In press, Schmetterling, In prep).

Whirling Disease Investigations

Whirling disease investigation relied on two methods: the histological examination of wild fish collected in Blackfoot River watershed and the histological examination of hatchery fish placed in sentinel cages. Compared to wild fish collections, the sentinel cage/hatchery fish method is a controlled and more reliable method of determining the infection severity, which can be correlated to fish mortality rates.

In fall of 1997, the first phase of the study included a basin-wide collection of wild fish, using electrofishing techniques. Wild fish were collected at 28 locations in the watershed, including 17 tributaries, plus 4 locations on the mainstem Blackfoot River. Fish were frozen and shipped to the Washington Animal Disease Diagnostic Laboratory in Pullman, Washington where a histological examination was used to determine infection rates. The phase-one objective was to identify the general distribution of the disease and broad level of infection within the watershed.

The phase-two sentinel cage study in 1998, relied on the histological examination of hatchery fish placed in sentinel cages in tributaries to, and in the mainstem of the Blackfoot River. Locations were selected based on phase-one study results. Twelve cages were placed in the Blackfoot watershed in summer 1998; six cages were placed tributaries, and six in the mainstem Blackfoot River. Timing of the study was based on mean daily temperature in the 50's, which correlates with TAM production and peak infections in fish. Fish were placed in the cages and exposed for ten days, moved to a lab for 60 days, sacrificed and shipped to the Washington Animal Disease Diagnostic Lab. The lab performed a histological examination was used to determine actual infection levels. At the time of the printing of this report, lab results have not been received for the phase two efforts.

Temperature

In 1997 and 1998, summertime water temperatures (° F) were recorded at 48-minute intervals using temperature data loggers (Hobos, Stowaway™, Onset Corp.) in 21 tributaries and 5 long-term mainstem monitoring sites. In 1997, temperatures were recorded at 18 locations, including 11 tributaries and two long-term monitoring stations on the Blackfoot River. In 1998, temperatures were recorded at 21 locations, including 14 tributaries and 5 Blackfoot River locations, four of which are long-term mainstem monitoring stations. Data for each station is provided is summarized with monthly mean, maximum, minimum and standard deviation (Appendix Exhibit E,F).

Channel Morphometrics

Where habitat restoration involves stream channel reconstruction, our techniques have evolved from relying largely on reference reaches to the techniques described by Rosgen (1996). The Rosgen classification of stream types, valley types combined with the techniques of determining channel geometry are generally accepted as the basis for defining morphologically stable streams. We have modified the Rosgen methods including the addition of essential habitat features to the channel and material native to the individual stream reach. Habitat restoration usually included creating habitat complexity keyed to the naturally occurring drainage features, creating secondary habitats along stream banks such as back-water areas or cut-off meanders, adding spawning gravel to riffles in spring creeks, securing wood in the channel, and placing mature native shrubs, sod mats and planting nursery stock along habitat units to provide shade and cover for fish. Pre- and post-treatment photos were taken at most project locations. More comprehensive habitat inventories were completed in 1998 at five tributaries using the modified version of the method described by Hankin and Reeves (1988) and in McMahon et al. (1996).

Blackfoot River Riparian Health Inventories

A riparian health inventory was completed on the mainstem Blackfoot River between Nevada Creek and the North Fork Blackfoot River, encompassing 11.2 miles of river (Marler 1998). The inventory mapped community types and erosion on high-resolution (1^2 meter pixels) imagery-based field maps and ranked riparian health by landownership. Plant community types, erosion, management units of areas of poorest health were digitized over the imagery in ArcView GIS format. A detailed description of the methods can be found in Marler (1998).

RESULTS / DISCUSSION

Fishery inventory and restoration results/discussion include data collections completed in 1997 and 1998, and are alphabetically organized within three categories. Part I summarizes the stream discharge, temperature data, along with fisheries monitoring in the Johnsrud and Scotty Brown Bridge sections of the Blackfoot River. Part II summarizes the status of restoration projects, fish population surveys and related monitoring in cold-water streams for the 1997 and 1998 field season. Part III presents results of additional fish surveys including drainages that may have the potential for restoration activities. Part IV present results of additional aquatic investigations in the Blackfoot Watershed including whirling disease studies, Blackfoot River riparian inventories and fishery investigations at Milltown Dam.

Monitoring objectives were to 1) document changes in the composition and densities of fish and their habitats resulting from restoration efforts; 2) document changes in land practices; 3) identify tributaries with thermal conditions favorable and unfavorable for trout, particularly native species; 4) present additional tributary fishery baseline information; and 5) identify future projects for fishery restoration.

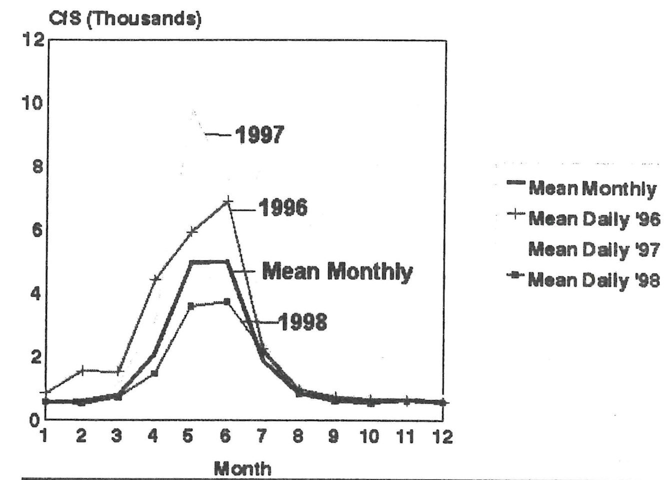


Figure 7. Mean Monthly Flows for the Blackfoot River near Bonner (Station 12340000) 1889 to 1998, Compared to Mean Daily Flows from 1996 to 1998

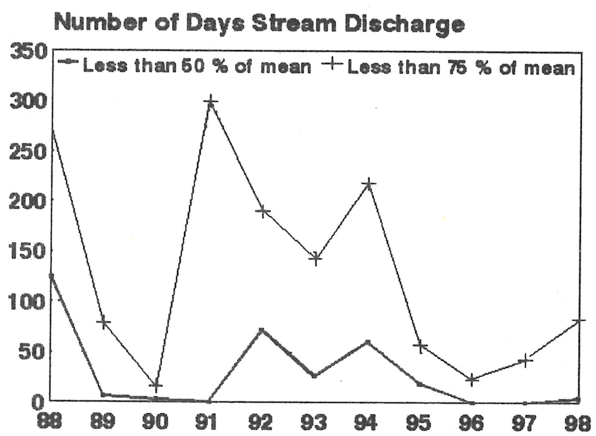


Figure 8. Blackfoot River relative drought conditions near Bonner, 1988-1998

PART I

Blackfoot River Environment

Between 1996 and 1998, the Blackfoot River was subjected to three significant environmental events that have influenced fish populations. The first event occurred in February of 1996 when an ice flow, several miles in length, moved 60 miles down the Blackfoot River from Nevada Creek to Milltown Dam near Bonner. The littoral zones inhabited by juvenile fish were subjected to considerable grinding action by ice and moving cobble substrates. The ice flow extended onto the lower floodplain and led to significant losses of sandbar willow (*Salix exigua*), the dominant woody shoreline vegetation, along the entire reach. Sandbar willow stands were reduced from 50% to 90% of previous densities based on ocular estimates. This edge vegetation is the primary refuge for fish during peak discharge periods. The combination of ice flow-related events appear to be largely responsible for major fishery declines in 1996, particularly in the lower Blackfoot River (Pierce et al. 1997).

The second major event occurred in June of 1997, when the Blackfoot River drainage was subject to an estimate flood with a 25-50 year recurrence interval. This event altered channels, widened floodplains and in general seems to have improved overall habitat conditions. However, the flood appears to have negatively affected the 1997 year-class of some non-native fish in certain tributary environments. The third major natural event is a three-year period of favorable base flow conditions from 1996 through 1998 (Figure 7,8). Favorable summer and winter flows combined with tributary restoration efforts have contributed to recent fishery improvements throughout mid to lower portion of the Blackfoot River ecosystem.

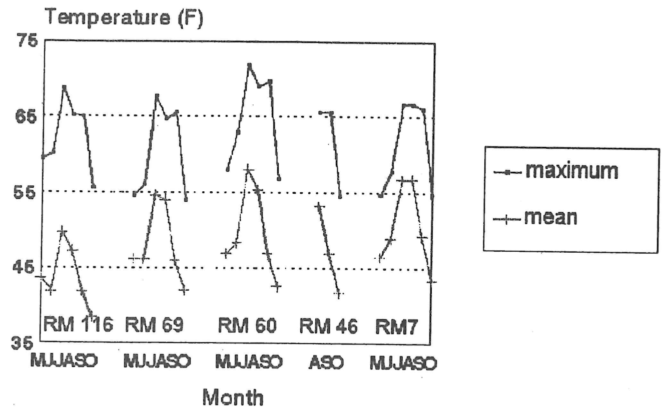


Figure 9. Maximum and mean monthly temperatures for five locations in the Blackfoot River in 1998.

River Temperatures

In 1998, stream temperatures were recorded at 5 long-term monitoring stations in the Blackfoot River: 1) above the Landers Fork at RM 116; 2) at the Cutoff Bridge at RM 69; 3) Raymond Bridge at RM 60; 4) Scotty Brown Bridge at RM 46; and 5) at Wisherd Bridge at RM 7 (Figure 9). In 1998, all data loggers, except for Scotty Brown Bridge, were placed the second week of May and pulled the second week of October. Data from Scotty Brown Bridge was collected from the second week of August through third week of October.

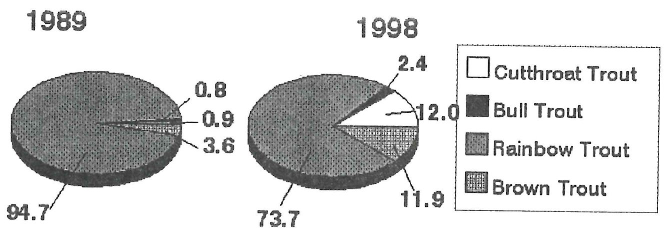


Figure 10. Species composition of the Blackfoot River fishery at the Johnsrud section 1989 and 1998.

Significant warming occurs in the Blackfoot River, as a partial result of Nevada Creek and the Clearwater River. However, several tributaries support lower summer-time temperatures than the mainstem Blackfoot River and help moderate river temperatures. These cooler streams include the North Fork Blackfoot River, Monture Creek, Belmont Creek, Gold Creek, Bear Creek, East Twin Creek, West Twin Creek and Johnson Creek. These cooler streams provide thermal refuge for Blackfoot River native fish.

Mean monthly temperatures at Wisherd Bridge, the downstream most thermograph location were approximately 4-7° higher than those recorded upstream of the Landers Fork confluence, the upstream most location. Much of the warming, however, occurs in the middle reaches of the River near Cutoff and Raymond Bridges. Maximum temperatures for the Blackfoot River were recorded at Raymond Bridge at 71.8°. The Clearwater River was also a significant contributor of higher water temperatures to the mainstem Blackfoot River. Mean monthly maximum temperature for the lower Clearwater river from June through September was 73.4° which is 5° higher than the highest Blackfoot River mean monthly maximum temperature of 68.4° recorded at Raymond Bridge. Maximum summer temperatures in the lower Clearwater River were recorded at 79.5° or 7.7° higher than any recorded temperature for the Blackfoot River in 1998 (Appendix Exhibit E).

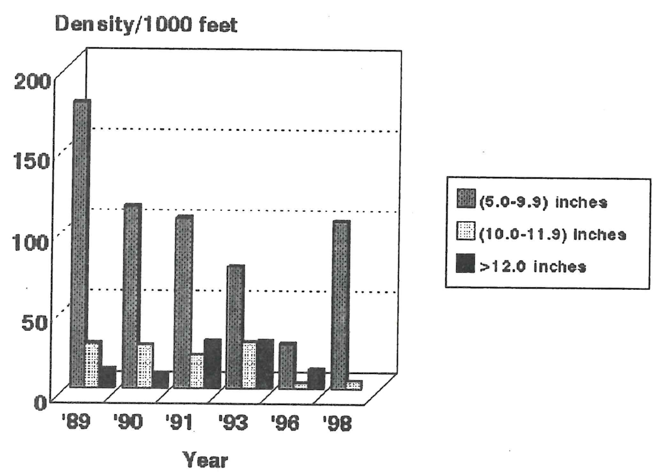


Figure 11. Estimated rainbow trout densities for the Johnsrud section of the Blackfoot River 1989-1998

Blackfoot River Fish Populations

Johnsrud Section

In 1998, trout species composition in the Johnsrud Section was 74% rainbow trout, 12% brown trout, 12% cutthroat trout and 2% bull trout (Figure 10). In 1996, sampling of the Johnsrud Section of the Blackfoot River recorded a major fisheries decline (Pierce et al. 1997). However, we recorded a significant increase in the total trout densities of fish ≥5.0 inches from 53.8 fish/1,000' in 1996 to 137 fish/1,000' in 1998.

The point estimate for rainbow trout (including rainbow×cutthroat trout hybrids) in the 5.0 to 9.9 inch class increased significantly from 28 to 104 fish/1,000' from 1996 to 1998 (Figure 9). Rainbow trout in the 10.0 to 11.9 inch class increased from an estimated 3.3 fish/1,000' in 1996 to 4.6 fish/1,000' in 1998. We were unable to estimate densities for rainbow trout ≥12.0 inches due to low catch efficiencies and/or low fish densities. Low numbers in the intermediate and large size classes likely reflect reduced numbers of smaller fish recorded in the 1996 sample and/or perhaps movement of fish out of the section.

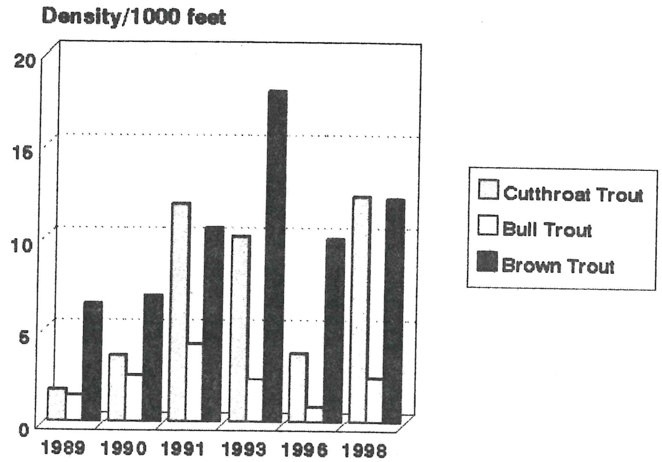


Figure 12. Estimated densities of westslope cutthroat, bull and brown trout (≥6.0") for the Johnsrud section, 1989-1998.

From 1996 to 1998, combined densities of cutthroat trout, bull trout and brown trout ≥6.0 almost doubled from 14.4 fish/1,000' to 26.7 fish/1,000'. Densities of cutthroat trout and bull trout ≥6.0 inches increased from 3.7 to 12.2 and 0.8 to 2.4 fish/1,000', respectively. Densities of brown trout ≥6.0 inches increased from 9.9 to 12.1 fish/1,000' between 1996 and 1998 (Figure 12).

In 1998, we captured two northern pike (*Esox lucius*) in the Johnsrud section. While the origin of these fish is unknown, it is probable they had come from the Clearwater Lakes where they have recently been illegally introduced. In 1997, the lower river tested negative for the presence of whirling disease.

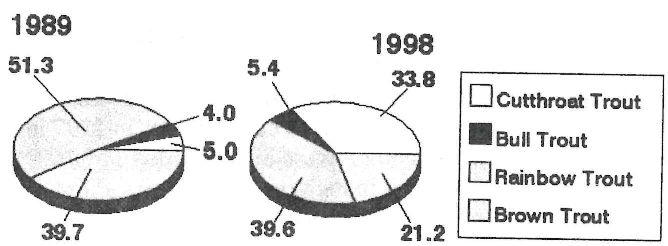


Figure 13. Species composition of the Blackfoot River at the Scotty Brown Bridge section

Scotty Brown Bridge Section

In 1998, the composition of the fishery was 40% rainbow trout, 21% brown trout, 34% westslope cutthroat trout and 5% bull trout (Figure 13). In 1998, estimated density of the total trout population (≥ 6.0 inches) was 67.3 fish/1,000' compared to 57.8 fish/1,000' in 1996.

Between 1996 and 1998, rainbow trout densities in the 4.0 to 10.9 inch size class increased from 10.5 to 12.0 fish/1,000'. Rainbow trout numbers in the 11.0 to 13.9 inch size class more than doubled, with densities increasing from 4.1 to 9.3 fish/1,000'. Densities of large rainbow trout (≥14.0 inches) declined from 10.6 to 5.6 fish/1,000' in 1998 (Figure 14). Reduced numbers in the larger rainbow trout likely reflect

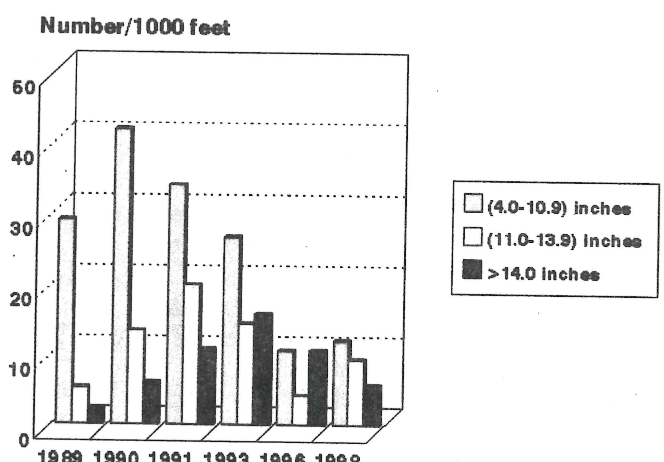


Figure 14. Estimated rainbow trout densities for the Scotty Brown Bridge section of the Blackfoot River 1989-1998.

declines in the small to intermediate size classes recorded in the 1996 sample, as well as, the effects of whirling disease (see Results Part IV).

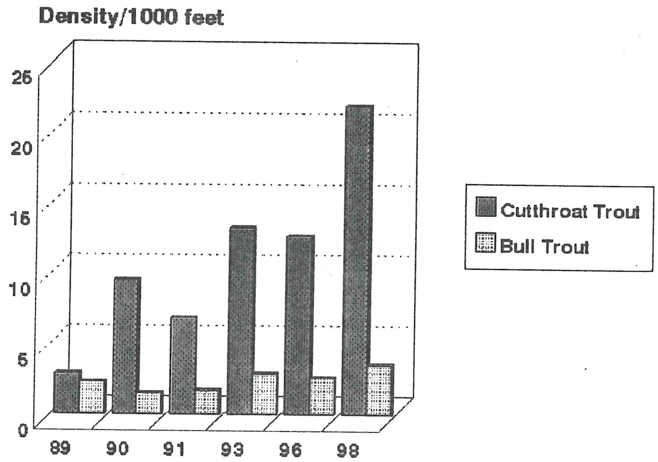


Figure 15. Estimated densities of westslope cutthroat and bull trout (≥6.0") in the Scotty Brown Bridge section, 1989-1998.

Estimated densities of bull trout (≥6.0 inches) increased from 2.6 to 3.5 fish/1,000' from 1996 to 1998. Bull trout estimates in 1998 show continued upward trending densities in this river section. Total densities of cutthroat trout (≥ 6.0 inches) continue trending upward with estimated densities increasing from 12.6 to 21.9 fish/1,000' between 1996 and 1998 (Figure 15). These cutthroat trout increases occurred in the 6.0 to 11.9 inch size class with densities increasing from 5.5 to 15.4 fish/1,000' from 1996 to 1998. Density estimates of the larger cutthroat trout (≥12.0 inches) actually declined from 7.3 to 3.5 fish/1,000' between 1996 and 1998. This decline may be partially explained by the timing of our sample, which in 1998 coincided with westslope cutthroat trout spawning movement out of the section.

In 1996, we were unable to obtain an adequate sample for a density estimate of brown trout in the 6.0 to 11.9 inch classes. In 1998, brown trout in the 6.0 to 11.9 inch classes had an estimated density of 6.7 fish/1,000' (Figure 16). From 1996 and 1998, Numbers of larger brown trout (≥12.0 inches) remained stable with densities of 6.8 to 6.7 fish/1,000' respectively. Although densities of the smaller brown tend to fluctuate in the Scotty Brown Bridge section, densities of the larger brown trout are showing a slight upward trend (Figure 16).

Whirling disease samples were collected from the Blackfoot River and several of its tributaries in 1997 in the area of Scotty Brown Bridge. The River sample taken at Russell Gates Fishing Access Site recorded 14 % of the fish sampled were infected with whirling disease. Cottonwood Creek located in the sampling and two tributaries upstream of the Scotty Brown Bridge section, Warren Creek and Kleinschmidt Creek also tested positive for whirling disease (Appendix Exhibit K).

RESULTS: PART II

Part II summarizes tributary restoration efforts undertaken between 1996 and 1998; however, many of the restoration efforts in this section are on going efforts initiated prior to 1996. For those streams, detailed fisheries and project information are in Pierce et al. (1997).

The analyses of fish population densities in Results Part II and III rely on two general methods. The first is a single pass catch-per-unit-effort (CPUE), the second is a population density estimate generated from a two or three pass depletion survey. We used simple linear regression to analyze the degree of association between the two methods. The results indicate a close relationship between the two methods, $r^2 = 0.902$, $P < 0.0001$ (Pierce et al. 1997). Small stream size and highly efficient electrofishing conditions in our study streams contributed to this outcome. Although the model demonstrates CPUE to be an good index to population density, CPUE does not include a confidence interval like the actual population density estimate.

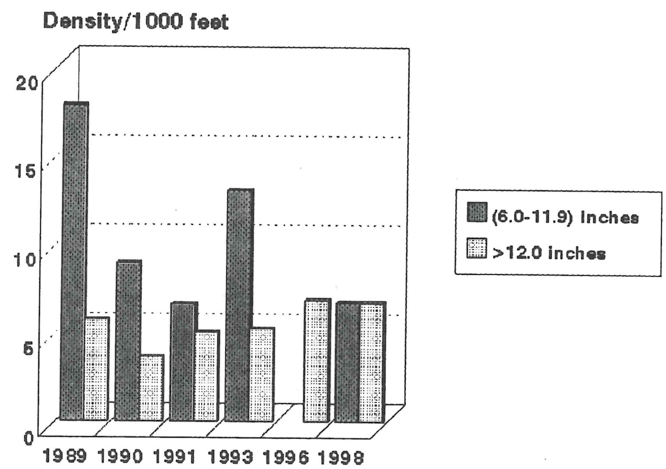
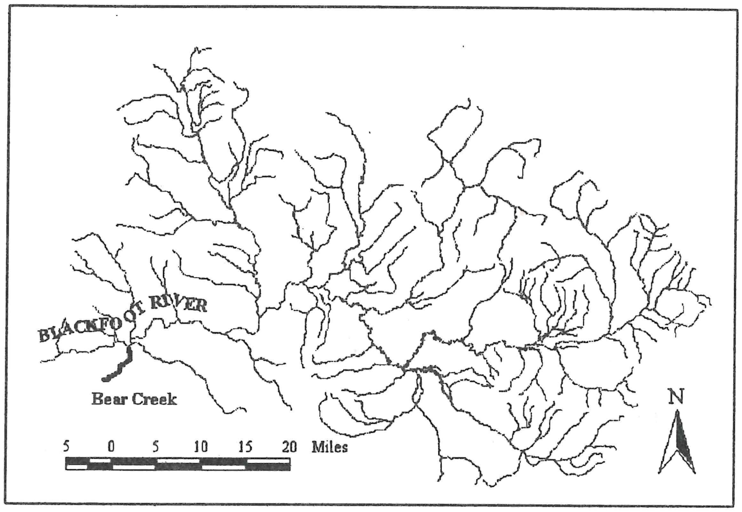


Figure 16. Estimated brown trout densities for the Scotty Brown Bridge section of the Blackfoot River. 1989-1998.

In the following sections of this report, CPUE refers to number of fish collected in a single electrofishing pass and is adjusted per 100' of stream (i.e., CPUE of 8 means 8 fish collected per 100' of sampled stream). The exception to this is CPUE for juvenile fish samples in the North Fork Blackfoot River where CPUE refers to number of fish collected per 100' of shoreline. Actual population estimates are referred to as density/100'. The 95% confidence intervals for these estimates are found in Appendix, Exhibit C.

PRINCLPLE FISHERY RESTORATION STREAMS

Bear Creek



Restoration Objectives
1) Restore stream habitat degraded by historical activities in the channel.
2) Restore fish migration corridors and thermal refuge for Blackfoot River fish.
3) Improve recruitment of trout to the Blackfoot River.

Cooperators
FWP, MPC, USFWS, NRCS, TU, Plum Creek, Private Landowners

Completed projects (year completed)
1) Improve fish passage (1995)
2) Irrigation upgrades (1995)
3) Riparian Grazing Improvements (1998)
4) Channel Reconstruction and habitat restoration (1998)

Project Summary

Bear Creek is a small and, until recently, severely degraded tributary to the lower Blackfoot River. The stream lacked pools because of channelization, logging and grazing in the riparian area. Limited fish passage at two culvert crossings and losses of fish to two irrigation ditches were also identified problems. From 1995 to 1998, several steps were taken to improve fish passage, reduce irrigation impacts and improve riparian land management. In 1998, a project was implemented that include the reconstruction of 1,870' of B4 channel, and included an additional 2,000' of habitat restoration. This project included riparian livestock management improvements (fencing and off stream water) and shrub plantings along the length of the project.

Project Monitoring

In 1998, post project habitat evaluations and pre-project fish populations monitoring were completed in addition to temperature monitoring for the Bear Creek Channel Reconstruction Project. The habitat survey was undertaken in the newly constructed channel. An overview of general habitat parameters is outlined below.

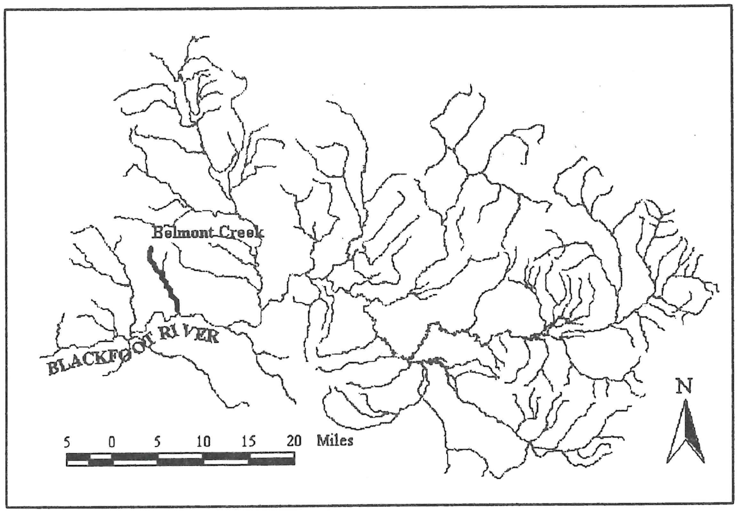
Habitat Restoration Monitoring

Overview of habitat parameters for the 1,870' of the new Bear Creek channel, Fall 1998.

Total # units	Total # pools	Wetted area (ft^2)	Total # woody stems	Total # large woody stems
87	62	1,163	184	139

Fish Population Monitoring

In 1998, two fish population survey sections were established as baseline prior to the habitat project in lower Bear Creek. The surveys showed rainbow trout to be the dominant species followed by brook and brown trout. Native salmonids were absent from both sampling locations. Total CPUE for the three species present range from 12.6 at mile 1.1 to 14.6 at mile 1.5 (Appendix Exhibit A, C). These surveys will be used to compare future fishery response for the project area.



Temperature Monitoring

The hobo was placed approximately 600' downstream of the restoration project area. Water temperatures varied in August (between 46 and 63°), when stream temperatures approached their highest levels in most streams. Daily water temperatures rose 10-12° most August days. Mean water temperatures in August was 55.2°, which is 6.5° cooler than the Blackfoot River in that area, indicating that Bear Creek, particularly with its improved fish habitat, will provide an important thermal refuge for salmonids in the lower Blackfoot River.

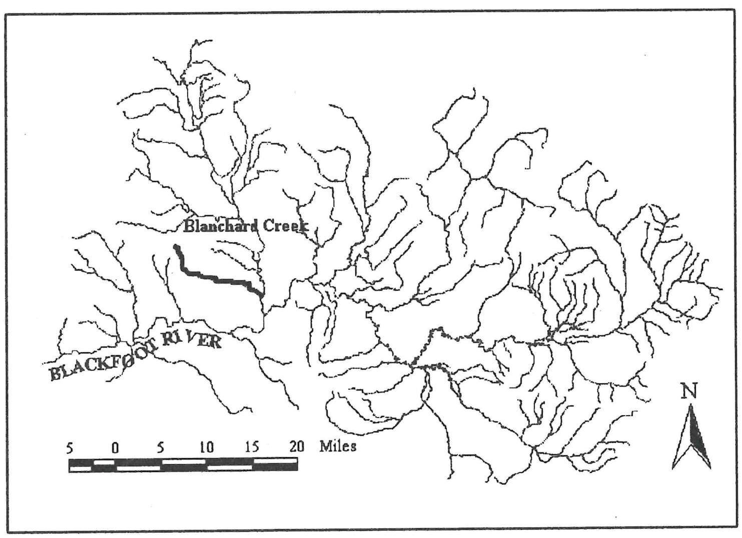
Belmont Creek

Belmont Creek is a core area bull trout stream. Several studies have reported on fish populations, fish passage improvements and basin-wide erosion control efforts (Pierce et al, 1997, Sugden 1994, Peters 1990).

Temperature monitoring

In and 1997 and 1998, temperature hobos were placed immediately upstream from the Belmont Creek confluence with the Blackfoot River. In 1997, monitoring was undertaken over a three-month period, extending from the second week of June through the second week of August. For July and August 1997, Belmont Creek had significantly lower temperatures (averaging 7 to 9° lower) than the Blackfoot River at Wisherd Bridge, with mean temperatures of 52.6 and 55.4° compared to 60.1 and 64.6°, respectively.

The 1998 temperature monitoring occurred over a 5-month period, beginning the second week of May and pulled the second week of October. Mean monthly temperatures ranging from a low of 50.1° in June to 56.0° in July. Maximum temperatures of 65.8° were recorded in late July. Mean summer-time temperatures for the four-month period of June through September was 53.4° compared to 58.9° in the Blackfoot River at Wisherd Bridge. Like Bear Creek, Belmont Creek provide water in August that is 4-5° below those found in the Blackfoot River in that river section.



Blanchard Creek

Restoration Objective

1) Improve minimum instream flows
2) Improve access, spawning and rearing conditions for trout.
3) Improve recruitment of trout to the Blackfoot River

Completed projects (year completed)

1) Water Lease (1993)
2) Riparian Grazing Improvements (1996)
3) Highway Culvert (1994)

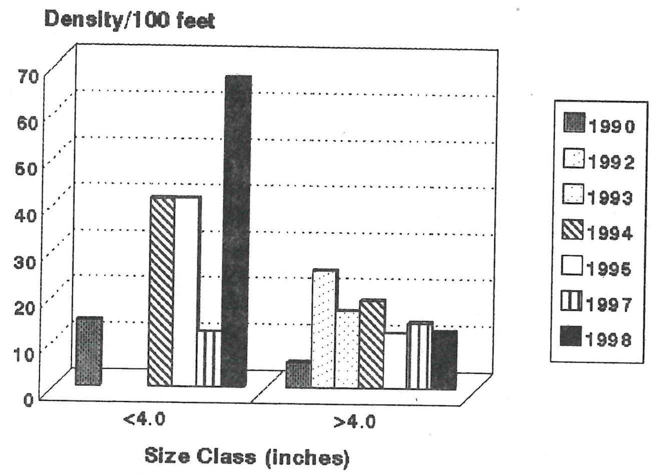


Figure 17. Estimated rainbow trout densities in Blanchard Creek (mile 0.1), 1990-1998.

Cooperators
FWP, USFWS, TU, Private Landowner, DNRC, Plum Creek, DOT,

Project Summary

Blanchard Creek is a small tributary to the lower Clearwater River. Blanchard Creek was historically dewatered in its lower one mile from irrigation withdrawal. Fish population surveys in 1990 indicated this dewatering, associated poor fish passage at headgates for two irrigation canals, and the Highway 200 stream crossing negatively impacted the fishery in the lower reaches of the tributary. Other problems identified in the drainage were road erosion and livestock impacts to the riparian area.

Although the water lease has been in effect since 1993, the water rights holder began increasing stream flows in 1991. The current water lease expires in 1999. A 10-year renewal of the water lease is being considered. In 1993, "fish-friendly" diversion structures were constructed and fitted with fish ladders at both diversion points. Improved management of riparian grazing was initiated by Plum Creek Timber Company and the DNRC. A culvert under Highway 200 was modified by the MDT to facilitate fish passage.

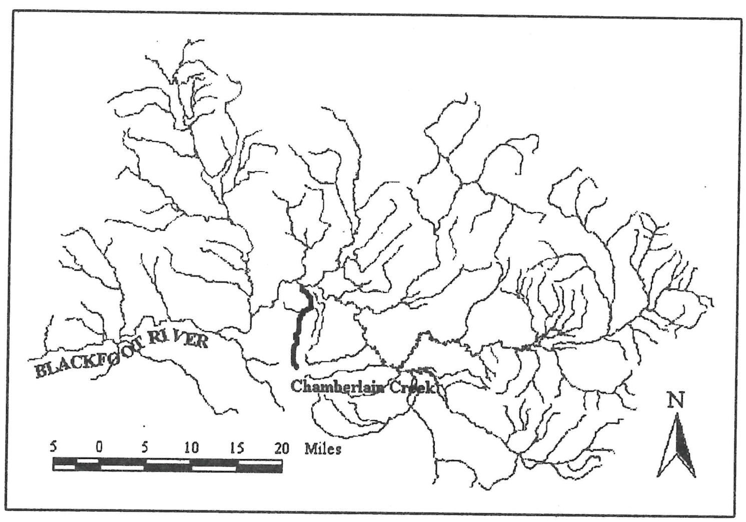
Fish Populations

Blanchard Creek has both rainbow trout (lower) and cutthroat trout (upper) dominated stream reaches and is a good producer of both species. Fish population in lower Blanchard Creek in the area of the diversions and water lease (stream mile 0.1) were monitored from 1990 to 1998. During this period, densities and species richness improved (Pierce et al. 1997). Densities of both YOY rainbow trout (<4.0") and age I plus (>4.0") rainbow trout have improved. In 1990, rainbow trout YOY densities were estimated at 14.4/ 100' compared to 67.0/ 100' in 1998. During this same period, age I and older rainbow trout increased from 5.6/ 100' to 12.3/ 100' (Figure 17).

Chamberlain Creek

Restoration Objectives

1) Obtain minimum instream flows.
2) Improve access, spawning and rearing conditions for westslope cutthroat trout.
3) Improve recruitment of cutthroat trout to the Blackfoot River.
4) Provide thermal refuge and rearing opportunities for fluvial bull trout.



Completed Projects (year completed)

1) Riparian Grazing Improvements (1996)
2) Habitat Restoration, Channel Reconstruction (1998)
3) Irrigation upgrades (1994-1998)
4) Conservation easements (1990)

Cooperators
FWP, USFWS, TU, BLM, Private landowners, Plum Creek

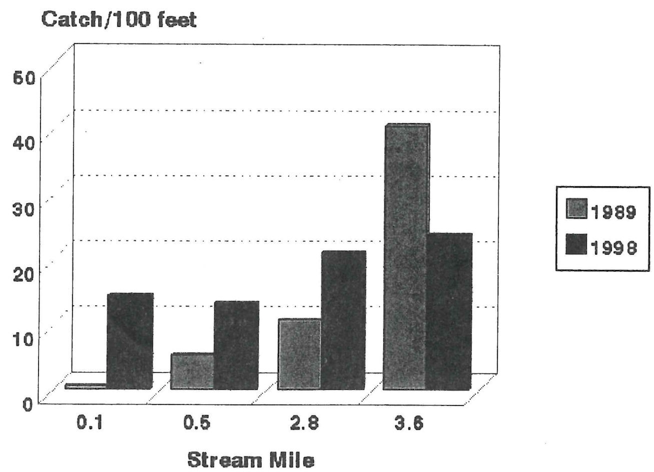


Figure 18. Catch of westslope cutthroat trout (>4.0") in four sections of Chamberlain Creek in 1989 (pre-project) and 1998 (post-project).

Project Summary

The upper reaches of Chamberlain Creek supports excellent densities of cutthroat trout; however, sections of lower Chamberlain Creek have been severely altered, leading to a major decline in the cutthroat fishery downstream of stream mile 4.0. Major impacts to the stream include channelization, loss of instream wood, poor fish passage near the mouth, dewatering, entrainment from irrigation withdraw, poor riparian livestock management and excessive sediment related to road drainage problems.

Since 1990, Chamberlain Creek has been the focus of a comprehensive fishery restoration effort. Projects include; road drainage repairs, riparian livestock management upgrades, fish habitat restoration, irrigation upgrades (consolidating ditches, water conservation and improved fish passage) and improved instream flows through water leasing (Pierce et al. 1997).

Fish Populations

Chamberlain Creek supports a significant migration of Blackfoot River fluvial cutthroat trout with reproduction occurring in mid to upper stream reaches. In 1998, fish population surveys were completed at four index reaches originally surveyed in 1989. Comparisons of the electrofishing catch show substantial increases in the project area post-treatment compared to the upstream control section at mile 3.8 (Figure 18). In 1997 and 1998 samples, four individual juvenile bull trout were recorded in the lower 4.0 miles of Chamberlain Creek. No bull trout were found in previous samples undertaken in these sections. Additional monitoring efforts related to the water lease include the development of flow rating curves in both the main channel and a major diversion.

In 1997 and 1998, Chamberlain Creek had more radio tagged westslope cutthroat trout using the stream for spawning than any other Blackfoot River tributary. Fish moved up and downstream in the Blackfoot River in excess of 30 miles to get to Chamberlain Creek (Schmetterling, In prep.). Redd counts from 1998 found 68 fluvial westslope cutthroat redds in a two mile section. Several cutthroat trout temporarily used pools from restoration projects. One radio-tagged fish spawned at the tail-out of one of these pools. Fluvial westslope cutthroat spawning has been documented in tributaries to Chamberlain Creek including both Pearson Creek and the East Fork of Chamberlain Creek (Schmetterling, In press).

Whirling disease sampling was undertaken in lower Chamberlain Creek in 1997. Results recorded one "suspect" fish. In 1998, sentinel cage studies were completed with no results yet reported.

Temperature Monitoring

The 1997 Chamberlain Creek a hobo was placed at stream mile 1.3 the second week of June and was pulled at the end of September. Mean temperatures for the four-month period was 52.2° (range 48.7 to 55.4). A maximum summer temperature was 63.5° in July.

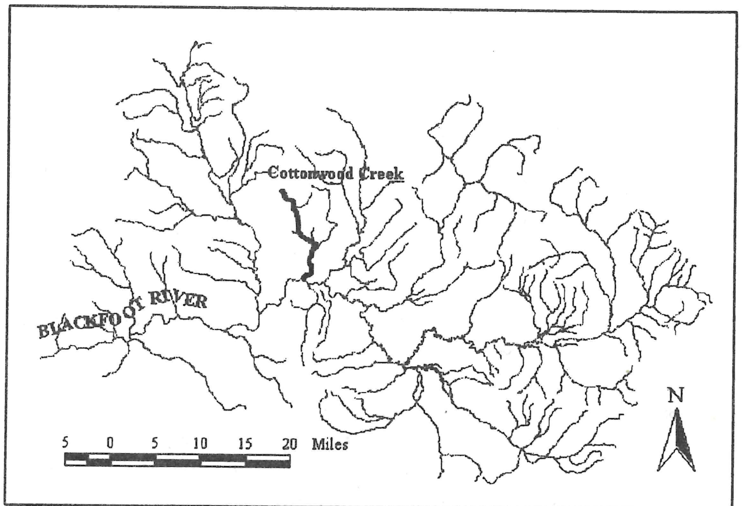
Cottonwood Creek

Restoration Objectives

1) Restore connection between upper and lower sections of the creek.
2) Improve riparian livestock management.
3) Initiate water conservation measures; eliminate loss of fish to irrigation canals.

Completed Projects (year completed)

1) Water Lease (1996)
2) Irrigation upgrades (1995-1997)
3) Riparian Grazing Improvements (1997-1998)



4) Conservation Easements (1995)

Cooperators
FWP, USFWS, DNRC, TU, Bandy Ranch, Montana State University, Private landowners

Project Summary

Losses of native fish and significant dewatering concerns provided the impetus for a comprehensive fisheries and water conservation effort on the Cottonwood Creek mainstem. The effort included fitting two major diversions with fish ladders, screening two irrigation canals, lining an 8,000' irrigation canal and leasing an estimated 8,663 acre feet of salvage water per year for instream flow purposes. Related efforts include improved riparian livestock management and conservation easements in the middle reaches of Cottonwood Creek.

Project Monitoring

Two types of project monitoring have been employed on the Cottonwood Creek project in the area of the Dryer Diversion. The first included installation of a staff gauge mounted to a partial flume positioned in the Dryer ditch 0.1 mile downstream of the diversion. The gauge identifies the maximum diversion allowed under the water lease (13 cfs = 0.6' on gauge). The second type of project monitoring includes fish population sampling at two locations (mile 7.5 and 12.0) in the area influenced by the water lease and irrigation upgrades.

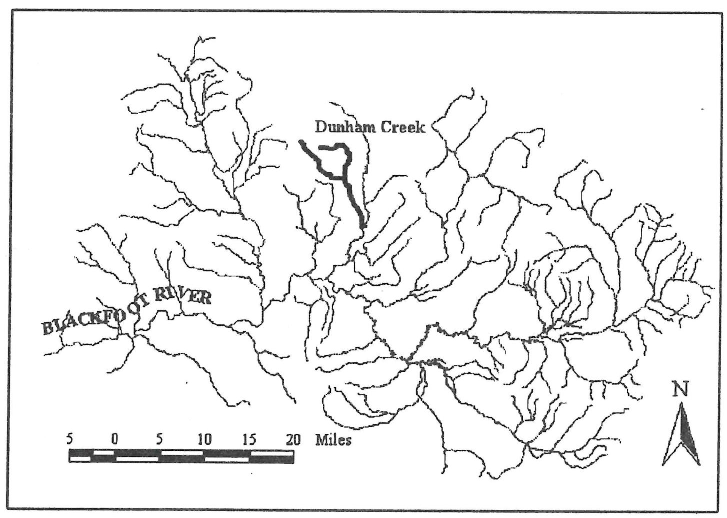
Fish Populations

Fish population monitoring was undertaken in 1997 and 1998 at mile 12.0 in a section of stream historically dewatered during the irrigation season. Densities of cutthroat trout (>4.0") were recorded at 2.9/100' and 6.8/100' in 1997 and 1998 respectively. Juvenile bull trout were recorded both years at this location. Other species present included brook trout and sculpins. Hybrid brook/bull trout were found in the 1997 sample.

A fish population survey, undertaken in July 1997 at mile 7.5 in a perennial stream section immediately below the intermittent section, recorded high numbers of brook trout and brown trout and low numbers of cutthroat trout. No bull trout were found in this section (Appendix Exhibit A, C)

Whirling disease has been documented in lower Cottonwood Creek. Upper Cottonwood Creek at mile 12.0 tested negative for whirling disease in 1997. A sentinel cage study has been completed in lower Cottonwood Creek in 1998. Results have not yet been reported.

Dunham Creek (Monture Creek tributary)



Restoration Objectives
1) Eliminate losses of native fish to irrigation canals.
2) Restore habitat and migration corridors.
3) Improve recruitment of bull trout and cutthroat trout to the Blackfoot River.

Cooperators
Private landowners, USFWS, FWP, TU, USFS

Completed Project (year completed)
1) Streambank stabilization (1996)
2) Canal screening (1996)
3) Channel restoration (pending)

Project Summary

Dunham Creek, a large tributary to Monture Creek, is an impaired spawning stream for fluvial westslope cutthroat and bull trout. In the early 1970's approximately 1.3 miles of the riparian area was clear-cut, burned, then channelized and is currently extremely unstable, with both laterally eroding and aggraded reaches, and goes intermittent in this stream section during base flow periods. The stream is attempting to reestablish a meander pattern in this reach but remains unstable. The USFS is evaluating the problem and has agreed to design a channel restoration plan in 1999 and tentatively implement a habitat restoration project in the year 2000.

An irrigation canal is located at stream mile 2.1. The diversion is found below a native fish spawning area and above a naturally intermittent stream reach. In the summer of 1995, the loss of westslope cutthroat, juvenile bull trout and a spawned, radio-tagged bull trout were documented in the canal. In fall 1996, the canal was fitted with Mackay style self-cleaning fish screen. The screen is designed to prevent losses of all fish to the canal.

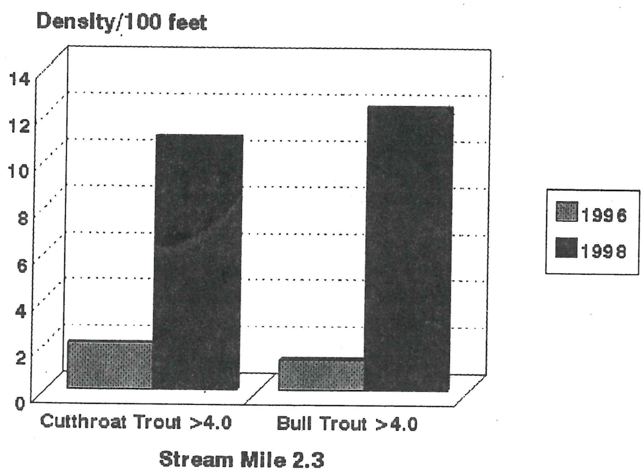


Figure 19. Estimated densities of westslope cutthroat and bull trout (>4.0") for Dunham Creek at mile 2.3, 1996 and 1998.

Fish Population Monitoring

Two fish population-monitoring stations were established in Dunham Creek in 1996 and were then resurveyed in 1998. In both 1996 and 1998, the upstream site (mile 4.2) located in the channelized area was sampled prior to the stream going subsurface. The downstream site (mile 2.3) was established in August 1996 upstream of an irrigation canal and prior to canal screening.

At mile 2.3, cutthroat trout (fish >4.0") densities increased from 2.0 fish/100' to 10.9 fish/100' between 1996 to 1998. Bull trout (>4.0") densities increased from 1.3 fish/100' to 12.2 fish/100' from 1996 to 1998 (Figure 18). Ditch sampling below the screen in August 1998 recorded no fish below the screen.

A comparison of the 1998 total fish densities (fish >4.0") at the two survey locations recorded a significant decline at the upstream survey site with density, decreasing from 22.6 to 8.0 fish per 100' of stream. Densities of all species (fish>4.0") recorded declines at the mile 4.2 survey station (Exhibit A and C).

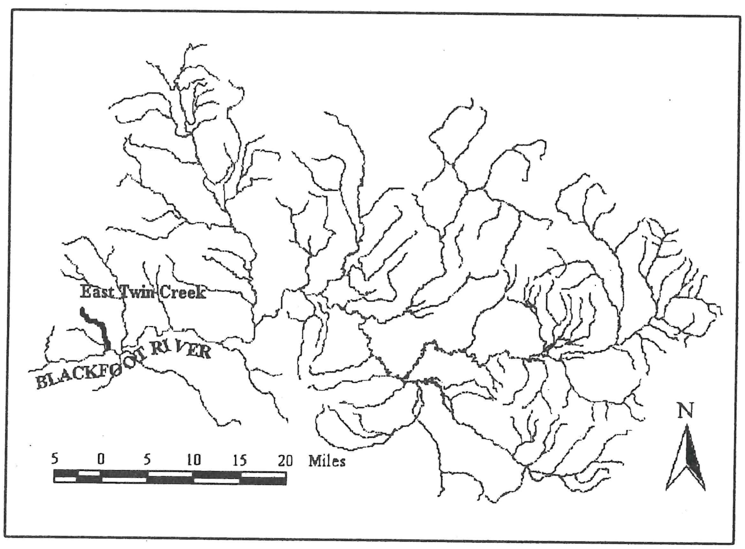
Swanberg (1997b) documented fluvial bull trout migrations and spawning in Dunham Creek using radio telemetry. In 1997, one radio tagged fluvial cutthroat trout migrated from the middle Blackfoot River into Dunham Creek. This fish spent approximately two weeks in this stream and spawned approximately one mile upstream of the screen before returning to the Blackfoot River (Schmetterling, In-prep). Both bull trout and cutthroat trout migrated at high water, allowing both species to ascend a seasonally intermitted reach in lower Dunham Creek.

East Twin Creek

1) Facilitate movement of fish; especially bull trout and westslope cutthroat trout.
2) Restore thermal refuge for native fish from the Blackfoot River fish

Cooperators

FWP, USFWS, TU, MPC, Plum Creek, Champion International



Completed Projects (year completed)
1) Culvert removal (1997)

Project Summary

East Twin Creek, a small tributary to the lower Blackfoot River, has been affected by seasonal fish passage problems. A perched 8' x 64' culvert on Champion International property has limited fish passage to base flow periods for approximately 25 years (FWP unpublished data). Flow velocities were recorded in excess of 10 feet/second in June 1997.

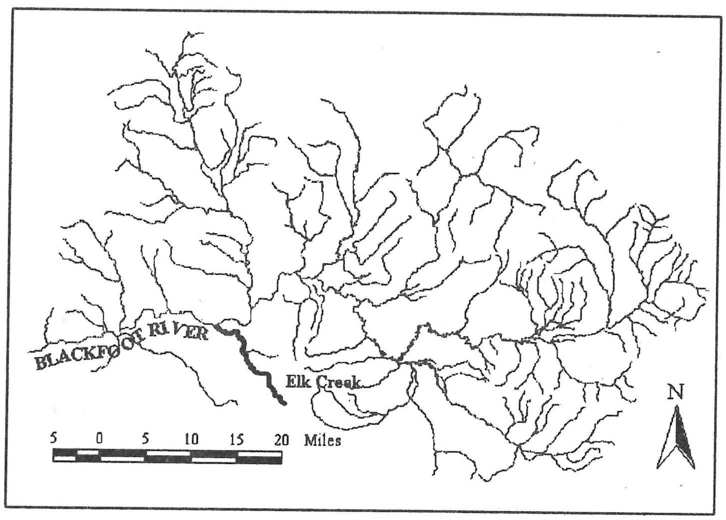
Fish Populations

Fish populations were sample above the culvert crossing before and after removal of the culvert. In the 1998 survey, a single bull trout was collected in the sample upstream of the old culvert (Appendix Exhibit A). Four samples in 1996 in East Twin Creek recorded no bull trout presence (Pierce et al. 1997). The fish is thought to be a juvenile fish from the Blackfoot River using this stream for rearing and thermal refuge.

Temperature Monitoring

The hobo was placed near the mouth of East Twin Creek the second week of May and pulled the second week of October 1998. Mean summer temperatures for the four-month period of June through September was 51.3°. Maximum monthly summer temperatures remained cool ranging from 53.6° in June to 58.4° in September. Maximum summer temperatures were 10° below Blackfoot River temperatures at Wished Bridge (56.2 vs. 66.7°), indicating that, like Bear Creek, this stream provides significant cool-water input during high temperature periods in the lower Blackfoot River.

Elk Creek



Restoration Objectives
1) Restore access from the Blackfoot River for spawning westslope cutthroat trout, bull trout, rainbow trout, and brown trout.
2) Eliminate significant sources of sediment
3) Improve management of livestock grazing

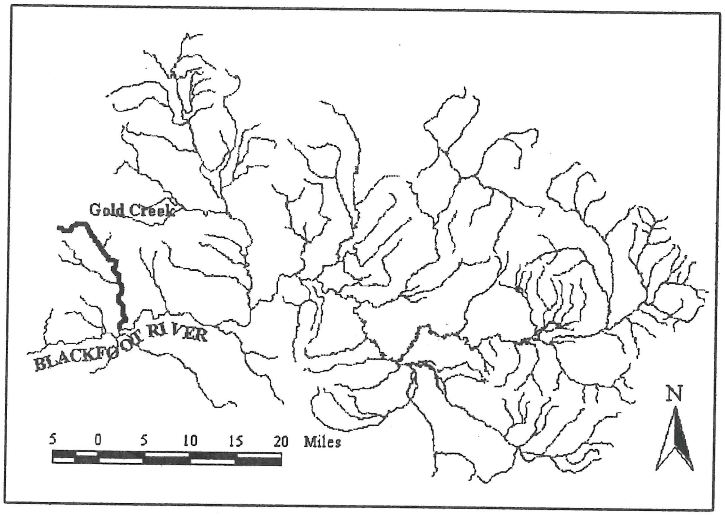
Cooperators

FWP, USFWS, TU, BLM, DNRC, private landowners, National Fish and Wildlife Foundation

Completed Projects (year completed)
1) Channel reconstruction and habitat restoration (1994)
2) Riparian grazing improvements (1994 and pending)

Project Summary

Elk Creek is an impaired Garnet Mountain stream and principal tributary to the Blackfoot River entering at river mile 28. Elk Creek is the only potential Blackfoot River spawning stream between Belmont Creek and Blanchard Creek, a distance of 17.7 river miles. Elk Creek fishery impacts result primarily from elevated instream sediment loading related to extensive placer mining activity, road drainage problems, channelization and poor riparian grazing activities. Two channel reconstruction projects were completed on Elk Creek in 1994. The upper project at mile 12.2 reconstructed approx. 1,200' of B4 channel in an area of historic placer mining. The lower Elk Creek project at mile 1.3-2.9 included 8,581' of channel reconstruction, habitat restoration and riparian livestock management improvements within the project (Pierce et al. 1997). Additional livestock management options have been designed and funded with implementation pending.



Fish Population Monitoring

Elk Creek has been the focus of extensive fishery and temperature monitoring efforts (Pierce et al. 1997). Recent fish population monitoring has been undertaken at two locations in Elk Creek post channel reconstruction (mile 2.3 and 12.2).

At mile 2.3, fish densities remain low; however, diversity of salmonids increased from 2 trout species (rainbow and brook trout) present in 1995 to 4 trout species (rainbow trout, brook trout, brown trout and cutthroat trout) present in 1997. Other species present in the new channel include sculpins and longnose suckers. Cutthroat trout densities although very low have increased from a CPUE of 0.0 in 1995 to a CPUE of 0.8 in 1997 (Appendix, Exhibit A).

At mile 12.2, fish population surveys were undertaken in 1996 and 1997. The only species present were brook trout. The CPUE increased from 0.5 in 1996 to 8.1 in 1998.

In 1997, Elk Creek tested negative for whirling disease.

Temperature Monitoring

In 1997, water temperatures have been monitored at two sites in Elk Creek and over a three-month period, extending from the second week of June to the second week of August. At the upstream station, located at the sunset hill road temperatures remained below 59°and did not exceed 64°. Mean temperatures increased 2 - 3° while maximum temperatures increased 4 - 7° at the downstream station stream mile 1.1 located at Highway 200.

Gold Creek

Restoration Objectives

1) Restore pool habitat and morphological complexity.
2) Facilitate movement of fish, especially bull trout and westslope cutthroat trout.
3) Restore thermal refuge for native fish from the Blackfoot River

Cooperators

FWP, USFWS, TU, Plum Creek, DNRC

Completed Projects (year completed)

1) Habitat Restoration (1996)
2) Erosion Control (1996)

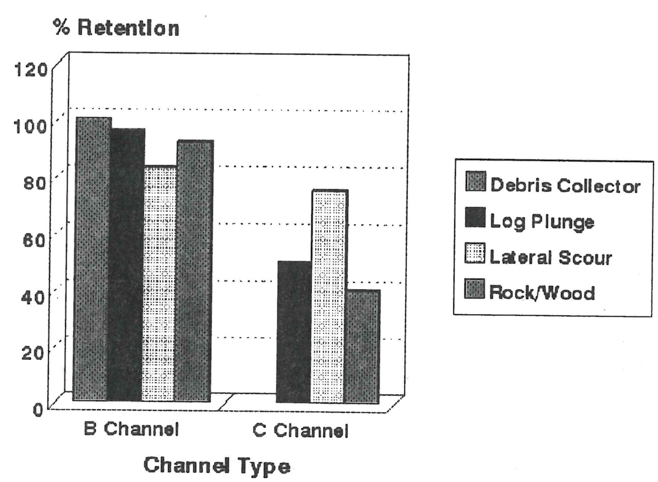


Figure 20. Percent retention of four types of habitat structures after an estimated 50-year flood event in Gold Creek, by channel type.

Project Summary

The harvest of riparian conifers and the actual removal or "cleansing" of large instream wood has reduced the diversity of fish habitat in lower three miles of Gold Creek. Prior to 1996, pools accounted for less than 1% of the stream area in the lower 3 miles. The low densities of age 1+ fish, including native fish, resulted from habitat simplification. In 1996, we constructed 66 structures made of natural material (rock and wood) that resulted in 61 new pools in 3-mile section of Gold Creek in an attempt to restore salmonid habitat.

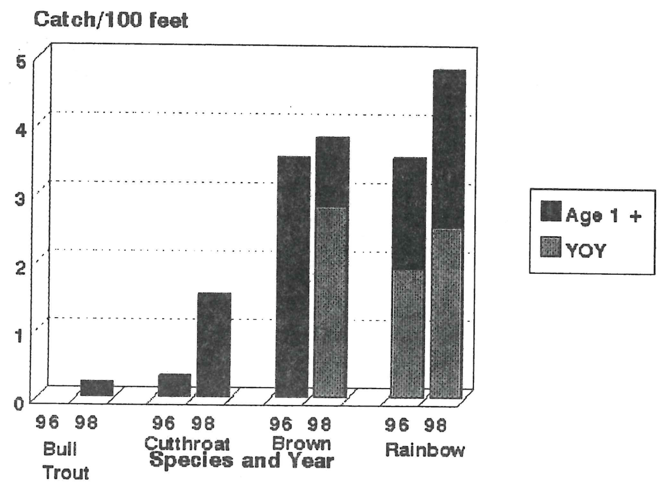


Figure 21. Catch of bull, westslope cutthroat, brown and rainbow trout in the project section of Gold Creek in 1996 (pre-project) and 1998 (post-project).

Project Monitoring

Eight months post-project in June 1997, an estimated 50-year flood event passed through the project area. This event provided an opportunity to evaluate success and failures of specific restoration techniques by geomorphic channel type following a major flood event. Three types of monitoring have been completed regarding the Gold Creek Project: 1) monitoring of the habitat structures, 2) electro-sampling of fish populations, and 3) radio tracking of fluvial westslope cutthroat trout and bull trout.

Habitat Monitoring

We evaluated four types of habitat structures for restoring stream channel complexity and for their ability to withstand a major flood event (Figure 20). Of the original 66 structures, 55 (85%) remained intact and stable following the flood event. Laterally confined reaches (B channel types) retained more pools than laterally extended (C channel types) reaches (Schmetterling and Pierce In press).

Fish Population Monitoring

A radio transmitter implanted bull trout used Gold Creek and the project area as a thermal refuge in summer 1997 and 1998. Both years it moved out of Gold Creek to the Blackfoot River as mainstem temperatures declined. In 1998, 3 radio-transmitter implanted fluvial westslope cutthroat trout spawned in Gold Creek. Most spawned approximately 7 miles up the drainage but used the pool habitat in the project area before and after spawning (Schmetterling in press).

In 1996, fish population survey stations were established prior to the restoration project, one section outside the project area (control) and one section in the project area (treatment). In 1998, post-project monitoring in the treatment section showed early signs of increased numbers of native fish in the project area (Figure 21).

In 1997, Gold Creek tested negative for whirling disease.

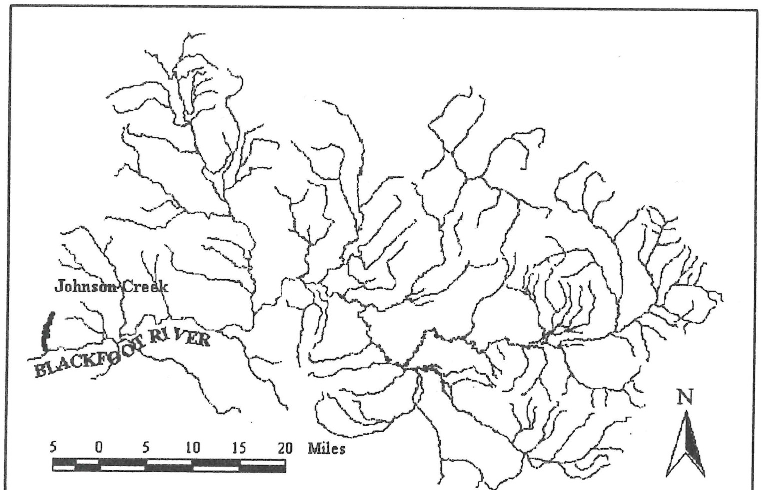
Temperature Monitoring

Water temperatures were recorded in Gold Creek at mile 1.3 from the third week of June through the third week of August in 1997, and from the middle of May through the middle of July in 1998.

Average stream temperatures did not exceed 55°. Maximum temperatures did not exceed 63°. In 1998, mean monthly temperatures were 4-6° lower than the Blackfoot River at Wisherd Bridge.

Johnson Creek

1) Facilitate movement of fish; especially bull trout and westslope cutthroat trout.
2) Restore thermal refuge for native fish from the Blackfoot River Fish



Cooperators

FWP, USFWS, TU, MPC, Private Landowner

Completed Projects (year completed)

1) Culvert removal (1997)

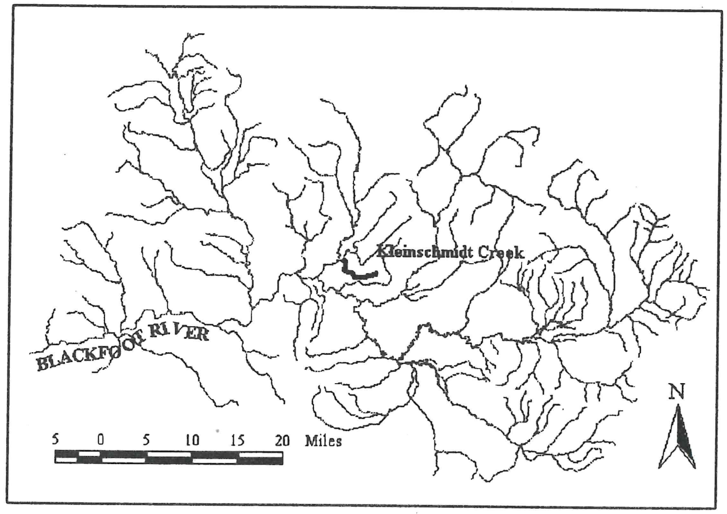
Project Summary

Johnson Creek, the lower-most tributary to the lower Blackfoot River, has been affected by seasonal fish passage problems due to a series of undersized culverts near the confluence. Flow velocities were recorded in excess of 10 feet/second in June 1997. The culverts were removed in winter of 1997 and replaced with a bridge.

Fish populations

Johnson Creek is a small, cold stream that supports several fish species including rainbow trout, brown trout, brook trout, cutthroat trout and bull trout in low numbers. Swanberg (1997b) documented bull trout using the stream for thermal refuge. In 1997, a fishery survey near the mouth of Johnson Creek found low numbers of cutthroat trout, brook trout and brown trout (Appendix Exhibit A).

Kleinschmidt Creek



Restoration Objectives
1) Reduce level of whirling disease through habitat restoration.
2) Restore stream channel morphology for all life stages of trout.
3) Increase recruitment of trout to the Blackfoot River.
4) Restore thermal refuge and rearing areas for North Fork bull trout.

Cooperators

FWP, USFWS, MDT, TU, Private Landowners

Completed Project (year completed)
1) 2,500' of channel restoration (1994, 1997)
2) 5,300' of channel restoration (pending)

Project Summary

Kleinschmidt Creek is a spring creek tributary to Rock Creek, entering immediately above the Rock Creek confluence with the North Fork Blackfoot River. Kleinschmidt Creek a severely degraded whirling disease positive stream has a history of channel alterations and extensive livestock over-grazing of the riparian area. The shallow and wide dimensions and overall condition of the channel are such that little natural fish habitat is present. To date, approximately 2,500' of channel has been restored to E4 geometry. Phase 2 (pending conservation easement) is a major effort that will reconstruct a remaining 5,300' to E4 and C4 geometry.

Project monitoring

Four types of project monitoring are to be included in this project: 1) pre- and post project habitat surveys (Pierce 1991), 2) fish population response to habitat restoration, and 3) temperature studies, and 4) pre- and post project whirling disease evaluations (sentinel fish cage studies plus macroinvertebrate including *Tubifex tubifex* sampling).

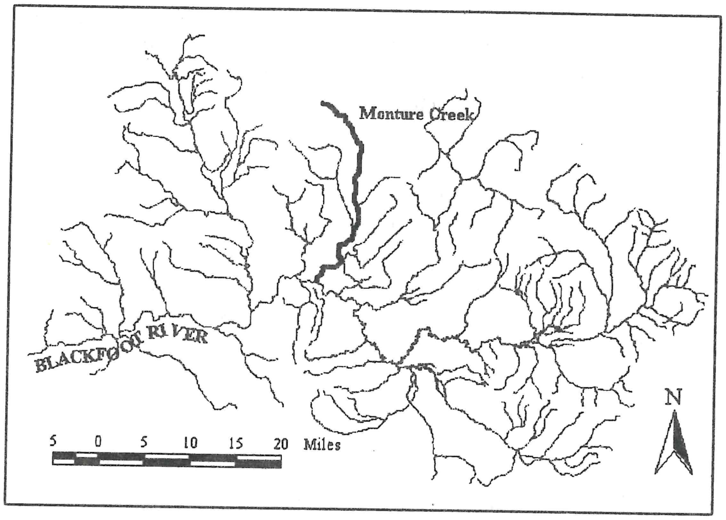
Fish Populations

Fish population surveys were completed in 1998 at two locations (stream mile 0.5 and 0.8). The downstream survey was located in a degraded section of channel (control). The upstream survey was completed in section channel restored in 1997 (treatment). The 1998 population surveys recorded brown and brook trout present in the samples, and found very little difference in population densities between the two sites. No native salmonids were found in Kleinschmidt Creek (Appendix Exhibit A, C).

Kleinschmidt Creek has highest recorded level of whirling disease in the Blackfoot Watershed to dates with a 44% infection level in 1997.

Summary of Two Pass Population Estimates For Kleinschmidt Creek at two locations

Date	Location (mile)	Section length	Species	Length class (in)	1st pass	2nd pass	Probability of capture	Estimate/100'± 95% C.I.
8/98	0.5	435'	Brown Trout	<4	36	13	0.64	13.0±2.8
				>4	6	3	0.50	2.8±2.7
8/98	0.8	400'	Brown Trout	<4	44	10	0.77	13.3±1.3
				>4	8	3	0.63	3.0±1.5



Temperature Monitoring

The Kleinschmidt Creek hobo was placed immediately above the Rock Creek Junction on May 25, 1998 and was pulled in late October 1998. For this summery, only temperatures collected from June through September were used. Temperatures in Kleinschmidt Creek were stable; however, temperatures appear to be relatively warm and consistently maintained a wider range of temperatures than Rock Creek. During this period, mean monthly temperatures were 52.7° or 2.7°warmer than Rock Creek. Mean temperature range was 19.1° compared to 15.6° in Rock Creek. Mean maximum monthly temperatures were 63.8° or 3.3° warmer than Rock Creek (Appendix, Exhibit E).

Monture Creek

Restoration Objectives

1) Restore habitat for spawning and rearing bull trout and westslope cutthroat trout.
2) Improve staging areas and thermal refuge for fluvial bull trout.
3) Improve recruitment of bull trout and cutthroat trout to the Blackfoot River.

Cooperators

FWP, USFWS, TU, Chutney Foundation, Private landowners, and an anonymous donor

Completed Projects (year)

1) Riparian Grazing Improvements (1993-1998)
2) Fish habitat restoration (1997)
3) Wetland Restoration, enhancing stream flows (1996)

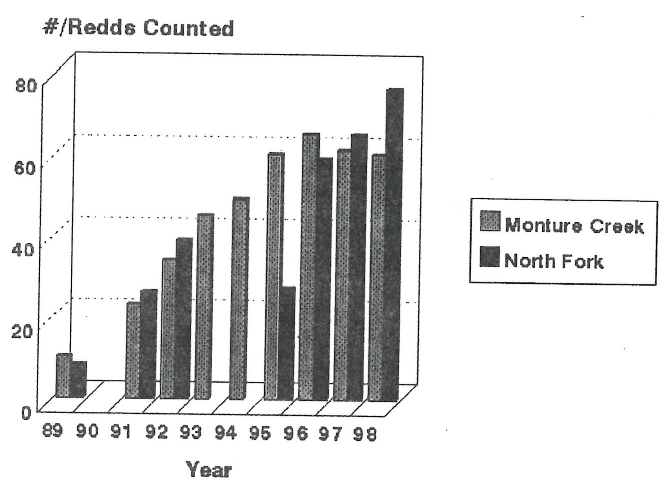


Figure 22. Bull trout redd counts for Monture Creek (index section) and North Fork Blackfoot River, 1989-1988.

Project Summary

Monture Creek, a large tributary to the middle Blackfoot River, is a principle-spawning stream used by the lower Blackfoot River fluvial bull trout and fluvial cutthroat trout. Monture Creek flows through an alluviated channel with shrub communities and large woody debris forming the majority of the habitat features.

From 1991 to 1998, riparian livestock management improvements have been made on 9.3 miles of the mainstem of Monture Creek. This represents 80% of the Monture Creek mainstem located on private lands. In 1997 a cooperative stream restoration project focusing on the placement of in-channel large woody debris, was

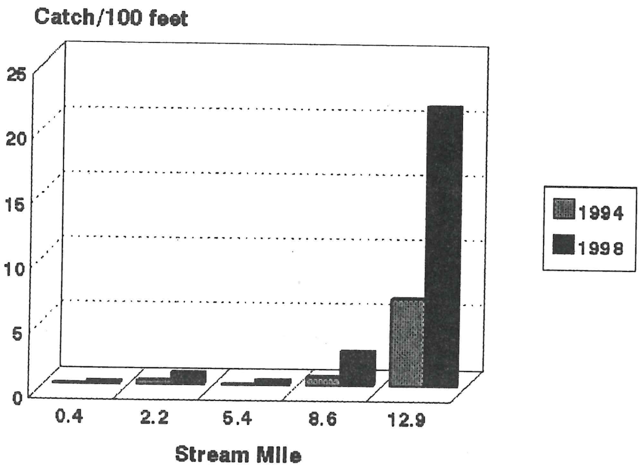


Figure 23. CPUE of juvenile bull trout in five sections of Monture Creek, 1994 and 1998.

completed for two sections of stream totaling 17,606'. Additional livestock management measures and shrub planting have been implemented throughout the restoration project area.

Project Monitoring

Fish population and habitat monitoring focused on four levels of information: 1) bull trout redd counts; and 2) juvenile bull trout monitoring at 5 long-term sampling locations; and 4) stream temperature monitoring; and 4) stream habitat surveys, focusing on instream woody debris placement.

Habitat Monitoring

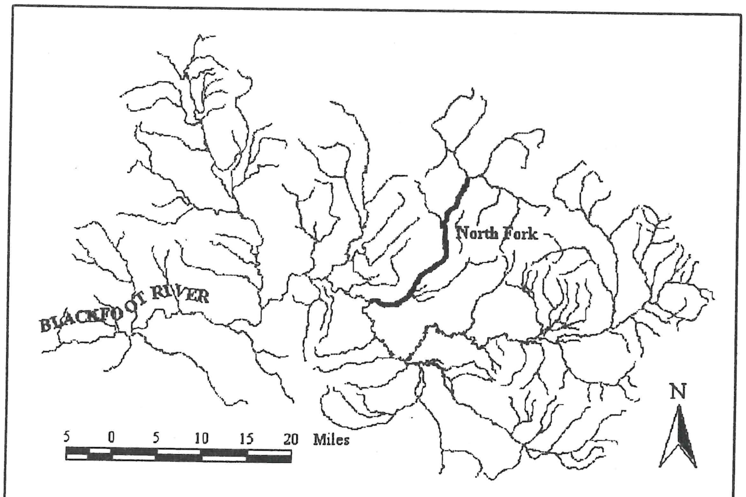
Habitat surveys focused largely on measuring instream woody debris. Project monitoring includes two unrestored reaches and two restored reaches. A brief overview of the survey results is outlined below.

Summary of active woody debris for four reaches of Monture Creek

Reach	Length	Total # active stems/1000'	Total # placed stems/ 1000'	% placed
1 (lower treatment)	6,856	18.1	11.2	62
2 (control)	5,284	6.1	-	-
3 (control)	3,784	6.6	-	-
4 (upper treatment)	10,750	15.3	8.3	46
Total restored (treatments)	17,606	16.4	8.6	52
Total unrestored (controls)	9,022	6.3	-	-

Fish Population Monitoring

The majority of Monture fish population sampling is directed towards monitoring adult and juvenile bull trout populations.



From 1989 to 1998, both bull trout redd counts and juvenile bull trout densities have increased (Figures 22,23). In 1998, single pass electrofishing surveys were completed at five long-term index survey sections on the mainstem. Combining all sampling locations in Monture Creek, the catch-per-unit-effort (CPUE) increased from 1.6/100' in 1994 to 5.6/100' in 1998 with bull trout numbers increasing at all survey locations. Catch statistics for other species collected in the five index sections are located in the Appendix, Exhibit A. The four lower Monture Creek samples (stream mile 0.4, 2.2, 5.4, and 8.6) are located in areas influenced by habitat restoration efforts.

In 1997, Monture Creek tested negative for whirling disease.

Temperature Monitoring

This hobo was placed at the mouth of Monture Creek in the second week of May and pulled the first week of October 1998. For this summary, only four months of data June through September are included. Mean summer temperature was 54.4 ° with mean monthly temperatures ranging from 48.7 in June to 57.9 in August. Mean maximum temperature was 64.1° with monthly maximum temperatures ranging from 56.7° in June to 67.7° in July. The hobos showed summer temperatures for lower Monture Creek similar to those in the Blackfoot River at Scotty Brown Bridge.

North Fork Blackfoot River

Restoration Objectives

1) Eliminate the loss of bull trout and westslope cutthroat trout to irrigation canals.
2) Manage riparian areas to protect habitat for native fish.
3) Improve recruitment of native fish to the Blackfoot River.

Cooperators

FWP, USFWS, TU, USFS, Private landowners

Other Completed Projects (year completed)

1) Screens on 5 canals (1998)
2) Riparian Grazing Improvements (1997)
3) Conservation Easements (1997-pending)

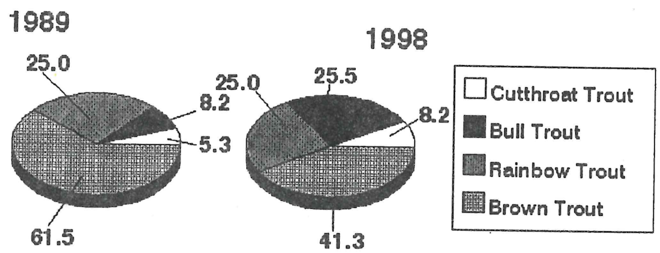


Figure 24. Species composition for the North Fork of the Blackfoot River.

Project Summary

The North Fork of the Blackfoot River is the primary Blackfoot River spawning tributary for fluvial bull trout. Restoration of the North Fork bull trout fishery has largely involved working with irrigators to eliminate fish entrainment into canals and improving riparian livestock management. Fish screening devices have been installed on all five active canals located between river mile 8.0 and 15.3. In addition, improvements have been made to the management of livestock along eight miles of riparian corridor. Conservation easements are currently in place along 8 miles of the stream. In addition, 950' of unstable C4 channel have been stabilized with native materials. Water conservation measures are being considered on several ranch properties.

The lower North Fork (below mile 6.1) is whirling disease positive with a 24% infection level. The disease appears to originate in Kleinschmidt Creek.

Fish Populations

Three levels of fish population surveys have been undertaken on the North Fork Blackfoot River including: 1) bull trout redd counts; 2) juvenile bull trout shoreline samples in index sections originally established in 1989; and 3) mark-and-recapture population surveys in the lower reach of the North Fork (RM 5.9-2.1). In 1998, fish surveys were completed in four of five irrigation canals downstream of fish screens. No fish were collected in any of these ditch samples.

The percent composition of the North Fork fishery is showing a higher percentage of native fish (Figure 24)

Bull trout spawning surveys, juvenile bull trout shoreline surveys, and mark-and-recapture surveys are all showing increasing numbers of bull trout (Figures 22, 25, 26)

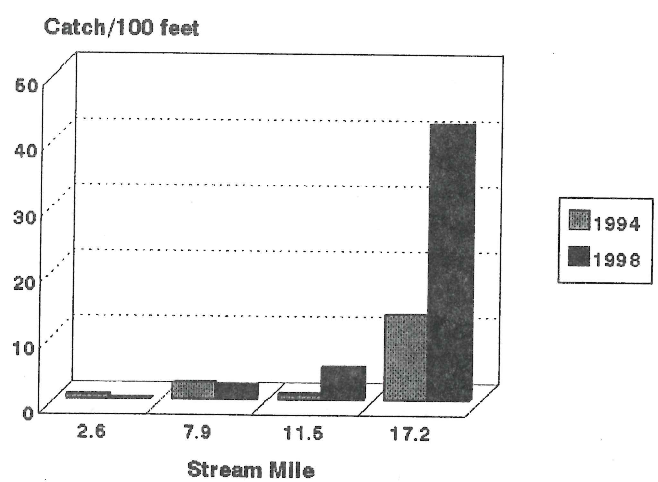


Figure 25. CPUE of juvenile bull trout in four sections of the North Fork Blackfoot River in 1994 and 1998.

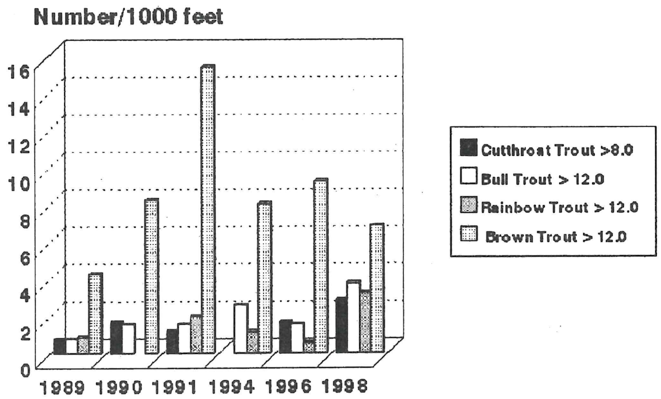


Figure 26. Estimated densities of trout in the North Fork Blackfoot River (RM 2.1-5.9), 1989-1998.

Mark and recapture surveys indicate westslope cutthroat densities (≥8.0") although low are slowly improving (Figure 26).

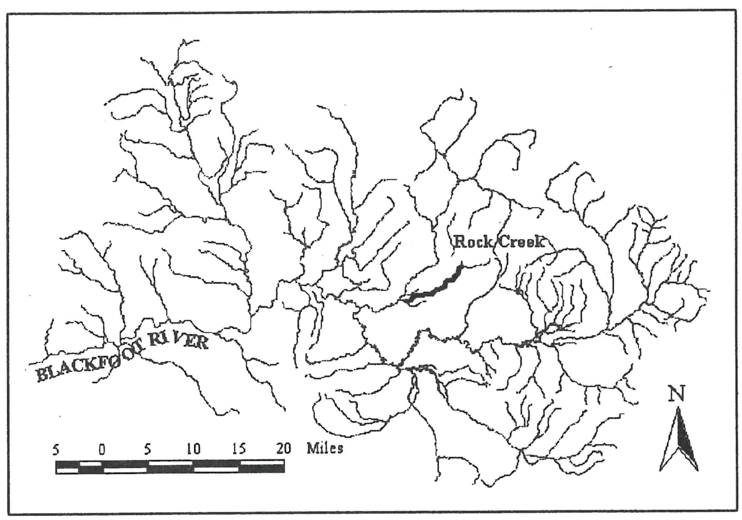
Rainbow trout and brown trout are present in the lower reaches of the North Fork. Rainbow trout densities have improved between 1996 and 1998. Brown Trout densities (fish ≥12.0") have declined between 1996 and 1998 although the long-term trend appears stable (Figure 26).

Stream Temperatures

The hobo was place in the lower North Fork near Harry Morgan Fishing Access Site the third week of May and pulled the second week of October 1998. Mean summertime temperatures for the four-month period, June through September, was 51.4 °. Mean monthly temperatures ranged from a low of 46.7 ° in June to a high of 53.9° in July. Mean maximum summertime temperatures were 59.6 ° while monthly maximum temperatures ranged from 54.2° in June to 62.7° in July. The North Fork remained relatively cool during the sampling period. Maximum water temperatures in July were 6° cooler than the coolest temperature recorded in the Blackfoot River (Appendix Exhibit E).

Rock Creek

Restoration objectives
1) Restore migration corridors for westslope cutthroat and bull trout.
2) Restore natural stream morphology to improve rearing and spawning habitat for all fish using the system.



Cooperators
FWP, USFWS, TU, DNRC, Private Landowners, National Fish and Wildlife Foundation, Chutney Foundation

Other Completed Projects (year completed
1) Habitat restoration (1992-1998)
2) Riparian grazing Improvements- grazing systems, off stream watering areas, riparian feedlot removal, shrub plantings (1997)

Project Summary

Rock Creek, an 8.2-mile tributary to the lower North Fork of the Blackfoot River, is essentially a spring creek in lower reaches gaining most of its surface flow from groundwater in the lower 1.5 miles of stream. Rock Creek has been the focus of an extensive restoration effort, with projects completed or currently pending on 5.5 miles of stream. Several monitoring reports describe habitat and fishery studies for this system (Peters 1990, Pierce 1991, Pierce et al. 1997).

Project Monitoring

Recent fish habitat and fish population surveys include 1) 1998 habitat surveys, 2) 1998 temperature monitoring, and 3) 1998 fish population monitoring at two locations. Habitat surveys were completed on approximately 18,000' of restored stream channel and an additional 6,200' of unrestored channel (Koopal 1998). Brief summaries of both habitat and fish population and stream temperature surveys are included below.

Habitat Monitoring

Summary of Total Woody Debris (active and inactive) and Percent Pool area for 2 Restored and 2 Unrestored Reaches of Rock Creek, 1998.

Section	Length	Status	Location (mile)	Woody debris (# stems/1,000')			% pool area
				Placed	Pre-existing	Total	
1*	6,428'	Restored	0.0-1.2				
Pre-project						14.7	20
Post-project				19.3		34.0	35
2**	2,507'	Unrestored	1.3-1.9	-	0	0	5
3	6,804'	Unrestored	3.9-5.1	-	0	0	13
4***	11,366'	Restored	5.1-8.2	16.3	4.3	20.6	33

* pre-and post project monitoring
** pre-project condition
*** post project condition

Fish Population Monitoring

Rock Creek supports rainbow trout, brown trout, brook trout and very low numbers of westslope cutthroat and bull trout. In 1998, densities of brown trout were significantly higher in the sample section at stream mile 0.7, which was within the area that had been restored, than in the section at mile 1.7 where no restoration has occurred (Figure 27). Mile 1.7 was within a proposed project restoration area-and shows pre-project fish populations and is a control for post-project evaluation of the Rock Creek restoration project at stream mile 0.7.

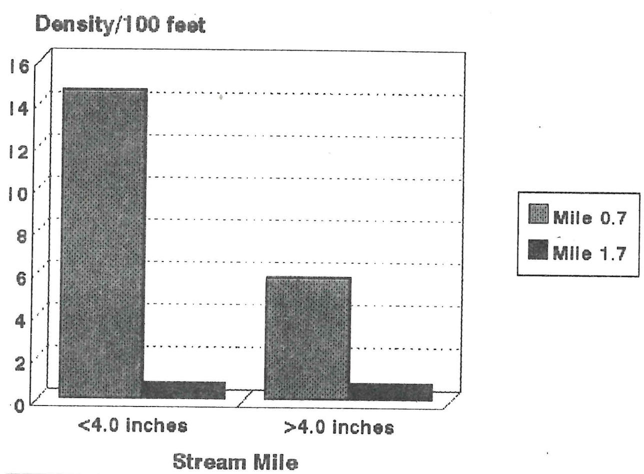


Figure 27. Estimated densities of Brown Trout at two sample locations in Rock Creek, 1998.

Temperature Monitoring

The Rock Creek hobo was placed immediately above the Kleinschmidt Creek confluence in late May and pulled in early October. Rock Creek maintains stable temperatures and, compared to Kleinschmidt Creek, maintained cooler summer temperatures. The mean temperature for Rock Creek from June through September was 51.0° which is an average of 2.7° cooler than Kleinschmidt Creek. Mean monthly maximum temperatures averaged 3.3° cooler than Kleinschmidt Creek. Rock Creek also maintained a consistently lower range of temperatures with an average monthly variation of 15.6° compared to 19.1° in Kleinschmidt Creek (Appendix Exhibit E).

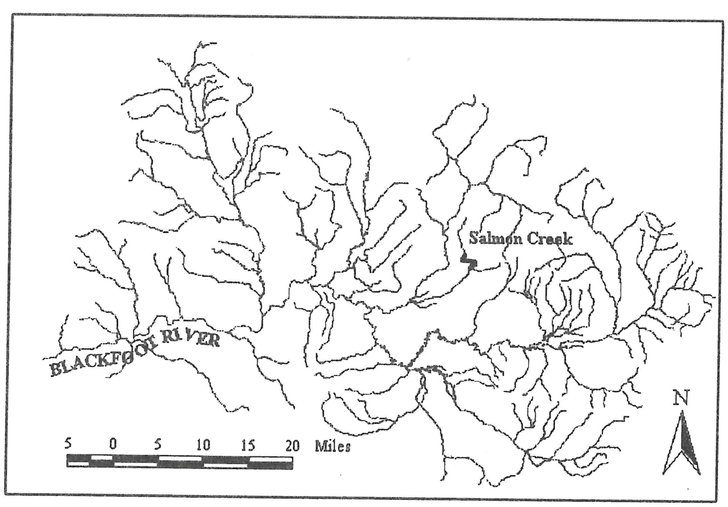
Salmon Creek

Restoration Objectives

1) Restore natural stream channel morphology to improve spawning and rearing habitat for fish.
2) Restore migration corridors for native fish
3) Improve recruitment of fish to the Blackfoot River

Cooperators

FWP, USFWS, TU, Private Landowners, Fish and Wildlife Foundation



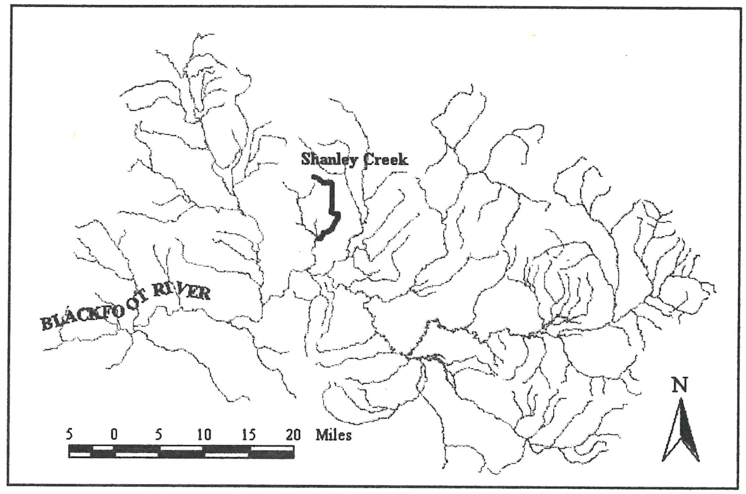
Project Summary

Salmon Creek is the outlet stream from Coopers Lake. Salmon Creek contributes the majority of the upper Rock Creek flow during base flow periods. The fishery in Salmon Creek has been impaired by poor fish passage, losses of fish to irrigation canals, dewatering of the stream channel, channelization, poor riparian grazing practices and concentrated streamside livestock feeding along Salmon Creek.

In 1997, a comprehensive restoration effort was undertaken on the lower 8,719 foot of C4 to E4 channel. The project included reconstructing 2,000' of E4 channel plus an additional 4,000' of habitat restoration along damaged riparian areas. An essential element to the restoration effort was the pool habitat development and placement of instream active woody debris. Riparian Livestock management measures were completed on the entire length of Salmon Creek including, off-stream water development and cross fencing. Shrub plantings occurred along the entire length of Salmon Creek project. Three irrigation headgates were upgraded. The two major canals coming off Salmon Creek were screened; the upstream screen is an infiltration gallery located in Spawn Lake. It is designed to be low maintenance and to screen age 1 and older fish from the ditch. The downstream paddle wheel driven screen with a 1/8" diameter screen is designed to keep out all fish. With the exception of YOY brook trout, which have been observed below this type of screen.

Project Monitoring

A fishery baseline was established in 1996 (Pierce et al. 1997). A post-project fish habitat survey was completed in 1998 (Koopal 1998). The habitat survey reported 51 pools comprised 18% of the stream area. Eighty-eight percent of the pool habitat units had woody debris. Ninety-two percent of total in-channel active woody was placed during the project.



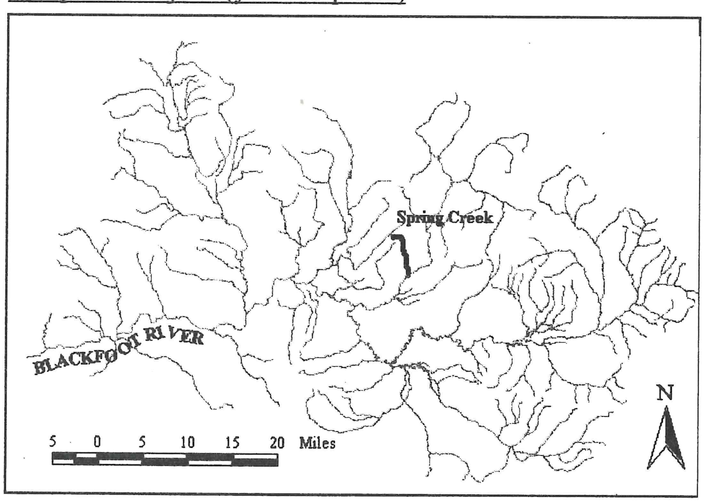
Shanley Creek

Restoration objectives
1) Restore habitat for all fish species
2) Restore migration corridors for native species
3) Reduce losses of fish to irrigation ditches
4) Maintain minimal in stream flows

Cooperators

FWP, USFWS, TU, Private Landowners, Bandy Ranch, Montana State University

Completed Projects (year completed)



1) Ditch screening (1994)
2) Riparian Grazing Improvements (1994-present)
3) Conservation easement (1996)

Project Summary

Shanley Creek, the primary tributary to Cottonwood Creek, has been the focus of several riparian improvement projects. Since 1994, most of the restoration efforts have focused on improving riparian grazing practices and upgrading irrigation systems to prevent or reduce fish losses and conserve water. There are currently three large pastures in the lower 1.8 miles of stream, on which riparian grazing improvements have been completed or pending.

The two fishery survey sites were established to monitor fishery responses to riparian livestock changes on the Bandy Experimental Ranch.

Fish Populations

Fish population surveys were completed at two locations in 1997 (mile 0.2 and 1.6). The downstream survey site, located at stream mile 0.2, is in a riparian livestock exclusion area. At this location, total trout densities (fish >4.0") have increased significantly from a pre-project density of 4.0 fish/100' in 1993 prior to livestock exclusion to densities of 12.5 fish/100' in 1996 after exclusion. Population densities from 1996 to 1997 remained stable at this location. Most of the fishery consists of brown and brook trout and low numbers of cutthroat trout. Cutthroat trout numbers, although low, appear to be improving in this reach of Shanley Creek.

The fishery monitoring station at stream mile 1.6 was established in 1996 in order to provide a fisheries baseline for a riparian "best management practices" grazing study. Two years of pre-project (1996 and 1997) baseline data indicate stable but low fish densities. Brook trout (fish>4.0") were estimated at 6.5 and 8.5 fish/100' in 1996 and 1997, respectively. Cutthroat trout densities (fish >4.0") were estimated at 2.6 and 2.0 fish/100' in 1996 and 1997, respectively (Appendix, Exhibit A and C).

Whirling disease samples were undertaken at two locations in Shanley Creek in 1997. The sample in lower Shanley Creek tested negative for whirling disease. The upper sample recorded one infected fish.

Spring Creek (North Fork Tributary)

Restoration objectives
1) Restore migration corridors for native species
2) Reduce losses of fish to irrigation ditches
3) Maintain minimal in stream flows

Cooperators

FWP, USFWS, TU, NRCS, Private Landowners, Plum Creek

Completed Projects (year completed)
1) Improving irrigation structures (1998)
2) Restore fish passage at culvert (pending)

Project Summary

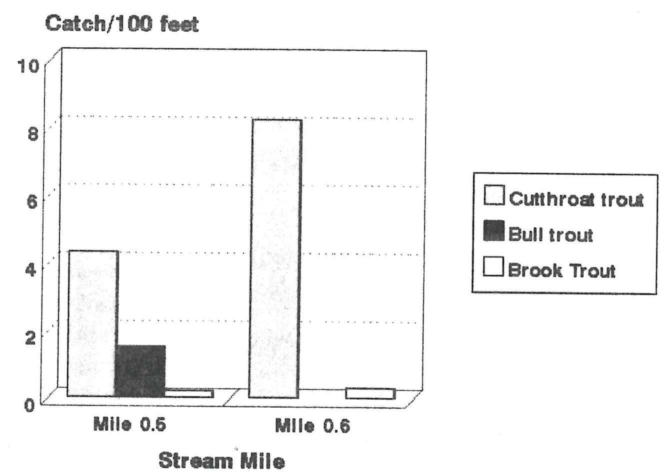


Figure 28. CPUE of westslope cutthroat, bull and brook trout collected above (mile 0.6) and below (mile 0.5) the Spring Creek culvert, 1997.

Spring Creek is a cold groundwater and basin-fed stream, entering the North Fork at stream mile 9.9. The stream originates on the north side of Ovando Mountain and flows 6 miles south to its junction with the North Fork and has a base flow of about 4 cfs. Fishery surveys indicate the stream to be a North Fork westslope cutthroat trout spawning stream and bull trout rearing stream. Two significant fishery impacts have been identified in this stream. One is a perched and undersized culvert on Plum creek properties near the mouth (mile 0.5) which Plum Creek has agreed to independently address. The second fishery problem was a defunct irrigation structure (stream mile 1.6) that served a large irrigation reservoir.

Because of the non-functional condition of the irrigation structure, the ditch captured the majority of high flows plus approximately 80% of stream base flows. In addition, the structure entrained fish, and resulted in channel instability due to the deposition of bedload upstream of the structure. In the fall of each year the reservoir was drained, resulting in reported fish kills at the site. In 1998, a new irrigation diversion was constructed and fitted with a Denil fish ladder and channel morphology restored at the site. The objectives of the new diversion are to improve water management, restore fish passage, improve instream flows and reduce entrainment. Water leasing and ditch screening are currently being considered.

Fish Populations

Two fish population survey locations were established in 1997; one above (mile 0.6) and one below (mile 0.5) the Plum Creek culvert. The surveys recorded generally low numbers of cutthroat trout and bull trout and very low densities of brook trout (Figure 28). Young-of-the-year bull trout were recorded below the culvert barrier; however, no bull trout were found above the culvert barrier. These YOY bull trout are thought to be migrant North Fork fish utilizing Spring Creek for rearing. A bull trout redd survey below the culvert in 1997 found no evidence of spawning activity in lower Spring Creek

Warren Creek

Restoration objectives

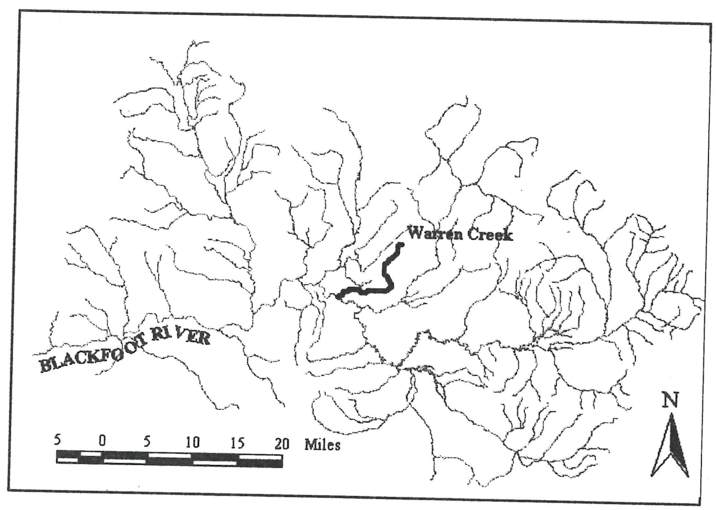
1) Restore riparian vegetation and stream habitat for all fish inhabiting the stream
2) Improve recruitment of trout to the Blackfoot River

Cooperators

FWP, USFWS, TU, NRCS, Private Landowners

Completed Projects (year completed)

1) Removal of three streamside feedlots (1996)
2) Improve fish passage at three locations (1995)
3) Riparian grazing system implemented (1991- present)
4) Channel reconstruction and irrigation upgrades (pending)
5) Conservation easement (1998)



Project Summary

Warren Creek, a small spring-fed tributary to the middle Blackfoot River, has been the focus of numerous riparian improvement projects. However fundamental problems with the habitat persist. These include: alteration and simplification to the habitat due to channelization; irrigation systems designed with no fishery considerations; dewatering and fish passage problems primarily in middle reaches of the stream. Additional projects currently being developed include channel reconstruction, water conservation and irrigation upgrades.

Fish Population Monitoring

Warren Creek supports an impaired fishery (Pierce et al. 1997). Four fish monitoring stations (mile 0.1, 0.4, 1.1, 3.6) that were originally sampled in 1991 were resurveyed in 1997. The 1997 surveys recorded moderate declines in the CPUE for fish >4.0" (Appendix Exhibit A). Reasons for the declines probably result from two factors declines in the mainstem fishery in 1996, and the presence of whirling disease that has been recorded in lower Warren Creek.

RESULTS: PART III

The following summaries are non-project streams where data was collected in 1997 and 1998 in order to better understand the tributary's role as a well as baseline data collection to help identify future project streams.

Bear Creek (Blackfoot River Tributary, near Ovando)

Bear Creek is a second order, basin-fed perennial tributary to the middle Blackfoot River near Ovando with a mean base flow of approximately 1-3 cfs. Bear Creek is a gravel/ pebble dominated stream which flows north in an alluvial valley and enters the Blackfoot River in a high gradient step-pool system at river mile 37.5, 0.8 miles upstream of the Clearwater confluence. From the East Fork down below the confluence with the West Fork much of the Bear Creek channel is confined and a Rosgen B type channel. After the confluence with the west fork, the stream flows out of the mountains onto an alluvial plain and the channel becomes laterally extended (Rosgen C channel type) before returning to an E channel. Fish habitat features in the upper reaches include step and plunge pools, formed mostly by instream wood.

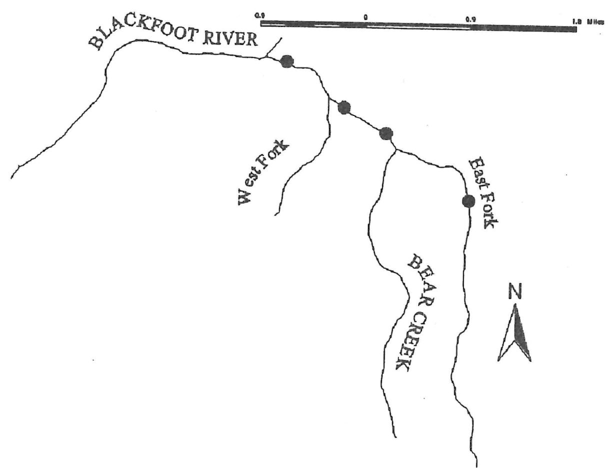


Figure 29. Shocking sections on Bear Creek.

The upper portions of this drainage is accessed primarily though the West Fork of Chamberlain Creek road, and there is another road that accesses the mouth area. This road currently extends to the junction of the East and West Forks of Bear Creek. Historically, this road followed much of the length of Bear Creek and connected with Lower Bear Creek Road. However, Bear Creek has washed out several portions of this road.

In 1998, we collected fish population estimates in four locations (Figure 29). Bear Creek is a cutthroat fishery though its entire length. Throughout the sampling, we did not encounter any other species of fish. Since this was the first time we sampled this stream, we collected tissue samples from 20 cutthroat for genetic testing.

There are two culverts, both of which are undersized, roughly one-third-bankfull stream width. The uppermost culvert may limit fish passage flows above base, while the lower culvert at a low grade. There is also a falls located just upstream of the west fork and may limit or exclude fish passage.

Bear Creek (historic North Fork tributary)

Bear Creek is a first order spring fed creek that originates in a meadow north of Kleinschmidt flat. It originates on private property and flows through Plum Creek land until it is captured by the Lund/Jorgenson irrigation ditch. On the mountain/valley floor interface Bear Creek is channelized. It appears as though it used to form a wetland near where it currently enters the ditch. Stream channel and riparian condition in mid to upper reaches are in good condition but lower reaches are channelized and over-widened. The stream suffers from road encroachment, and the landowners are working to discontinue use on and/ or obliterate that road. We sampled one section of Bear Creek in the summer of 1998 approximately 400 yards below its origin and found westslope cutthroat trout in low densities, no other species were found. Additionally, we sampled a small section located in the campground in its middle reaches but did not find any differences in species composition or abundance. We collected tissue samples from all fish handled for genetic analysis.

Cottonwood Creek

Cottonwood Creek is a large second order tributary to lower Douglas Creek. Channel types range from laterally confined cobble and gravel reaches (Rosgen B channel types) to slightly sinuous laterally extended Rosgen C channel types. In the mountains, The Cottonwood Creek channel has good habitat and channel features consistent with these channel types. However, when it reaches the valley is chronically dewatered for irrigation before it enters lower Douglas Creek at river mile 1.3.

East Fork of Chamberlain Creek

East Fork drains 7 miles^2 is a first order, principal tributary accounting for approximately 40% of the flow in Chamberlain Creek. The East fork enters Chamberlain Creek at stream mile 2.7 at elevation 4132'. Mean base flow in the East Fork is approximately 0.7 cfs. The upper portions of the East Fork drainage have been heavily harvested. There are two road crossings and culverts in the lower East Fork drainage that may be seasonal or selective fish passage barriers. The first one occurs immediately upstream of the confluence with Chamberlain Creek. During the fluvial westslope cutthroat trout spawning migration in 1997, velocities at the downstream end of the culvert was measured at approximately 4 feet/ second. The culvert was replaced in 1998, because of road drainage problems; with a 4' diameter squashed culvert and set at a lesser grade. However, in May 1998, during the fluvial westslope cutthroat trout spawning period, velocities at the upstream end was measured at 2 feet/second and at the downstream end 4 feet/ second. Flows through the upper culvert were measured at 2 feet/ second in June 1997.

Above the second culvert fish habitat is in excellent condition with a large amount of instream woody debris providing habitat and morphological complexity to the channel. Below this point, sections of the channel are highly degraded. Some sections are channelized while others are braided, and the channel geometry is altered. In this area are several springs.

The East Fork of Chamberlain Creek supports abundant westslope cutthroat trout and appears to be one of the better producers of YOY westslope cutthroat in the Blackfoot River drainage. In 1997, one radio-tagged fluvial westslope cutthroat trout migrated from the Blackfoot River and spawned upstream of the second culvert. In 1998, that fish spawned approximately 2 miles downstream in Chamberlain Creek (Schmetterling, In prep). In 1998, several fluvial westslope cutthroat trout redds were observed in the lower mile of stream, attributes of these are in Schmetterling (In press).

Copper Creek

Copper Creek is an important native fish stream and the principle tributary to the Landers Fork. In August 1998, a fishery survey station (RM 6.2) originally established in 1989 was resurveyed. The 1998 bull trout CPUE for fish >4.0" was 3.8 fish/100', compared to 2.6 fish/100' in 1989. In 1998, CPUE for westslope cutthroat trout > 4.0" was 2.2 fish/100' compared to 2.3 fish/100' in 1989.

The hobo in Copper Creek was placed downstream of Snowbank Lake on July 9, 1997 and pulled on August 30, 1997. During this period, water temperatures were very low and stable compared to most streams in the Blackfoot basin. Maximum temperature range during the period of record was 9.5° with a minimum of 43.0° and 52.5° in August. Mean daily temperatures were 46.6° and 47.6° for July and August, respectively.

Landers Fork

In 1998, a hobo was placed in the Landers Fork at the Highway 200 crossing in late July and pulled in early October. During the monitoring period, maximum temperatures were stable, ranging form 54.6 to 59.4°. Mean daily temperatures ranged from a low of 47.1° to a high of 52.4°; this is approximately 5° cooler than the Blackfoot River above the Landers Fork confluence. For the period of July through September, maximum monthly temperatures were 7-10° lower than maximum temperatures recorded in the Blackfoot River above the Landers Fork confluence. Cooler temperatures indicate the Landers Fork may provide important thermal refuge for native fish in the upper Blackfoot River. In 1997, the Landers Fork tested negative for whirling disease and T. tubifex were not collected in worm samples (Dan Gustafson, personal communication).

Douglas Creek

Douglas Creek the principle tributary to Nevada Creek, supports a pure population of westslope cutthroat trout in the headwaters, but supports an impaired fishery in lower reaches. In 1994, fish population inventories at two locations (RM 0.2 and 8.0) of lower Douglas Creek recorded no salmonids below RM 8.0 and no fish at the RM 0.2. In 1997, four additional upstream fishery surveys were undertaken (RM 11.2, 14.3, 15.5 and 16.0) in the headwaters of Douglas Creek located above, between and below a series of instream reservoirs. These fishery surveys recorded a significant shift in the composition of the fishery, ranging from 100% cutthroat trout in the upstream sample (RM 16.0), to 98% non-game fish at the lower station (RM 11.2). The upstream sample, taken above the upper reservoir, recorded a CPUE for westslope cutthroat trout of 5.4 fish/100' compared to 0.7 fish/100' at the downstream section, below the reservoir. YOY westslope cutthroat trout were recorded at the two upstream sample locations, while no YOY westslope cutthroat trout were found at the two downstream locations. Interestingly all fish sample in this stream were native species. These species include longnose sucker, redside shiner and longnose dace (Appendix Exhibit A)

Hobos were place at two locations in the upper Douglas Creek watershed, one in the stream above the reservoirs, and one below the reservoirs. The hobo below the reservoir showed significant warming compared to the upstream station. Mean monthly temperatures in July were 21° higher in the creek below than above the reservoirs. Maximum water temperatures in July above the reservoir reached 55°. Maximum temperature below the reservoir reached 79.5° (Appendix Exhibit E).

McCabe Creek

The McCabe Creek hobo was set in the second week of May and pulled the beginning of October 1998. For this summary, four months of data, June through September, were used. McCabe Creek supports a very cold and stable summer temperature regime. Mean temperature was 46.5°, with mean daily temperatures ranging from 43.3 in June to 48.0° in August. Mean maximum stream temperature was 53.2°, with a mean daily maximum ranging from 51.8 in August to 54.6 in July. Mean July temperatures were approximately 8° lower than those in Monture Creek (47.2° compared to 55.8°).

McElwain Creek

McElwain Creek is a second order tributary to lower Nevada Creek near Helmville. It flows north east from its headwaters in the Garnet Mountain and onto the Nevada Valley before entering Nevada Creek at river mile 1.2. In 1998, we conducted fish population surveys in two sections, one located on BLM land at approximately stream mile 2.5. Another section was established on private land at stream mile 1.0 (Figure 30). Westslope cutthroat trout were the only fish species captured in either station. We collected tissue samples from 25 fish in the upstream station to determine genetic purity. There are several sites on McElwain Creek Road where springs on the uphill side are captured by the road. One of these springs has created a channel in the road and others are causing erosion. Generally, habitat is in good condition in the upper reaches with instream wood creating step and plunge pools.

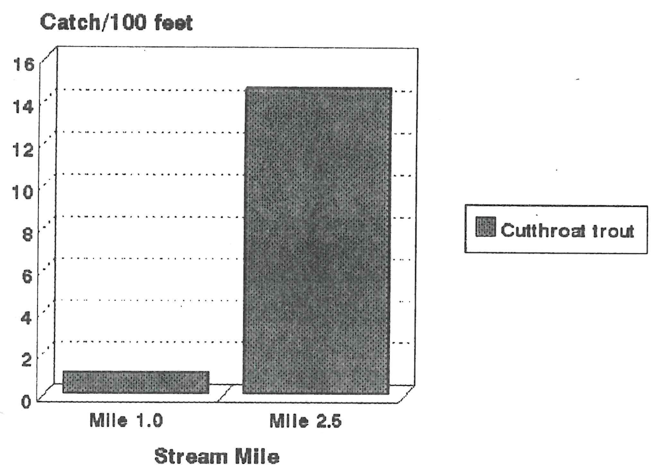


Figure 30. Westslope cutthroat trout CPUE at two locations in McElwain Creek in 1998.

Once McElwain Creek leaves the mountains, most of its flow is seasonally diverted for irrigation. We sampled a reach below this point when discharge was approximately 1 cfs. Riparian vegetation in this reach was dominated by pasture grass, and had poor bank stability. The channel in this reach was incised with eroding banks and high water turbidity. The abundance of cutthroat trout captured in this section compared to the upper section is indicative of this decline in flow and overall habitat quality (Figure 30).

Warm Springs Creek and Burnt Bridge Creek (Tributaries to Gold Creek)

Warm Springs Creek and Burnt Bridge Creek are two perennial tributaries to lower Gold Creek in Missoula County. Ownership of both these tributaries begins at their headwaters on Plum Creek Timber Co. land, then the streams flow briefly through state land and Warm Springs Creek flows through private land before returning to Plum Creek and ultimately to BLM property as they enter Gold Creek. This report summarizes data collected on both these streams taken in June 1998. Numerous diversions for flood irrigation occur along both streams that have probable negative impacts on upstream fish passage, fish loss, and a loss of channel maintenance of bed forms from the decreased flows.

Warm Springs Creek

Warm Springs Creek contains rainbow trout in low densities. Four sections were sampled in single-pass electrofishing surveys. The two upper most sections on Warm Springs Creek yielded no fish. Below Daemon's Fork road, the uppermost section yielded the most fish. This section was located in a mature alder and Hawthorne dominated reach, with dense cover and relatively stable channel characteristics for Rosgen E and C channel types. On a single pass in a 200' section, we collected 7 rainbow trout and found 1 tailed frog. On the lower section located in a hayfield, we only collected 1 rainbow trout, but observed 2 others in a 215' section. This survey section, was in an E channel type but was moderately entrenched, and had no mature woody vegetation, and very little pool development. As this stream flows though the hay field, it departs from its natural channel and runs straight to the end of the high terrace above Gold Creek, where it looses a defined channel and flows downhill to a side channel. There is a dry channel that may have historically captured the flow from Warm Springs Creek and delivered it to Gold Creek. Currently, there is poor fish passage from Gold Creek into Warm Springs Creek as the water spills over the hill slope on the high terrace. According to the landowner, bull trout and cutthroat trout were historically present in the stream.

Burnt Bridge Creek

Three sections were surveyed on Burnt Bridge Creek. Brook trout comprised 100% of the species collected from the lower section in a hayfield to the uppermost section above the culvert on Daemon's Fork Road. One tailed frog was collected in the upstream most section and in the lower reaches spotted frogs were abundant (>30). The channel in the hayfield was impaired. It is an entrenched and channelized Rosgen E channel with little pool development, low sinuosity (from channelization) and high velocities. Percent fine sediment is high and apparent in the lower reaches and reach below culvert. Burnt Bridge Creek enters the Gold Creek floodplain in a step-pool system that does not appear to be a barrier to upstream migration as found in Warm Springs Creek.

In the past (prior to 1993), fish have been reported as far up as the headwaters, where the mainstem, a spring, comes out of the ground. Currently, there is a culvert that may have backed up flows sufficiently to allow bed load deposition, raising the bed elevation. The reach above the culvert is no more than 5" deep. The culvert on Daemon's Fork Road does not seem to be a barrier to upward migration at low flows, but probably is at least a selective barrier at high flows because of its length.

Several sites in the Burnt Bridge and Warm Springs Creek drainage have roads drainage problems. The run off problem has been addressed in the past with the installation of culverts and borrow pits along much of Gold Creek Road. However, these have not totally eliminated the problem. In all three of the sites on Gold Creek Road, road drainage is being directed into the streams rather than into the collection devices. The barrow pits must be better designed or maintained, possibly with the help of water bars.

West Twin Creek

The hobo was placed near the mouth of West Twin Creek the second week of May and pulled the second week of October 1998. Stream temperatures were very similar to East Twin Creek. Both remained cool in the summer. For West Twin Creek, mean summer temperatures, June through September, was 50.2°. Maximum monthly temperatures ranged from 50.9° in June to 58.7° in September. Maximum temperatures in July for West

Twin Creek were approximately 10° below Blackfoot River temperatures at Wisherd Bridge (56.2° compared to 66.7°), indication that West Twin Creek provides significant cool-water input during high temperature periods in the lower Blackfoot River.

RESULTS: PART IV Additional Aquatic Investigations

Whirling Disease Status

Over the last several years, the parasite *Myxobolus cerebralis,* which causes whirling disease in many fish species, has been discovered in streams and rivers throughout western Montana. High-risk areas for contracting the disease include spring creeks, tailwater fisheries and degraded stream environments. Conversely, unimpacted mountain streams and rivers, warm trout waters and lake outlets are listed as low risk areas (Gustufson 1996). Habitat degradation appears to be a contributing cause of the spread and impact of whirling disease. The 1996 Whirling Disease Conference developed a list of five ecological factors that seem to influence the presence of the disease and potential for population impacts. Whirling disease sites: 1) are highly productive, 2) get low frequency of flushing flows, 3) have brown trout presence to act as a source for the disease, 4) are relatively low gradient, and 5) have human-altered or enrich habitats that amplify the pathogen.

Significant research into the epidemiology and ecology of whirling disease has been undertaken over the last few years. This research provides insight into the importance of ecosystem function and maintaining native fish life history variation. Studies indicate there is temporal and spatial variation in risk to infection even in highly infected stream systems (McMahon et al. 1999). Temporal variation of infection risk varies with temperature. For rainbow trout, peak infection occurs at daily mean temperatures of 53-55°, and decline in colder or warmer water temperatures (Vincent 1999). Thus, when and where fish spawn and rear in relation to water temperature could have a significant effect on infection risk (McMahon et al. 1999). It appears that the effects of this disease on rainbow trout are substantially higher if first exposed within the first nine weeks of age (Ryce et al. 1999). Spatial variation in infection risk varies with distribution and abundance of *T. tubifex*. Even in infected systems, *T. Tubifex* abundance and levels of whirling disease can vary widely (Smith 1999).

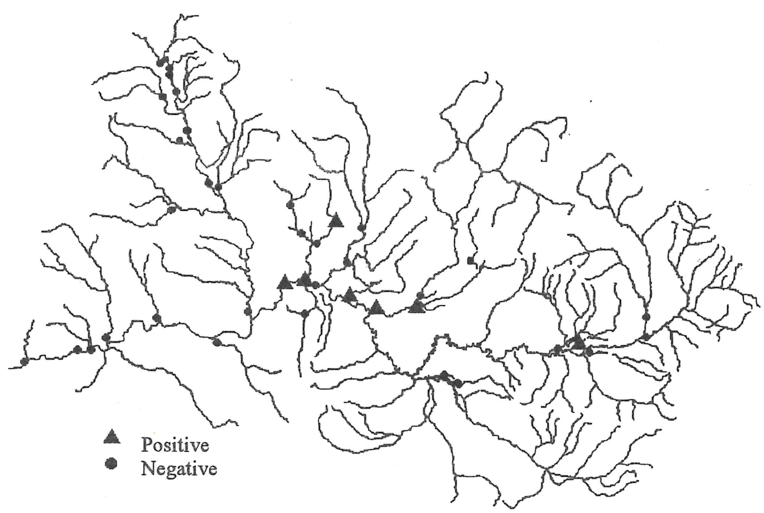


Figure 31. Whirling disease sample results for the Blackfoot River Basin through 1997.

Two types of whirling disease investigations were completed in the Blackfoot River watershed between 1997 and 1998. The first was a basin-wide, two-phase histological study, designed to help determine the general distribution of the disease and measure the intensity of whirling disease using two separate methods. The phase-one objective was to identify the general distribution of the disease and broad level of infection within the watershed. The second was a study to describe the distribution of the alternate host (*T. Tubifex*) of the parasite, *M. cerebralis,* which causes whirling disease. This study was completed on the mainstem Cottonwood Creek, a whirling disease positive stream.

From 1995 through 1997, wild fish were collected at 38 locations in the watershed, including 23 tributaries plus 7 locations on the mainstem Blackfoot River (Appendix, Exhibit J). As of 1997, five of 23 tributaries, and the Blackfoot River near Cottonwood Creek, tested positive for whirling disease. The positive results were generally concentrated in the central region of the watershed in groundwater-fed stream environments. The Clearwater drainage, several peripheral basin-fed streams and the lower Blackfoot River mainstem tested negative for the disease (Figure 30). The highest infection rate was recorded in Kleinschmidt Creek (44% infection), a tributary to the lower North Fork Blackfoot River. In the North Fork Blackfoot River downstream of Kleinschmidt Creek, infection rates attenuated to lower levels (24% infection). Downstream of the North Fork, in the mainstem Blackfoot River, levels continued to decline at the Russell Gates Fishing Access Site (FAS) to 14%. The lower Blackfoot River at Marco Flats FAS tested negative for the disease. Two other tributaries appeared to have moderate level infections; they include lower Warren Creek (21% infection) and lower Cottonwood Creek (27% infection); both tributaries enter the mainstem Blackfoot River between Russ Gates FAS and the North Fork confluence. Low level infections were recorded in Lincoln Spring Creek (2% infection), a tributary to the upper Blackfoot River, and upper Shanley Creek (2% infection), a tributary to Cottonwood Creek. One fish collected in lower Chamberlain Creek was suspect to the disease.

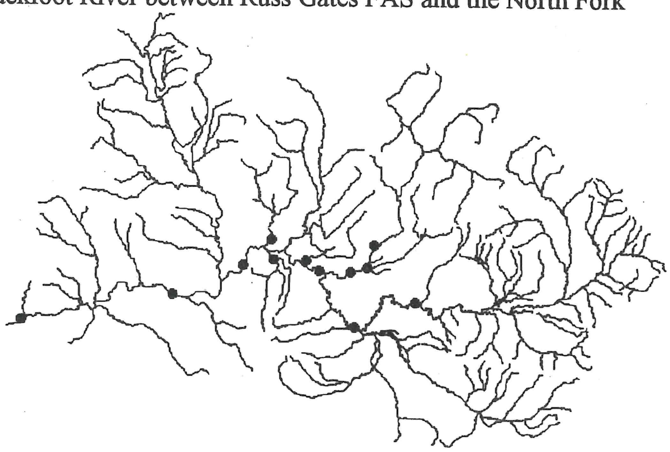


Figure 32. Map of cage locations and whirling disease sample locations in the Blackfoot River watershed through 1998.

The second phase was a sentinel cage study undertaken in 1998. The sentinel cage study relies on histological examination of hatchery fish placed in sentinel cages. Compared to wild fish collections, the sentinel cage/hatchery fish method is a more controlled and accurate method of determining infection severity. Twelve cages were placed in the Blackfoot River watershed in the summer 1998. Locations were selected based on phase-one study results. Six cages were placed in tributaries, and six in the mainstem Blackfoot River (Figure 32). Mainstem locations were selected to identify infection levels by river reach. Tributary cage sites were 1) Kleinschmidt Creek, 2) North Fork Blackfoot River upstream and downstream of Kleinschmidt Creek, 3) Warren Creek, 4) Cottonwood Creek, and 5) Chamberlain Creek. At the time of this publication, phase two results have not been completed

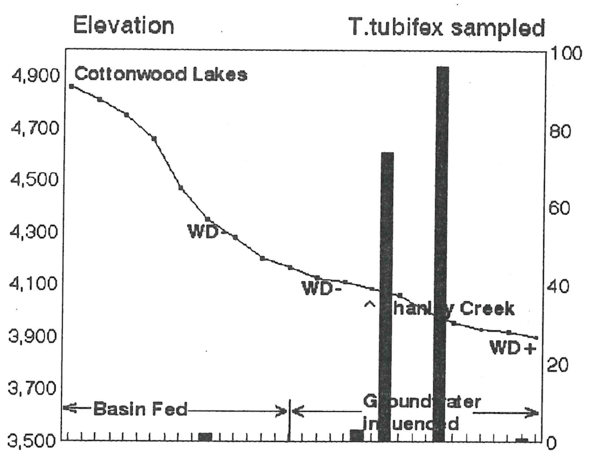


Figure 33. Cottonwood Creek longitudinal profile plotted against *T. tubifex* abundance, showing locations of whirling disease samples and results in

In her thesis Smith (1999), studied the distribution and abundance of *T. Tubifex* along the longitudinal profile of Cottonwood Creek, a whirling disease positive tributary to the Blackfoot River. Her sampling was stratified by geomorphic unit ranging from a high elevation glacial valley to outwash areas in the upper basin to moraine and marsh environments in the lower basin. Her results reported an inverse relationship between *T. tubifex* and elevation, and a positive relationship with *T. Tubifex* and certain geomorphic and habitat features in the lower basin (Figure 33). Downstream changes include decreased stream gradient, and a reduction in the stream's ability to transport larger sediment particles and higher levels of organic matter that provides habitat for *T. Tubifex*. The majority of *T. Tubifex* in Cottonwood Creek was found in Rosgen C channel types, which are characterized by low gradients and meandering riffle/pool patterns predominately cobble and smaller substrates. Her results recorded no significant relationship to localized streambank disturbance, indicating *T. Tubifex* abundance may occur naturally in this system; Smith (1999) also recommended future research focus on the relationship of water chemistry to *T. Tubifex*. Other researchers in western Montana have found relationships between riparian damage and the environment that fosters whirling disease (McWilliams et al. 1999). Other researchers in Montana have found higher densities of tubificids in soft sediments than in the faster flowing areas (Kerans et al. 1999).

The inverse relationship between *T. tubifex* and elevation provides hope that Blackfoot River native trout, westslope cutthroat trout and bull trout, might escape widespread infection, due to their reliance on headwater tributaries for spawning and rearing. However, the situation also underscores the threat facing non-native species particularly rainbow trout, which tend to spawn in lower elevations in areas of TAM production, including areas of lower Cottonwood Creek. Stream temperatures also change over the length of a stream.

Likewise, human-related disturbance such as road drainage, poor riparian cattle grazing and timber harvest are typically more frequent in lower elevations. These activities and disturbances could increase the amount of fine sediment within the streambed, thereby providing additional habitat for T. tubifex. These activities can elevate stream temperatures and nutrient levels in lower stream reaches, potentially influencing the duration and rates of TAM release.

Two on-going Blackfoot River restoration strategies should help moderate future impacts of whirling disease. One strategy involves modifying or restoring the riparian environment to make it less favorable for the worm host. Reducing stream temperatures and instream, fine sediment levels and restoring healthy invertebrate communities through continued basin-wide riparian restoration efforts contribute to this strategy. This strategy is currently being undertaken on all whirling disease positive tributaries including Cottonwood Creek, Shanley Creek, Warren Creek, Kleinschmidt Creek and the North Fork of the Blackfoot River. The second strategy involves restoring the native trout with life histories that prevent exposure of young fish at an age when they are most vulnerable to whirling disease.

Milltown Dam Fishery Investigations (from Schmetterling and McEvoy, in review)

Milltown Dam, located at the confluence of the Blackfoot and Clark Fork Rivers, has blocked upstream fish migrations since its construction 1907. Recent radio-telemetry studies have shown downstream movement of bull trout and westslope cutthroat trout over Milltown dam (Swanberg 1997 a, b, Schmetterling, In prep). Although many potadromous fishes make extensive migrations, dams which block their upstream migrations are not often mitigated with passage facilities.

We studied and estimated the numbers of all fish species attempting to migrate beyond Milltown Dam, a Clark Fork River hydroelectric dam in Montana, over the course of one year. Using a radial gate raceway as a fish trap, we found 9 of the 13 local fish species seasonally congregated below Milltown Dam, captured over 17,000 fish and estimated their total migrating populations to exceed 60,000 individuals. Spring captures were correlated with temperature and migrations were related to spawning for rainbow trout and largescale suckers (*Catostomus macrocheilus*). In contrast, fall movements of northern pikeminnow(*Ptychocheilus oregonensis*) and westslope cutthroat trout were not spawning related and were made by immature individuals. Largescale sucker migrations in the fall were not correlated with environmental variables and were not in response to spawning. We only captured five mountain whitefish (*Prosopium williamsoni*) although several thousand congregate to spawn in the Milltown Dam tailrace annually. Redside shiners (*Richardsonius balteatus*), peamouth (*Mylocheilus caurinus*) and longnose dace (*Rhinichthys cataractae*) were also captured though the causes of their movements are unknown. Fish remained at the dam for a long time exposed to high water temperatures and developed injuries from trying to ascend the dam. While the reasons for the movements of many of these fishes is only speculative, the spatial and temporal impacts of Milltown Dam on individuals and populations are probably having significant community level impacts.

Radio-telemetry studies (Swanberg 1997a, b; Schmetterling In prep) have shown downstream movement of fluvial bull trout and westslope cutthroat trout over the dam. Other species have not been studied but are also suspected of moving over the dam. Downstream movement of rainbow trout may partially explain capture data gathered from the Blackfoot River in the Johnsrud section. There, rainbow trout of the size captured below Milltown Dam (>12" TL) are in very low densities. In 1998, only 9% (52 fish) of the rainbow trout captured in the Johnsrud section were greater 12" TL (this report).

The Clark Fork River has more liberal harvest limits than the Blackfoot River. Harvest of larger fish is allowed (one fish >15"), while harvest of any fish over 12" is illegal in the Blackfoot River. Since metals have been implicated as a primary cause for low trout production in the middle Clark Fork (Knudsen 1992), one might expect the population structures to be reversed in these two systems. However, that is not the case.

Currently, Milltown Dam has no upstream fish passage facilities. Disease considerations are currently preventing fish movement over the dam. Selective fish passage has been denied by MFWP Wild Fish Transfer

Committee. The Committee's denial stems from a concern over the spread of whirling disease to spawning areas by infected adult fish. However, whirling disease positive fish occur throughout areas upstream of Milltown Dam with populations of migrating fish, which are already delivering the disease to spawning areas. Moreover, this barrier is affecting migratory fish population in the Blackfoot River. In 1999, Milltown Dam fishery investigations will continue estimating the abundance of all fish species attempting to migrate past Milltown Dam with an emphasis on native trout (westslope cutthroat and bull trout) and less abundant native non-game fish (peamouth, redside shiners, longnose dace and northern pikeminnow).

Blackfoot River Riparian Health Inventory from Nevada Creek to the North Fork Confluence

Riparian plant community structure and health are important elements of stream health, since plants serve many functions in river systems. These functions include soil stabilization and stream bank protection from flooding and scouring, moderation of water temperatures, as well as contribution of wood for stream habitat. Loss of functional riparian plant communities can result in increased erosion and sediment load and higher water temperatures, which can have deleterious effects on aquatic ecosystems.

The Nevada Creek watershed has been shown a primary contributor of elevated water temperatures and other non-point pollutants in the section of the Blackfoot River between Nevada Creek and the North Fork Blackfoot River. This river reach has warmer temperatures, supports low numbers of fish number and receives very little native fish use compared to downstream river reaches (Peters and Spoon 1989, Swanberg 1997b). Of five river reaches monitored for summer-time water temperatures, this reach of river has consistently higher river temperatures than other reaches (Pierce et al. 1997, this report).

The Marler (1998) riparian health inventory addresses the previous lack of information available on the riparian vegetation and health along the Blackfoot River between Nevada Creek and the North Fork confluence. Since poor riparian health has been suspected to contribute to low numbers of native fish in this section, an independent consultant was hired to inventory riparian plant communities and assess riparian health. This 12-mile stretch is predominately characterized by conifer woodlands (dominated by rocky mountain juniper closer to Nevada Creek, and giving way to Douglas fir downstream). The second most common community type was exotic grassland; these were historically sage grasslands dominated by bluebunch wheatgrass and rough fescue, now converted into hayfields (timothy stands) or grazing pastures, with a high proportion of Kentucky bluegrass.

The majority of the riparian areas in the study section were rated as "unhealthy." Using the 1997 Riparian and Wetland Research Program's health evaluation form three of the four principle landowners riparian areas were ranked as "unhealthy", with the remaining ownership described as "healthy, but with problems." Usually this ranking was due to overgrazing and the subsequent loss of deep-rooted riparian vegetation to prevent erosion. High establishment of noxious weeds in the riparian areas was the second most common reason for low health rating. The exotics weeds spotted knapweed (*Centaurea maculosa*), Canada thistle (*Cirsium arvense*), wooly mullein (*Verbascum thapsus*), white sweet clover (*Melilotus alba*) and yellow sweet clover (*Melilotus officinale*) were widely distributed. However, henbane (*Hyoscyamus niger*) and hound's tongue (*Cyanoglossum vulgare*) were only found in small patches and an attempt should be made to remove these plants before they become better established.

Length of eroded banks was calculated for each landowner and categorized as natural (usually high cliffs) or as a result of anthropogenic disturbance (usually cattle grazing). Natural erosion occurs on 6,012' feet of the total 115,466' or 5%. However, 19,919' of erosion was considered human caused which represents 17% of the section length. Based on ownership, proportion of total eroded banks range from 13-27%. Since the cliff account for a significant length of the river section, functional riparian communities in adjacent areas are especially valuable.

The vegetation, eroded banks, health ratings and land ownership were incorporated as layers into an Arc View project. The base layer for the project is high-resolution ADAR imagery. The ability to view these features in various combinations allows landowners and agency cooperators to prioritize areas for restoration, and determine what efforts are needed for restoration of the riparian area (e.g. riparian fencing, revegetation, weed control, etc). The results of this study were distributed to landowners, NRCS and the North Powell Conservation District, which is the local watershed group supervising the restoration effort in this portion of the watershed. Future projects with goals to address identified problems in this reach need to be developed.

Recommendations

1) Continue the current level of effort by the FWS Partners for Fish and Wildlife Program and FWP on the Blackfoot River Restoration Project. The Blackfoot River drainage is currently the site of one of the largest, most successful, on-going ecosystem restoration efforts in the United States. The approach has been non-regulatory and relies heavily upon the abilities of private landowners and the restoration team to communicate directly with each other. The continuation of this effort depends upon maintaining personnel with primary job responsibilities of coordinating efforts that incorporate necessary land management changes that are sensitive to fish and wildlife. This effort is considered educational at a very broad scale ranging from individual landowners to the congressional level. One wildlife specialist from the FWS and one fish specialist from FWP currently form the core of the restoration effort. Support and additional efforts should be provided through watershed groups including the Big Blackfoot Chapter of Trout Unlimited, the North Powell Conservation District, the Blackfoot Challenge as well as other agencies and organizations.

2) Complete a bull trout restoration and management plan for the Blackfoot River basin. All restoration objectives need to identify the source of additional funding and personnel needs to accomplish this goal.

3) Continue long-term fish population monitoring at the Johnsrud and Scotty Brown Bridge sections of the Blackfoot River, the Harry Morgan on the North Fork Blackfoot River and in areas of tributary restoration projects. Continue monitoring stream water temperatures in the Blackfoot River and tributaries. Support continued special study efforts such as telemetry and whirling diseases studies and incorporate pertinent results into the restoration effort.

4) Coordinate educational efforts with landowners and agencies about restoration methods and results at the local, state and federal levels. Incorporate the NRCS into the restoration efforts with regard to funding and fish-friendly irrigation design.

5) Expand restoration efforts in the Nevada Creek watershed and native fish restoration efforts in the Upper Blackfoot basin.

6) Continue monitoring efforts on all restoration projects and prepare comprehensive progress reports every two years.

7) Consider an upstream fish passage facility at Milltown Dam and continue mitigation of Milltown dam impacts in the lower Blackfoot River Watershed.

8) Focus restoration and protection on migration corridors, spawning and rearing areas, tributaries which have a high proportion of their stream length in higher elevations, basin-fed streams with steeper gradients, which have been found less susceptible to *T. tubifex*.

9) Continued or increased landscape protection efforts through conservation easements on critical fish and wildlife habitat in cooperation with the Montana Land Reliance, Nature Conservancy, US Fish and Wildlife Service and Montana Fish, Wildlife and Parks.

Acknowledgements

The projects outlined in this report are the direct result of cooperative between government agencies, private landowners and environmental groups. These efforts demonstrate that solutions to significant environmental problems can occur among a diversity of interest groups and multiple landowners over a large spatial scale.

We extend our appreciation to the Big Blackfoot Chapter of Trout Unlimited for their unending support of this project. We appreciate all the grant writing, conflict resolution, funding and, most of all, continued involvement in all the important issues facing the aquatic resources of the Blackfoot River. We extend our thanks to the North Powell Conservation District for their willingness to assume lead responsibility in restoration efforts in the Nevada Creek watershed.

We extend a special thank you to the private landowners particularly the ranching community of the Blackfoot Valley. Private timber and agricultural land provides much of the open space and habitat necessary for fish and wildlife resources. Your willingness to accept new ideas, inconveniences and extra work made these projects possible. Your stewardship is the key to the long-term success of the restoration efforts.

The U. S. Fish and Wildlife Service Partners for Fish and Wildlife Program, particularly Jim Stutzman and Greg Neudecker, have greatly improved communications, funding, scope and number of projects with many private landowners involved in Blackfoot River restoration efforts. Your conservation easement program is essential to the long-term protection of aquatic habitats. Your participation to restore and maintain critical bull trout and westslope cutthroat trout habitat has become a model for native fish recovery not only on private lands but also within the agency.

Special thanks to Brent Mabbott and the Montana Power Company for support with research and restoration projects and personnel funding. To all the agencies, foundations, businesses, landowners and individuals that contributed dollars and services we thank you for your cooperation and generosity particularly the Montana Land Reliance, Nature Conservancy, Orvis, Sundance Foundation, Ducks Unlimited, National Fish and Wildlife Foundation, Montana Trout Foundation, Wildlife Forever Foundation, Cinnabar Foundation and Chutney Foundation. Additional agency cooperators include U.S. Forest Service, Bureau of Land Management, Natural Resource Conservation Service, Department of Natural Resource Conservation, Montana Department of Transportation, Montana Department of Environmental Quality.

We especially thank the Future Fisheries Committee, Glen Phillips, Dennis Workman and Don Peters with Montana Fish, Wildlife and Parks for the long-term support of this endeavor. Project monitoring in 1997 and 1998 could not have been completed without the help of numerous volunteers, interns and employees, especially Tim Swanberg, Lauren Minto and David McEvoy. Finally, comments by Don Peters and Greg Neudecker improved the quality of this report.

Literature Cited

Allendorf, F. W., and R. F. Leary. 1988. Conservation and distribution of genetic variation in a polytypic species, the cutthroat trout. Conservation Biology 2:170-184.

Behnke, R. J. 1992. Native trout of western North America. American Fisheries Society Monograph 6.

Bjornn, T. C. 1971. Trout and Salmon movements in two Idaho streams as related to temperature, food, streamflow, cover and population density. Transactions of the American Fisheries Society 90(1):27-31.

Bjornn, T. C. and J. Mallet. 1964. Movements of planted and wild trout in an Idaho river system. Transactions of the American Fisheries Society 93(1):70-76.

Burner, C. J. 1951. Characteristics of spawning nests of Columbia River salmon. United States Fish and Wildlife Service Fisheries Bulletin 52:97-110.

Hankin, D. G. and G. H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. Canadian Journal of Fisheries and Aquatic Science 45:834-844.

Kerans, B. L., M. M. Gangloff, and E. R. Vincent. 1999. Spatial relations between whirling disease severity and tubificids. Proceedings of the Fifth Annual Whirling Disease Symposium, Research and Management Perspectives, Missoula, MT. Whirling Disease Foundation, Bozeman, MT.

Knudsen, K. 1992. Phase I: Milltown Fisheries Protection, Mitigation and Enhancement Plan. Montana Power Company, Butte.

Koopal, M. 1998. Stream habitat analysis of select tributaries to the Blackfoot River, 1998. Report prepared for the Montana Fish, Wildlife and Parks, Missoula.

Liknes, G. A. 1984. The present status and distribution of the westslope cutthroat trout (*Salmo clarki lewisi*) east and west of the continental divide in Montana. Report to Montana Department of Fish, Wildlife and Parks, Helena.

Liknes, G. A. and P. J. Graham. 1988. Westslope cutthroat trout in Montana: life history, status and management. Pages 53-60 *in* R. E. Gresswell, editor. Status and management of cutthroat trout. American Fisheries Society, Symposium 4, Bethesda, Maryland.

Lucas, M. C. and P. A. Frear. 1997. Effects of a flow-gauging weir on the migratory behaviour of adult barbel, a riverine cyprinid. Journal of Fish Biology 50:382-396.

Marcy, B. C., A. D. Beck, and R. E. Vlanowicz. 1978. Effects and impacts of physical stress on entrained organisms. Pages 135-188 *in* J. R. Schubel and B. C. Marcy, editors. Power plant entrainment: a biological assessment. Academic Press New York.

McIntyre, J. D., and B. E. Reiman. 1995. Westslope cutthroat trout. Pages 1-15 *in* M. K. Young, editor. Conservation assessment for inland cutthroat trout. U.S. Forest Service General Technical Report RM-256.

McMahon, T. E., A. V. Zale, and D. J. Orth. 1996. Aquatic habitat measurements. Pages 83-115 *in* B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

McMahon, T. E. and 9 co-authors. 1999. Life history variation in rainbow trout in relation to whirling disease infection risk. Proceedings of the Fifth Annual Whirling Disease Symposium, Research and Management Perspectives, Missoula, MT. Whirling Disease Foundation, Bozeman, MT.

Marler, M. 1998. Riparian vegetation and health on the Blackfoot River between Nevada Creek and the North Fork confluence. Report prepared for the North Powell Conservation District and Montana Fish, Wildlife and Parks, Missoula.

McWilliams, J., P. L. Hansen and D. Hinckley. 1999. Relating habitat variables to incidence of whirling disease. Proceedings of the Fifth Annual Whirling Disease Symposium, Research and Management Perspectives, Missoula, MT. Whirling Disease Foundation, Bozeman, MT.

Peters, D. and R. Spoon. 1989. Preliminary fisheries inventory of the Big Blackfoot River. Montana Department of Fish, Wildlife and Parks, Missoula.

Peters, D. 1990. Inventory of fishery resources in the Blackfoot River and major tributaries, Montana Department of Fish, Wildlife and Parks, Missoula.

Pierce, R. 1991. A stream habitat and fisheries analysis for six tributaries to the Blackfoot River. Montana Department of Fish, Wildlife and Parks, Missoula.

Pierce, R., D. Peters and T. Swanberg. 1997. Blackfoot River restoration progress report. Montana Fish, Wildlife and Parks, Missoula.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bulletin of the Fisheries Research Board of Canada, Bulletin 191. Ottawa, CA.

Ryce, E. K., E. MacConnell and A. V. Zale. 1999. Effects of age and dose on the development of whirling disease in rainbow trout. Proceedings of the Fifth Annual Whirling Disease Symposium, Research and Management Perspectives, Missoula, MT. Whirling Disease Foundation, Bozeman, MT.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado

Schmetterling, D., and R. Pierce. In press. Success of instream habitat structures after a 50-year flood in Gold Creek, Montana. Restoration Ecology.

Schmetterling, D. A. In press. Attributes of fluvial westslope cutthroat trout redds in four Blackfoot River tributaries. North American Journal of Fisheries Management.

Schmetterling, D. A. In-prep. Spawning ecology of fluvial westslope cutthroat trout in the Blackfoot River drainage, Montana.

Schmetterling, D. A. and D. H. McEvoy. In review. Abundance and diversity of fishes migrating to a hydroelectric dam in Montana. North American Journal of Fisheries Management.

Shepard, B. B., K. L. Pratt, and P. J. Graham. 1984. Life histories of westslope cutthroat and bull trout in the upper Flathead River basin, Montana. Montana Department of Fish, Wildlife and Parks, Helena.

Shepard, B. B., B. Sanborn, L. Ulmer and D. C. Lee. 1997. Status and risk of extinction for westslope cutthroat trout in the upper Missouri River basin, Montana. North American Journal of Fisheries Management 17:1158-1172.

Smith, L. 1998. Study on the Distribution and abundance of *Tubifex tubifex* within Cottonwood Creek in the Blackfoot Drainage. Master of science thesis, University of Montana, Missoula

Sugden, B. 1994. Belmont Creek Watershed Analysis. Plum Creek Timber Company. Missoula

Swanberg, T. R. 1997a. Movements of bull trout in the Clark Fork River system after transport over Milltown Dam.

Northwest Science 71(4):313-317.

Swanberg, T. R. 1997b. Movements and habitat use by fluvial bull trout in the Blackfoot River, Montana. Transactions of the American Fisheries Society 126:735-746.

Swanberg, T. and L. Burns. 1997. Movement and habitat use of radio-tagged bull trout in the upper Blackfoot River drainage. Special report Region 2 Fisheries, Montana Fish Wildlife and Parks, Missoula, Montana.

Swanberg, T. R., D. A. Schmetterling, and D. H. McEvoy. 1999. Comparison of surgical staples and silk sutures for closing incisions in rainbow trout. North American Journal of Fisheries Management. In press.

Vincent, R. 1999. How the relationship between water temperature and the intensity of *Myxobolus cerebralis* infections in rainbow trout can be used in management solutions. Proceedings of the Fifth Annual Whirling Disease Symposium, Research and Management Perspectives, Missoula, MT. Whirling Disease Foundation, Bozeman, MT

Appendix

Exhibit A: Summary of catch and size statistics for Blackfoot River tributaries fish sampling, 1997-98.

Exhibit B: Mark and recapture estimates in the Blackfoot River drainage, 1997-98.

Exhibit C: Summary of two and three pass population estimates in the Blackfoot River drainage, 1997-98

Exhibit D: Summary of water temperature monitoring locations for the Blackfoot River and tributaries.

Exhibit E: Water temperature-monitoring summaries for the Blackfoot River and tributaries, 1997-1998.

Exhibit F: Table of restoration streams and activities through 1996.

Exhibit G: Table of restoration streams and activities from 1997-1998.

Exhibit H: Table of restoration streams and cooperators in projects through 1996.

Exhibit I: Table of restoration streams and cooperators in projects completed in 1997 and 1998.

Exhibit J. Table of whirling disease sampling locations in the Blackfoot River watershed through 1998.

Exhibit K: Maps of monitoring and project locations in the Blackfoot River Watershed.

Exhibit A: Catch per unit effort (CPUE) and size statistics for Blackfoot River tributaries, 1997-1998

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Length range (in)	Mean Length (in)	CPUE (#/100' in 1st Pass	YOY CPUE (#/100' in 1st Pass
Basin Creek	0.7	15N, 13W, 33B	7-Aug-97	200	EB	3	3	3	2.1-3.0	2.5	1.5	1.5
					SCUL	Present						
Bear Creek	1.1	13N, 16W, 18B;	31-Jul-98	310	RB	39	30	8	1.9-7.7	4.7	9.7	2.6
lower river trib.		13N, 16W, 7C			LL	8	6	4	3.0-8.2	4.5	1.9	1.3
					EB	3	3	0	4.3-5.5	5.0	1.0	0.0
					Sculpins	Common						
	1.5	13N, 16W, 13B	31-Jul-98	327	RB	26	24	2	32-7.5	4.9	7.3	1.8
					LL	2	2	0	8.5-12.0	10.2	0.6	0.0
					EB	23	21	4	2.5-6.4	4.8	6.4	1.2
					Sculpins	common						
Bear Creek	lower	14N, 14W, 11	22-Jun-98	175	CT	11	11	4	2.2-7.7	4.2	6.3	2.3
middle river trib.	mid	14N, 14W, 13	15-Jun-98	225	CT	32	32	21	1.8-7.4	3.3	14.2	9.3
	mid upper	14N, 13W, 18	15-Jun-98	175	CT	18	18	9	2.2-5.9	3.3	10.3	5.1
Bear Creek, E. Fork	upper	14N, 14W, 13	15-Jun-98	100	CT	16	16	9	2.2-4.9	3.5	16.0	9.0
Bear Creek near North Fork	1.0	15N, 11W, 11A	7-Jul-98	150	CT	7	7	3	2.6-5.5	4	4.7	2.0
Belmont Creek	0.6	14N, 16W, 24B	14-Sep-98	360	RB	168	120	72	2.2-9.3	4.8	33.3	20.0
					LL	55	40	34	2.6-16.5	3.9	11.1	9.4
					SCUL	Present						
	0.5	14N,16W, 24B	8-Aug-97	160	DV	1	1	0	8.5	8.5	0.6	0.0
					RB*	32	16	16	1.2-7.6	3.8	10.0	10.0
					LL	1	1	0	7.5	7.5	0.6	0.0
					SCUL	Present						
					Tailed Frog	Present						
	1.5	14N,16W, 14A	8-Aug-97	350	RB	13	13	4	3.0-9.3	5.0	3.7	1.1
					LL	2	2	0	8.0-15.0	11.5	0.6	0.0
					SCUP	Present						

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Length range (in)	Mean Length (in)	CPUE (#/100' in 1st Pass	YOY CPUE (#/100' in 1st Pass
Blanchard Creek	0.1	14N, 14W, 5A	12-Aug-97	550	CT	2	2	0	5.4,7.1	6.3	0.4	0.0
					RB*	138	96	46	2.1-8.0	4.1	17.5	8.4
					LL	9	5	3	2.8-6.8	4.5	0.9	0.5
					EB	2	1	0	7.9	7.9	0.2	0.0
					SCUL	Common						
					LND	Uncommon						
					MWF	Uncommon						
			23-Sep-98	425	CT	1	1	0	5.1	5.1	0.2	0.0
					RB*	239	140	104	2.4-9.4	4.4	32.9	24.5
					LL	22	17	4	3.3-5.7	4.0	4.0	0.9
					EB	1	1	0	6.3	6.3	0.2	0.0
					SCUL	Common						
					MWF	Uncommon						
Burnt Bridge Creek	lower	14N, 16W, 31	18-Jun-98	250	EB	12	12	7	1.8-5.7	3.2	4.8	2.8
	upper	14N, 16W,36	11-Jun-98	297	EB	5	5	2	2.1-6.8	4.4	2.2	0.9
					tailed frog	present						
Chamberlain Creek	0.1	15N, 13W, 32	17-Sep-98	430	CT	114	98	36	2.0-10.8	4.4	22.8	8.4
					LL	37	28	12	2.0-16.7	4.7	6.5	2.8
					RB	6	5	0	4.4-7.4	5.5	1.2	0.0
					EB	7	6	3	3.2-8.4	4.5	1.4	0.7
					LSS	Uncommon						
					RSS	Uncommon						
					MWF	1	1	0	4.1		0.2	0.0
	0.5	15N, 13W, 3D	17-Sep-98	336	CT	153	101	57	2.0-8.5	3.7	30.1	17.0
					LL	7	7	1	3.5-14.0	6.6	2.1	0.3
					EB	1	1	0	5.5	5.5	0.3	0.0
					SCUL	Common						
	0.7	15N, 13W, 3D	26-Aug-97	295	DV	2	2	0	8.7,8.9	8.8	0.7	0.0
					CT	20	15	8	2.0-7.2	3.7	5.1	2.7
					LL	1	1	1	2.6	2.6	0.3	0.3
					LNS	Present						
					SCUL	Common						
	2.8		17-Sep-98	315	DV	1	1	0	10	10.0	0.3	0.0

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Length range (in)	Mean Length (in)	CPUE (#/100' in 1st Pass	YOY CPUE (#/100' in 1st Pass
					CT	136	115	39	2.0-9.4	4.5	31.5	10.7
					LL	4	4	2	3.5-14.0	6.6	1.1	0.5
					RB	2	2	0	5.0-9.4	7.2	0.5	0.0
	3.8	14N,13W, 8D	18-Sep-98	365	DV	1	1	0	7.6	7.6	0.3	0.0
					CT	189	142	56	0.4-8.6	4.4	38.9	15.3
					EB	14	12	2	2.2-9.8	5.5	3.3	0.5
East Fork Chamberlain			5-Nov-97	175	CT	130	130	114	1.8-6.1	2.1	74.3	65.1
Copper Creek	6.2	15N,8W,9 A	28-Aug-98	550	DV	55	55	34	2.2-7.6		10.0	6.2
					CT	28	28	16	2.8-11.5		5.1	2.9
					Sculpin	Common						
Cottonwood Creek	7.5	15N, 13W, 5C	26-Aug-97	425	CT	2	2	0	4.3-10.4	7.3	0.5	0.0
					EB	167	90	39	2.5-9.3	4.9	21.2	9.2
					LL	44	24	17	2.1-13.7	4.5	5.6	4.0
					SCUL	Present						
					Spotted Frog	Present						
	12.0	16N, 14W, 24DD	30-Jul-97	470	DV	5	2	0	2.3-5.3	4.3	0.4	0.0
					CT	18	12	3	2.7-8.9	5.6	2.6	0.6
					EB	7	4	0	4.1-5.0	4.6	0.9	0.0
					DVxEB	2	2	0	6.0,6.2	6.1	0.4	0.0
					SCUL	Present						
					Tailed Frog	Present						
			1-Oct-98	470	CT	38	27	11	2.1-11.7	5.1	5.7	2.3
					DV	2	0	0	2.8-4.8	5.3	0.0	0.0
					EB	1	1	1	5.3	5.3	0.2	0.2
spring creek	0.1	15N, 13W, 5C	2-Sept-97	240	EB	17	17	13	2.2-4.5	3.5	7.1	5.4
@ mi 7.5					LL	3	3	3	2.4-2.7	2.6	1.3	1.3
					SCUL	Present						
Cottonwood Creek		12N, 11W, 26A	3-Aug-98	235	CT	25	25	8	2.9-8.1	4.8	10.6	3.4
Nevada Creek trib.					EB	3	3	0	4.1-8.4	5.7	1.3	0.0

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Length range (in)	Mean Length (in)	CPUE (#/100' in 1st Pass	YOY CPUE (#/100' in 1st Pass
Douglas Creek	11.2	12N,12W, 14A	19-Aug-97	150	CT	1	1	0	9.1	9.1	0.7	0.0
					LNS	7	7				4.7	
					RSS	24	24				16.0	
					LND	19	19				12.7	
Below lower Reservoir	14.3	12N, 12W, 21A	19-Aug-97		CT	6	6	0	6.9-10.0	8.3		
					LNS	17						
					RSS	21						
					LND	2						
Below upper Reservoir	15.5	12N, 12W, 15A	19-Aug-97	252	CT	36	36	4	2.0-11.4	6.1	14.3	1.6
					LNS	40						
Above upper Reservoir	16	12N, 12W, 15B	19-Aug-97	294	CT	16	16	6	1.3-7.1	4.6	6.3	2.4
Dunham Creek	2.3	16N, 12W, 19B	18-Aug-98	426	CT	48	40	11	1.4-11.2	5.8	6.8	2.6
					DV	64	40	12	2.4-16.3	4.7	9.4	2.8
					EB	7	7	2	2.6-5.0	4.8	1.6	0.5
					SCUL	Common						
	4.2	16N, 13W, 12D	17-Aug-98	660	CT	33	24	5	1.4-9.1	4.7	3.6	0.8
					DV	28	17	4	2.4-9.7	5.2	2.6	0.6
					EB	7	6	0	5.2-6.3	5.0	0.9	0.0
					SCUL	Present						
East Twin Creek	0.2	13N, 17W, 2C	31-Aug-98	460	DV	1	1	0	8.1	8.1	0.2	0.0
					CT	2	1	0	4.9-7.3	6	0.2	0.0
					RB	52	44	34	1.4-5.9	3	9.6	7.4
					LL	14	12	11	2.5-9.2	3.4	2.6	2.4
					EB	33	33	7	2.0-7.1	4.5	7.2	1.5
Elk Creek	2.3	14N, 14W, 31B	23-Sept-97	380	CT	6	3	2	2.6-4.3	3.4	0.8	0.5
					RB*	6	4	2	1.7-14.0	7.9	1.1	0.5

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Length range (in)	Mean Length (in)	CPUE (#/100' in 1st Pass	YOY CPUE (#/100' in 1st Pass
					EB	2	1	1	7	7.0	0.3	0.3
					LL	1	1	0	9.3	9.3	0.3	0.0
					SCUL	Common						
	12.2	12N, 14W, 1B	23-Sep-97	200	EB	26	16	12	2.5-9.6	4.1	8.0	6.0
Gold Creek	0.2	14N , 16W, 31B	12-Sep-97	435	LL	13	9	3	2.2-6.5	4.3	2.1	0.7
					RB	49	28	16	1.6-7.6	3.4	6.4	3.7
	1.9	14N, 16W, 30D	29-Sep-97	435	DV	2	0	0	6.9-7.5	7.1	0.0	0.0
					LL	14	8	0	5.6-16.1	9.5	1.8	0.0
					RB	43	21	14	2.4-7.9	3.6	4.8	3.2
					DVxEB	3	1	0	6.4-8.5	7.7	0.3	0.0
			10-Aug-98	400	CT	8	6	0	5.5-16.3	9.0	1.5	0.0
					DV	2	1	0	7.2-9.8	9.4	0.2	0.0
					DVxEB	1	0	0	11.4	11.4	0.0	0.0
					LL	21	15	11	2.4-12.3	5.1	3.8	2.8
					RB	45	19	10	1.6-11.7	5.0		
					MWF	1	0	0	7.6	7.6	0.2	0.0
					SCUL	Common						
	2.7	14N, 16W, 30B	12-Sep-97	194	CT	9	2	1	3.4-6.5	4.4	1.0	0.5
					LL	10	9	0	5.5-17.7	11.2	4.6	0.0
					RB	6	5	0	4.2-9.0	6.6	2.6	0.0
Johnson Creek	0.1	13N,18W, 14B	12-Aug-97	370	CT*	6	6	1	2.8-5.9	4.9	1.6	0.3
					EB	4	4	1	3.8-7.6	5.4	1.1	0.3
					LL	1	1	0	4.7	4.7	0.3	0.0
					Sculpin	Present						
					Tailed Frogs	Present						
Kleinschmidt Creek	0.5	14N, 11W, 5	11-Aug-98	435	LL	58	41	36	2.2-8.4	3.3	9.4	8.2
					EB	12	8	5	2.5-4.8	3.5	1.8	1.1
					Sculpin	Common						

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Length range (in)	Mean Length (in)	CPUE (#/100' in 1st Pass	YOY CPUE (#/100' in 1st Pass
Kleinschmidt Creek	0.8	14N,11W, 5	11-Aug-98	428	LL	65	52	44	2.1-12.1	8.7	12.1	9.8
					EB	29	22	20	2.5-7.1	3.3	5.1	4.7
					Sculpin							
McElwain Creek	lower	13N,11W, 18	17-Jul-98	400	CT	3	3	0	6.5-7.7	7.0	0.8	0.0
	Upper	13N, 12W, 28	24-Jun-98	310	CT	45	45	14	2.1-6.0	4.2	14.5	4.5
McCabe Creek, above culvert	2.2	15N, 12W, 5C	30-Jul-97	203	CT	19	19	7	1.8-7.5	4.5	9.4	3.4
Monture Creek	0.4	15N, 13W, 27C	17-Aug-98	420	DV	1	1	0	23.8	23.8	0.2	0.0
					CT	3	3	0	7.0-12.8	9.5	0.5	0.0
					*RB	95	95	72	1.6-12.0	4.2	15.3	11.6
					LL	30	30	24	2.4-18.0	4.6	4.8	3.9
					EB	1	1	0	8.3	8.3	0.2	0.0
					LNS	2	2	0	4.3-6.4	5.3	0.3	0.0
					Sculpin	Common						
					Dace	Present						
	2.2	15N, 13W, 22D	17-Aug-98	423	DV	4	4	0	8.4-11.4	9.2	0.9	0.0
					CT	1	1	0	13.3	13.3	0.2	0.0
					*RB	83	83	77			19.6	18.2
					LL	23	23	13			5.4	3.1
					Sculpin							
					Dace							
	5.4	15N, 13W, 13A	14-Aug-98	456	DV	2	2	0	5.5-6.8	6.2	0.4	0.0
					CT	8	8	0	1.1-6.6	2.7	1.8	0.0
					*RB	63	63	60	1.2-4.9	2.0	13.8	13.1
					LL	20	20	19	2.3-5.8	2.8	4.4	4.2
					EB	6	6	4	2.2-5.3	3.6	1.3	0.9
					LNS	2	2	1	2.3-6.2	4.3	0.4	0.2
					Sculpin							
	8.6	15N, 12W, 6C	14-Aug-98	689	DV	18	18	17	2.5-9.8	3.6	2.6	2.5
					*CT	40	40	35	2.0-14.4	2.5	5.8	5.1

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Length range (in)	Mean Length (in)	CPUE (#/100' in 1st Pass	YOY CPUE (#/100' in 1st Pass
					LL	36	36	35	2.0-6.4	2.6	5.2	5.1
					EB	48	48	43	2.7-5.7	3.1	7.0	6.2
					Sculpin							
	12.9	16N. 12W, 29B	14-Aug-98	295	DV	64	64	54	2.7-7.2	3.3	21.6	18.3
					CT	5	5	2	3.7-6.8	4.8	1.7	0.7
					EB	31	31	16	2.2-7.8	4.1	10.5	5.4
					Sculpin	Common						
North Fork Blackfoot River	2.6	14N, 12W, 11C	10-Sep-98	770	RB	25	25	23	2.0-6.2	2.6	3.2	3.0
					LL	60	60	53	2.2-10.0	3.4	7.8	6.9
					EB	1	1	0	4.1	4.1	0.1	0.0
					MWF	1	1	1	3.5	3.5	0.1	0.1
	7.9	14N, 12W, 10D, 11D	10-Sep-98	800	DV	17	17	12	2.8-8.7	4.1	2.1	1.5
					RB	7	7	6	2.4-5.4	2.8	0.9	0.8
					LL	1	1		3	3	0.1	0.0
	11.5	15N, 11W, 15C	16-Sep-98	385	DV	19	19	18	3.0-8.5	3.6	4.9	4.7
					CT	1	1	0	6.5	6.5	0.3	0.0
	17.2	16N, 11W, 35B	16-Sep-98	205	DV	86	86	76	2.8-7.9	3.7	42.0	37.1
ditch @ mi 10.0	0.1	15N, 11W, 21C	30-Jul-98	510	no fish							
ditch @ mi 10.7	0.2	15N, 11W, 28C;	30-Jul-98	825	no fish							
ditch @ mi 15.3	0.1	15N, 11W, 2C	30-Jul-98	1650	no fish							
Pearson Creek	0.1	15N,13W, 33B	7-Aug-97	575	EB	10	10	7	2.6-6.5	4.3	1.7	0.0
Rock Creek	0.7	14N, 11W, 5B	12-Aug-98	502	DV	1	0	0	6.3	6.3	0.0	0.0
					RB	40	40	40	1.2-2.5	1.9	17.8	17.8
					LL	82	62	38	2.9-17.1	4.4	12.4	7.6

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Length range (in)	Mean Length (in)	CPUE (#/100' in 1st Pass	YOY CPUE (#/100' in 1st Pass
					EB	21	13	6	2.4-8.3	5.0	2.6	1.2
					SCUL	Common						
	1.7	14N, 11W, 5A	12-Aug-98	414	RB	1	0	0	2.7	2.7	0	0
					LL	6	6	3	3.3-6.1	4.5	1.4	0.7
					EB	35	28	12	3.2-7.6	4.4	6.7	2.9
					LND	Present						
					LSS	Present						
Shanley Creek	0.2	15N, 13W, 9B	15-Aug-97	360	CT	4	4	1	3.9-8.9	5.4	1.1	0.3
					EB	74	54	30	2.2-10.2	4.4	15.0	8.3
					LL	14	11	7	2.6-8.9	4.0	3.1	1.9
					SCUL	Common						
	1.6	15N, 13W, 3B	15-Aug-97	466	CT	12	10	2	3.0-7.6	5.7	2.1	0.4
					EB	126	73	47	2.0-8.3	3.5	15.7	10.1
					LL	2	2	1	3.1,10.2	6.1	0.4	0.2
					SCUL	Common						
					Spotted Frog	Abundant						
					West. Toad	Uncommo n						
Spring Creek, Trib. to N.F	0.5	15N,13W, 21B	8-Oct-97	650	DV	10	10	10	2.4-3.1	2.7	1.5	1.5
					CT	28	28	21	1.7-7.6	2.9	4.3	3.2
					EB	1	1	1	2.8	2.8	0.2	0.2
	0.6	15N,13W, 21B	27-Oct-97	305	CT	25	25	23	13.5-4.9	2.2	8.2	7.5
					EB	1	1	0	6.9	6.9	0.3	0.0
Warm Springs Creek	0.5	14N, 17W, 36A	18-Jun-98	215	RB	3	3	0	4.5-6.0	5.5	1.4	0.0
	0.8		18-Jun-98	200	RB*	7	7	2	3.6-5.9	4.2	3.5	1.0
Warren Creek	0.1	14N, 13W, 1B	16-Sept-97	200	LL	15	9	1	3.8-10.6	6.5	4.5	0.5
					RB	7	3	0	5.8-9.2	6.6	1.5	0.0
					SUCKE R	Present						
					SCUL	Present						
	0.4	14N, 13W, 1A	16-Sept-97	120	LL	6	6	4	3.3-5.0	6.5	5.0	3.3

Stream	River Mile	Location (T, R, S)	Date Sampled	Section Length (ft)	Species	Total Number Captured	Number Captured 1st Pass	YOY Captured 1st Pass	Length range (in)	Mean Length (in)	CPUE (#/100' in 1st Pass	YOY CPUE (#/100' in 1st Pass
					RB	4	3	3	2.9-3.5	3.1	2.5	2.5
	1.1	15N, 12W, 31C	16-Sept-97	510	EB	3	3	0	4.1-8.4	5.7	0.6	0.0
					RB	1	1	0	6.9	6.9	0.2	0.0
					LL	11	9	3	3.5-8.5	5.6	1.8	0.6
					LNS	61	61	25	2.2-9.8	5.2	12.0	4.9
					LSS	7	7	0	4.1-6.3	5.1	1.4	0.0
					RSS	3	3	1	3.9-4.0	3.9	0.6	0.2
	3.6	15N, 12W, 32C	23-Sept-97	420	EB	77	77	5	3.1-10.5	5.3	18.3	1.2
					LNS	9	9	2	3.3-7.9	5.9	2.1	0.5
					LSS	17	17	16	2.0-4.4	2.6	4.0	3.8
					SCUL	7	7	2	3.3-4.6	4.1	1.7	0.5
Yourname Creek	1.8	13N, 12W, 10B	17-Aug-92	150	CT	45	39	23	2.4-7.0	0.0	26.0	15.3
East Twin Creek	2		31-Aug-98	460	DV	1	1	0	8.1	8.1	0.2	0.0
					CT	2	1	0	4.9-7.3	6	0.2	0.0
					RB	52	44	34	1.4-5.9		9.6	7.4
					LL	14	12	11	2.5-9.2		2.6	2.4
					EB	33	33	7	2.0-7.1		7.2	1.5

***YOY may include RB×CT hybrids**

Exhibit B: Mark-recapture population estimates in the Blackfoot River drainage, 1998

Stream	River Mile Mid-point	Location (T,R,S)	Date Sampled	Section Length (ft)	Species	Size Class (in)	Marked	Captured	Recaptured	Efficiency	Total Estim ± 95%CI	Estim/1000' ± 95%CI
Blackfoot River, Johnsrud Section	13.5	13N,16 W,6	28-May-98	18700	CT	6.0-11.9	36	32	6	0.17	173± 109	9.3 ± 5.7
						≥12.0	15	11	3	0.20	47 ± 34	2.5 ± 1.8
					DV	≥6.0	9	13	2	0.22	46 ± 40	2.4 ± 2.1
					LL	≥6.0	47	37	7	0.15	227 ± 134	12.1 ± 7.0
					*RB	5.0-9.9	161	168	13	0.08	1995 ± 967	104 ± 51
						10.0-11.9	27	27	8	0.30	86 ± 45	4.6 ± 2.4
						≥12.0	33	17	0	0.00		
Scotty Brown	43.9	15N,13 W,32	19-May-98	20064	CT	≥6.0	19	17	4	0.21	71 ± 49	3.5 ± 2.4
						≥12.0	87	89	17	0.20	439 ± 180	21.9 ± 8.8
					DV	≥6.0	11	17	2	0.18	71 ± 65	3.5 ± 3.2
					LL	6.0-11.9	33	31	7	0.21	135 ± 78	6.7 ± 3.8
						≥12.0	34	26	6	0.18	134 ± 82	6.7 ± 4.0
					*RB	4.0-11.0	51	41	8	0.16	242 ± 135	12.0 ± 6.6
						11.0-13.9	33	21	3	0.09	186 ± 150	9.3 ± 7.4
						≥14.0	26	24	5	0.19	112 ± 73	5.6 ± 3.6
North Fork Blackfoot River	4.0	12W,14 N,10D	29-Aug-98	20430	CT	≥8.0	26	19	8	0.31	59 ± 28	2.9 ± 1.3
						≥12.0	15	6	3	0.20	27 ± 16	1.3 ± 0.8
					DV	6.0-11.9	9	18	1	0.11	94 ± 103	4.6 ± 4.9
						≥12.0	20	14	3	0.15	78 ± 60	3.8 ± 2.9
					LL	6.0-11.9	49	57	14	0.29	192 ± 83	9.4 ± 4.0
						≥12.0	61	68	29	0.48	142 ± 38	6.9 ± 1.8
					*RB	6.0-11.9	18	26	3	0.17	127 ± 105	6.2 ± 5.0
						≥12.0	22	20	6	0.27	68 ± 39	3.3 ± 1.9

*Includes fish identified as hybrids

Exhibit C: Summary of two and three pass population estimates in the Blackfoot River drainage, 1997-1998.

Stream	River Mile	Location (T,R,S)	Date Sampled	Section Length (ft)	Species	Size Class (in)	1st Pass	2nd Pass	3rd Pass	Prob. of Capture	Total Estimate ± CI	Estim/100' ± CI
Bear Creek	1.1	13N, 16W, 18B, 7C	31-Jul-98	310	RB	<4.0	8	0	-	1.00	8.0 ± 0.0	2.6 ± 0.0
						>4.0	23	8	-	0.65	35.3 ± 8.9	11.4 ± 2.9
					LL	<4.0	4	2	-	0.50	8.0 ± 9.6	2.6 ± 3.1
						>4.0	2	0	-	1.00	2.0 ± 0.0	0.6 ± 0.0
					EB	>4.0	3	0	-	1.00	3.0 ± 0.0	1.0 ± 0.0
	1.5	13N,16W, 13B	31-Jul-98	327	RB	<4.0	6	1	-	0.83	7.2 ± 1.2	2.2 ± 0.4
						>4.0	18	1	-	0.94	19.6 ± 0.5	5.8 ± 0.2
					LL	<4.0	0	0	-	0.00		
						>4.0	2	0	-	1.00	2.0 ± 0.0	0.6 ± 0.0
					EB	<4.0	4	1	-	0.75	5.3 ± 1.9	1.6 ± 0.6
						>4.0	16	1	-	0.94	17.0 ± 0.6	5.2 ± 0.2
Belmont Creek	0.5		8-Aug-97	160	DV	>4.0	1	0	-	1.00	1.0 ± 0.0	0.6 ± 0.0
					RB	>4.0	16	10	-	0.38	42.7 ± 44.4	26.7 ± 27.8
					LL	>4.0	1	0	-	1.00	1.0 ± 0.0	0.6 ± 0.0
	0.6		14-Sep-98	360	LL	<4.0	34	13	-	0.62	52.6 ± 18.7	14.6 ± 5.2
						>4.0	6	2	-	0.67	9.0 ± 4.2	2.5 ± 1.2
					RB	<4.0	72	36	-	0.50	144 ± 41	40.0 ± 11.3
						>4.0	47	12	-	0.74	63.1 ± 6.9	17.5 ± 1.9
Blanchard Creek	0.1	14N, 14W, 5A	12-Aug-97	550	CT	>4.0	2	0	-	1.00	2.0 ± 0.0	0.4 ± 0.0
					RB	<4.0	46	14	-	0.70	66.1 ± 9.5	12.0 ± 1.7
						>4.0	50	18	-	0.64	78.1 ± 14.2	14.2 ± 2.6
			23-Sept-98	425	RB	<4.0	199	60	-	0.70	285 ± 19.5	67.0 ± 4.6
						>4.0	39	10	-	0.74	52.5 ± 6.4	12.3 ± 1.5
					LL	<4.0	5	2	-	0.60	8.3 ± 5.8	2.0 ±1.4
						>4.0	12	3	-	0.75	16.0 ± 3.4	3.8 ± 0.8
Chamberlain Creek	0.1	15N,13W,32	17-Sep-98	430	CT	<4.0	27	19	-	0.30	91.1 ± 106.6	21.2 ± 24.8
						>4.0	49	17	-	0.65	75.0 ± 13.0	17.4 ± 3.0
					LL	<4.0	12	5	-	0.58	20.6 ± 9.9	4.8 ± 2.3
						>4.0	16	4	-	0.75	21.3 ± 3.9	5.0 ± 0.9
	0.7	15N, 13W, 3D	26-Aug-97	295	DV	>4.0	2	0	-	1.00	2.0 ± 0.0	0.7 ± 0.0
					CT	<4.0	8	2	-	0.75	10.7 ± 2.8	3.6 ± 0.9
						>4.0	7	3	-	0.57	12.2 ± 8.1	4.2 ± 2.8
					LL	<4.0	1	0	-	1.00	1.0 ± 0.0	0.3 ± 0.0
	0.5	15N, 13W, 3D	17-Sep-98	336	CT	<4.0	57	28	-	0.51	112 ± 34.3	33.3 ±10.2
						>4.0	44	23	-	0.48	92.2 ± 36.8	27.4 ± 11.0
					LL	<4.0	1	0	-	1.00	1.0 ± 0	0.3 ± 0.0
						>4.0	6	0	-	1.00	6.0 ± 0.0	1.8 ± 0.0
	2.8	15N, 13W, 32	17-Sep-98	315	CT	<4.0	41	4	-	0.90	45.4 ± 1.6	14.4 ± 0.5
						>4.0	73	17	-	0.77	95.2 ± 7.4	30.2 ± 2.3
					LL	<4.0	2	0	-	1.00	2.0 ± 0.0	0.6 ± 0.0
						>4.0	2	0	-	1.00	2.0 ± 0.0	0.6 ± 0.0
	3.8	14N,13W,17A	18-Sep-98	365	CT	<4.0	56	25	-	0.55	101 ± 26	27.7±7.0
						>4.0	86	22	-	0.74	116±9	31.7±2.6
					EB	>4.0	10	1	-	0.90	11.1±0.8	3.3±0.2
Cottonwood Creek	12.0	16N,14W,24D	30-July-97	470	CT	<4.0	3	0	-	1.00	3.0 ± 0.0	0.6 ± 0.0
						>4.0	9	3	-	0.67	13.5 ± 5.1	2.9 ± 1.1
					EB	>4.0	4	0	-	1.00	4.0 ± 0.0	0.9 ± 0.0

Stream	River Mile	Location (T,R,S)	Date Sampled	Section Length (ft)	Species	Size Class (in)	1st Pass	2nd Pass	3rd Pass	Prob. of Capture	Total Estimate ± CI	Estim/100' ± CI
					DVxEB	<4.0	2	0	-	1.00	2.0 ± 0.0	0.4 ± 0.0
			1-Oct-98	470	CT	<4.0	12	3	-	0.75	16.0 ± 3.4	3.4 ± 0.7
						>4.0	15	8	-	0.47	32.1 ± 23.0	6.8 ± 4.9
Dunham Creek	2.3	16N, 13W, 12D	18-Aug-98	426	CT	<4.0	11	7	-	0.36	30.2 ± 40.0	7.1 ± 9.4
						>4.0	18	11	-	0.39	46.3 ± 42.7	10.9 ± 10.0
					DV	<4.0	13	11	-	0.15		
						>4.0	27	13	-	0.52	52.1 ± 22.2	12.2 ± 5.2
					EB	3.0-8.3	7	0	-	1.00	7.0 ± 0.0	1.6 ± 0.0
					ALL	>4.0	50	24	-	0.52	96.2±29.9	22.6±7.0
	4.2	16N, 13W, 12D	18-Aug-98	660	DV	>4.0	13	7	-	0.46	28.2 ± 22.2	4.3 ± 3.4
					CT	>4.0	18	3	-	0.83	21.6 ± 2.2	3.3 ± 0.3
					EB	>4.0	6	1	-	0.83	7.2 ± 1.2	1.1 ± 0.2
					ALL	>4.0	37	11	-	0.70	52.7 ±8.2	8.0 ±1.2
Elk Creek	2.3	14N, 14W, 31B	23-Sep-97	380	CT	>4.0	1	0	-	1.00	1.0 ± 0.0	0.3 ± 0.0
					RB	>4.0	2	0	-	1.00	2.0 ± 0.0	0.5 ± 0.0
					LL	>4.0	1	0	-	1.00	1.0 ± 0.0	0.3 ± 0.0
	12.2	12N,14W,1B	23-Sep-97	200	EB	<4.0	12	8	-	0.33	36.0 ± 52.6	18.0 ± 26.3
						>4.0	4	2	-	0.50	8.0 ± 9.6	4.0 ± 4.8
Gold Creek	0.2	14N, 16W, 31b	12-Sep-97	592	DV	>4.0	1	0		1.00	1.0±0.0	0.2±0.0
					RB	>4.0	12	7		0.42	28.8±28.7	4.9±4.7
					LL	>4.0	6	2		0.67	9.0±4.2	1.5±0.7
	1.9	14N, 16W, 30D	10-Aug-98	400	DV	>4.0	1	1	-			
					CT	>4.0	6	1	-	0.83	7.2 ± 1.2	1.8 ± 0.3
					RB	<4.0	10	1	-	0.90	11.1 ± 0.8	2.8 ± 0.2
					LL	<4.0	11	0	-	1.00	11.0 ± 0.0	2.8 ± 0.0
						>4.0	4	3	-	0.25		
	2.5	14N,16W,30b	12-Sep-97	375	RB	>4.0	5	1		0.80	6.2 ±1.5	1.7 ±0.4
					LL	>4.0	9	1		0.89	10.1±0.9	2.7±0.2
Kleinschmidt Creek	0.5	14N, 11W, 5	11-Aug-98	435	LL	<4.0	36	13	-	0.64	56.4 ± 12.1	13.0 ± 2.8
						>4.0	6	3	-	0.50	12.0 ± 11.7	2.8 ± 2.7
					EB	<4.0	5	4	-	0.20		
						>4.0	3	0	-	1.00	3.0 ± 0.0	0.7 ± 0.0
	0.8		11-Aug-98	428	LL	<4.0	44	10	-	0.77	56.9 ± 5.5	13.3 ± 1.3
						>4.0	8	3	-	0.63	12.8 ± 6.2	3.0 ± 1.5
					EB	<4.0	20	5	-	0.75	26.7 ± 4.4	6.2 ± 1.1
						>4.0	2	2	-	0.00		
Rock Creek	0.7	14N, 11W, 5B	12-Aug-98	502	EB	<4.0	6	2	-	0.67	9.0 ± 4.2	1.8 ± 0.8
						>4.0	7	6	-	0.14		
					LL	<4.0	40	18	-	0.55	72.7 ± 22.2	14.5 ± 4.4
						>4.0	22	2	-	0.91	24.2 ± 1.1	4.8 ± 0.2
					all	>4.0	30	8	-	0.73	40.9±6.0	8.1±1.2
	1.7	14N, 11W, 5A	12-Aug-98	414	LL	>4.0	3	0	-	1.00	3.0 ± 0.0	0.7 ± 0.0
						<4.0	3	0	-	1.00	3.0 ± 0.0	0.7 ± 0.0
					EB	>4.0	12	2	-	0.83	14.4 ± 1.8	3.5 ± 0.4
						<4.0	16	5	-	0.69	23.3 ± 5.9	5.6 ± 1.4
					all	>4.0	15	2	-	0.87	17.1±1.4	4.2 ± 0.3
Shanley Creek	0.2	15N, 13W, 9B	15-Aug-97	360	CT	>4.0	3	0	-	1.00	3.0 ± 0.0	0.8 ± 0.0
					LL	>4.0	4	3	-	0.25	16.0 ± 15.6	5.3 ± 20.7
					EB	>4.0	24	6	-	0.75	32.0 ± 4.8	8.9 ± 1.3

Stream	River Mile	Location (T,R,S)	Date Sampled	Section Length (ft)	Species	Size Class (in)	1st Pass	2nd Pass	3rd Pass	Prob. of Capture	Total Estimate ± CI	Estim/100' ± CI
	1.6	15N, 13W, 3B	15-Aug-97	466	ALL	>4.0	31	9	-	0.71	43.7 ± 7.1	12.1 ± 2.0
					CT	>4.0	8	1	-	0.88	9.1 ± 1.0	2.0 ± 0.2
					EB	>4.0	26	9	-	0.65	39.8 ± 9.4	8.5 ± 2.0
Warren Creek	0.4	14N, 13W, 1A	16-Sep-97	120	RB	2.9-4.8	3	1	-	0.67	4.5±2.9	3.8±2.5
					LL	3.3-5.0	6	0	-	1.00	6.0±0.0	5.0±0.0
	1.1	15N,12W, 31C	16-Sep-97	510	RB	>4.0	1	0	-	1.00	1.0±0.0	0.2±0.0
					LL	<4.0	3	1	-	0.67	4.5±2.9	0.9±0.6
						>4.0	6	1	-	0.83	7.2±1.2	1.4±0.2
					EB	>4.0	3	0	-	1.00	3.0±0.0	0.6±0.0
	3.6	15N,12W,32C	23-Sep-97	420	EB	<4.0	5	1	-	0.80	6.2±1.5	1.5±0.4
						>4.0	72	27	-	0.63	115±19	27.4±4.5
					LSS	2.0-4.9	17	13	-	0.24	72.2±148	17.2±35.3
					LNS	7.3-8.2	9	5	-	0.44	20.2±20.6	4.8±4.9
					Sculpin	3.3-5.1	7	4	-	0.43	16.3±20.2	3.9±4.8

* Sample may include rainbow trout/cutthroat trout hybrids

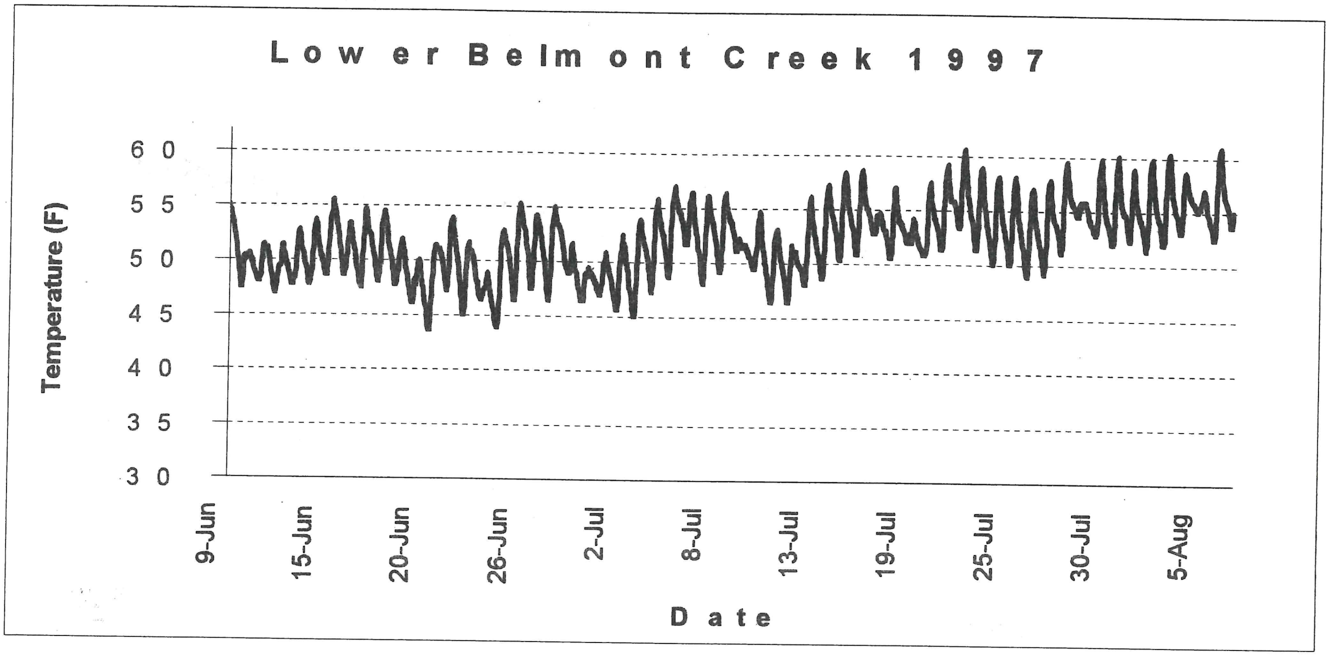
Exhibit D: Hobo locations from 1994-1998

Stream	Section	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	94	95	96	97	98
Bear Creek	Mile 1.0								x	x	x							x
Belmont	Lower Belmont Creek								x	x	x	x			x			
Belmont	Lower Belmont Creek						x	x	x								x	
Belmont	Lower Belmont Creek					x	x	x	x	x	x							x
Belmont	Lower Belmont Creek							x	x	x						x		
Blackfoot	Belmont Creek								x	x	x			x				
Blackfoot	Belmont Creek				x	x	x		x		x	x			x			
Blackfoot	Belmont Creek						x	x								x		
Blackfoot	Belmont Creek							x									x	
Blackfoot	Cutoff Bridge					x	x	x	x	x	x							x
Blackfoot	Helmville Cutoff Bridge								x	x	x	x	x	x				
Blackfoot	Helmville Cutoff Bridge								x	x	x				x			
Blackfoot	Above Landers Fork					x	x	x	x	x	x							x
Blackfoot	Raymond Bridge								x	x	x			x				
Blackfoot	Raymond Bridge								x	x	x				x			
Blackfoot	Raymond Bridge					x	x	x	x	x	x							x
Blackfoot	Scotty Brown Bridge						x	x	x	x	x					x		
Blackfoot	Scotty Brown Bridge								x	x	x							x
Blackfoot	Wisherd Bridge								x	x	x	x	x	x				
Blackfoot	Wisherd Bridge		x	x	x				x	x	x				x			
Blackfoot	Wisherd Bridge						x	x	x	x						x		
Blackfoot	Wisherd Bridge						x	x	x								x	
Blackfoot	Wisherd Bridge					x	x	x	x	x	x							x
Blackfoot North Fork	Harry Morgan			x	x	x	x	x	x	x	x							x
Blackfoot North Fork	Ovando-Helmville								x	x	x	x	x	x				
Blackfoot North Fork	Ovando-Helmville				x	x	x		x	x	x				x			
Blackfoot North Fork	Ovando-Helmville						x	x	x	x						x		
Blackfoot North Fork	USFS Bridge								x	x	x	x	x	x				
Blackfoot North Fork	USFS Bridge				x	x	x		x	x	x				x			
Blackfoot North Fork	USFS Bridge							x	x	x						x		

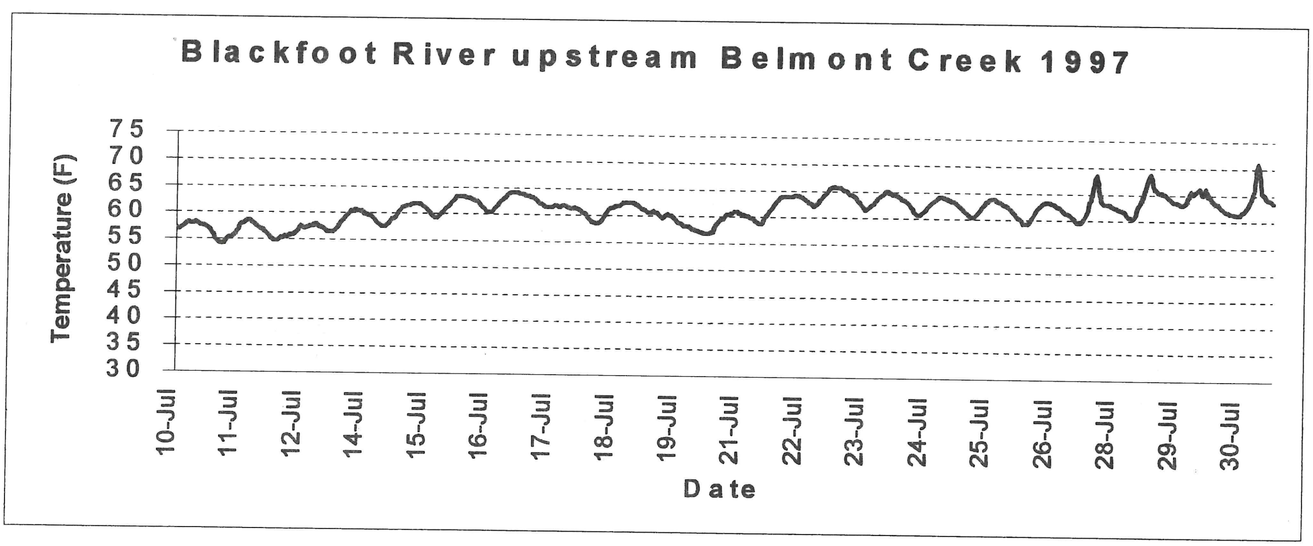
Stream	Section	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	94	95	96	97	98
Chamberlain Creek							x	x	x	x							x	
Clearwater River	Mouth					x	x	x	x	x	x							x
Copper Creek	USFS Bridge						x	x	x	x						x		
Copper Creek	USFS Bridge							x	x								x	
Cottonwood Creek	Above Shanley						x	x	x								x	
Cottonwood Creek	Above HWY 200						x	x	x								x	
Dick Creek	Widgeon Pond bridge						x	x	x								x	
Dick Creek	Near mouth					x	x	x									x	
Dick Creek	Below Widgeon						x	x	x								x	
Douglas Creek	Above reservoirs					x	x	x	x									x
Douglas Creek	Below reservoirs					x	x	x	x									x
East Twin Creek	Near mouth					x	x	x	x	x	x							x
Elk Creek	HWY 200 Crossing								x	x	x			x				
Elk Creek	HWY 200 Crossing					x	x		x	x	x				x			
Elk Creek	HWY 200 Crossing						x	x	x	x						x		
Elk Creek	HWY 200 Crossing						x	x	x								x	
Elk Creek	Mouth				x	x	x		x	x	x				x			
Elk Creek	Mouth						x	x	x								x	
Elk Creek	sunset hill bridge								x	x	x			x				
Elk Creek	sunset hill bridge				x	x	x		x	x	x				x			
Elk Creek	sunset hill bridge						x	x	x	x						x		
Elk Creek	sunset hill bridge						x	x	x								x	
Gilbert	above reservoir				x	x	x	x	x	x	x				x			
Gilbert	above reservoir						x	x	x							x		
Gold Creek	Mouth						x	x	x							x		
Gold Creek	Plum Creek bridge						x	x	x	x						x		
Gold Creek	Plum Creek bridge					x	x	x										x
Hoyt Creek	HWY 200					x	x	x	x	x							x	
Johnson	Mouth								x	x	x	x		x				

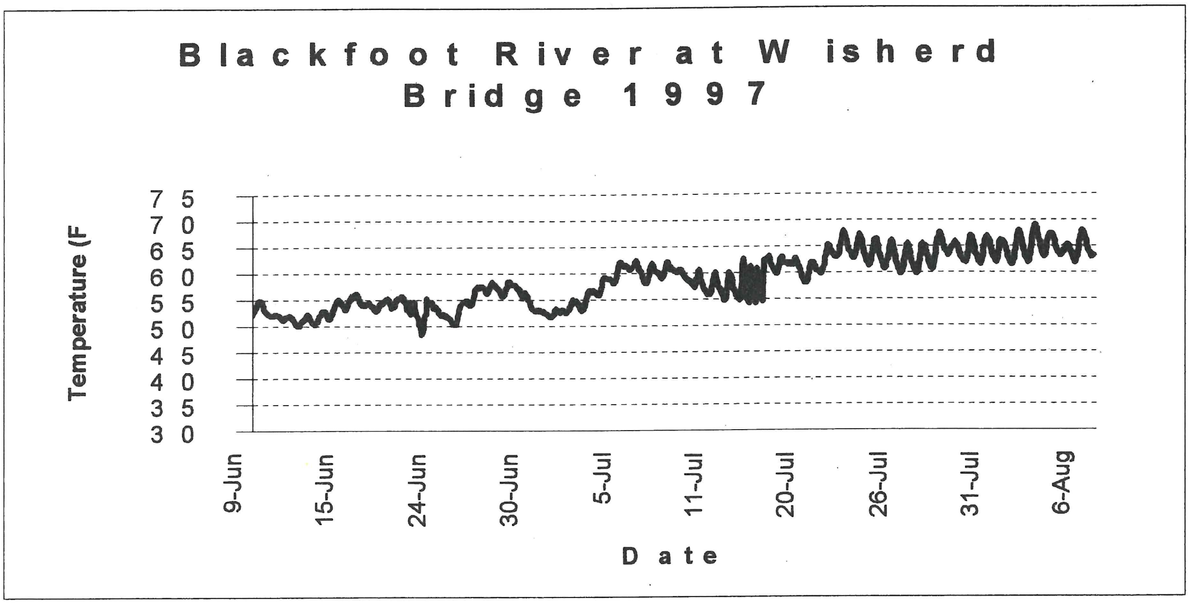
Stream	Section	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	94	95	96	97	98
Johnson	Mouth				x	x	x		x	x	x				x			
Johnson	Mouth						x	x	x	x	x					x		
Kleinschmidt Creek	Mouth					x	x	x	x	x	x							x
Landers Fork	FS Bridge								x	x						x		
Landers Fork	HWY 200 Bridge								x	x						x		
Landers Fork	HWY 200 Bridge							x	x	x								x
McCabe Creek	County road					x	x	x	x	x								x
Monture	HWY 200 Bridge	x	x	x	x	x	x		x	x	x			x				
Monture	HWY 200 Bridge				x	x	x								x			
Monture	HWY 200 Bridge						x	x	x	x						x		
Monture	HWY 200 Bridge							x	x								x	
Monture	HWY 200 Bridge					x	x	x	x	x	x							x
Monture	Monture Campground Bridge	x	x	x	x	x	x		x	x	x	x	x	x				
Monture	Monture Campground Bridge				x	x	x		x	x	x				x			
Monture	Monture Campground Bridge						x	x	x	x						x		
Nevada	Above Douglas Creek								x	x	x	x	x	x				
Nevada	Above Douglas Creek				x	x	x		x	x	x				x			
Nevada	Below Douglas Creek								x	x	x			x				
Nevada	Below Douglas Creek				x	x	x		x	x	x				x			
Nevada	Below Douglas Creek						x	x	x	x	x					x		
Nevada	Helmville					x	x	x	x	x	x							x
Nevada	Below Nevada Reservoir								x	x	x	x	x	x				
Nevada	Below Nevada Reservoir				x	x	x		x	x	x				x			
Nevada	Below Nevada Reservoir						x	x								x		
Nevada	Below Nevada Reservoir						x	x	x								x	
Nevada	Below Nevada Reservoir					x	x	x	x	x	x							x
Nevada	Mouth								x	x	x	x	x	x				
Nevada Spring	Mouth								x	x	x	x		x				
Nevada Spring	Mouth				x	x	x		x	x	x				x			
Rock Creek	Near mouth					x	x	x	x	x							x	
Rock Creek	Near mouth					x	x	x	x	x								x
Shanley Creek	Near mouth						x	x	x								x	
West Twin Creek	Near mouth					x	x	x	x	x	x							x

Exhibit E: Water temperature-monitoring summaries for the Blackfoot River and tributaries, 1997-1998

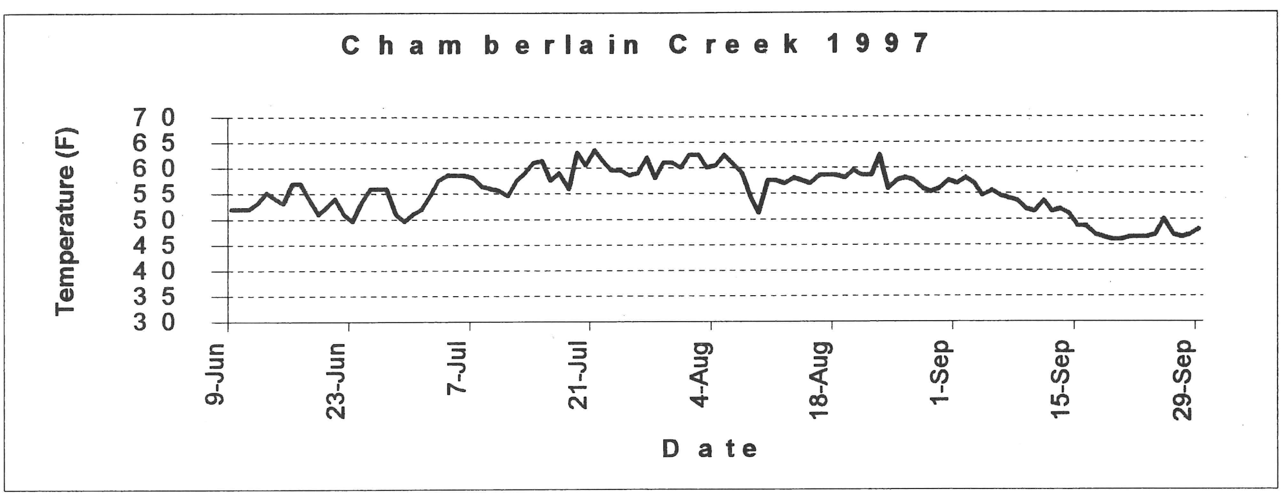


	June	July	Aug
Minimum	43.6	45.0	51.4
Maximum	55.6	60.6	60.9
Mean	50.0	52.6	55.4
Standard Deviation	2.4	3.0	2.2

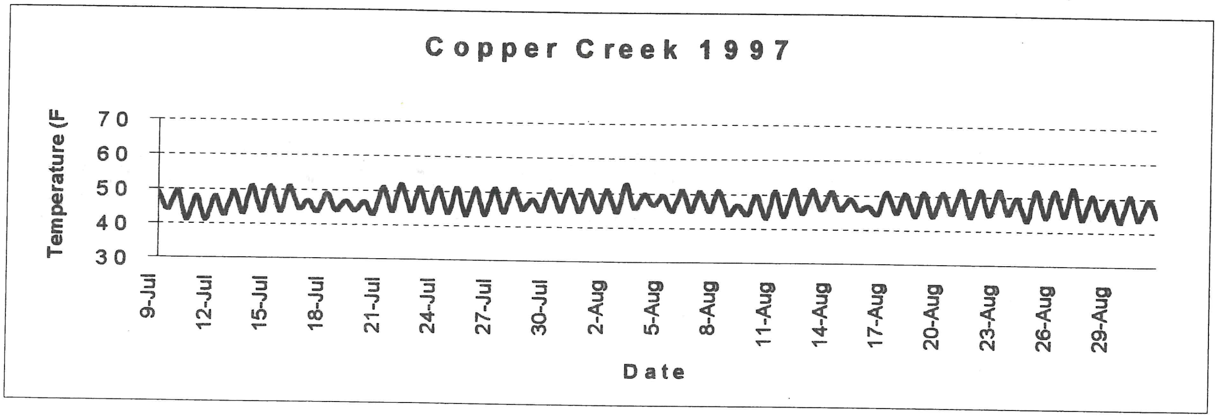




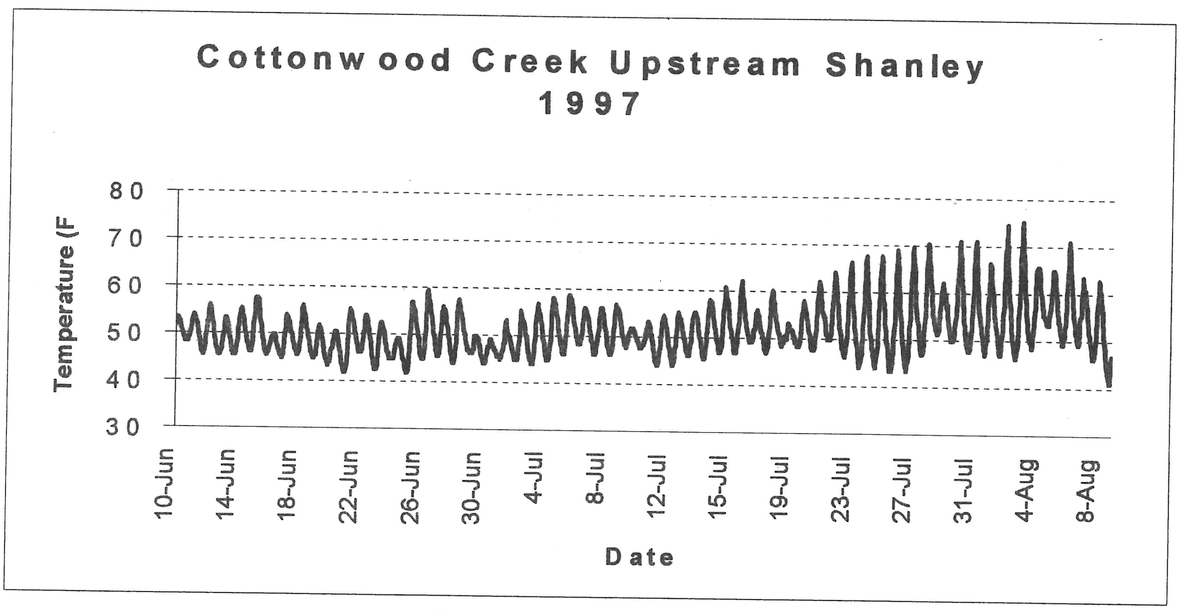
	June	July	August
Minimum	48.3	51.7	61.5
Maximum	58.4	67.9	69.0
Mean	53.8	60.1	64.6
Standard Deviation	2.2	3.9	1.9



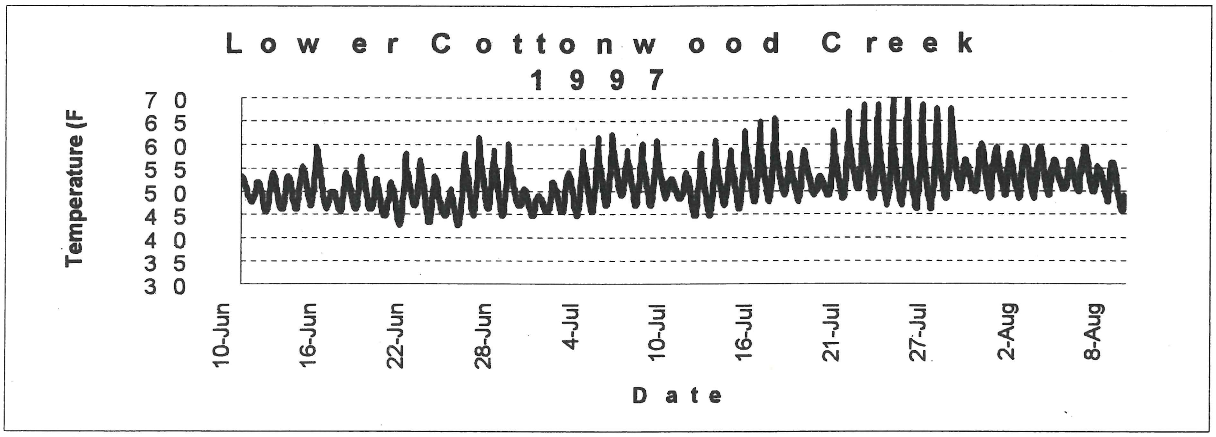
	June	July	August	September
Minimum	43.0	43.5	48.0	41.0
Maximum	57.0	63.5	62.5	58.0
Mean	50.1	54.6	55.4	48.7
Standard Deviation	3.9	4.8	3.6	4.4



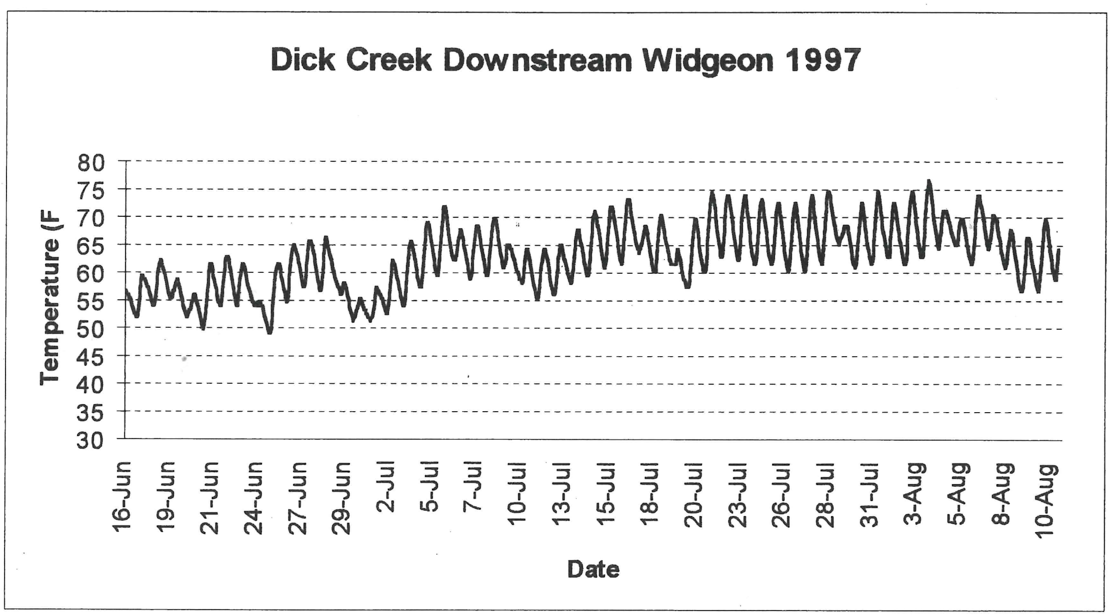
	July	August
Minimum	41.0	43.0
Maximum	52.0	52.5
Mean	46.6	47.6
Standard Deviation	3.4	3.3



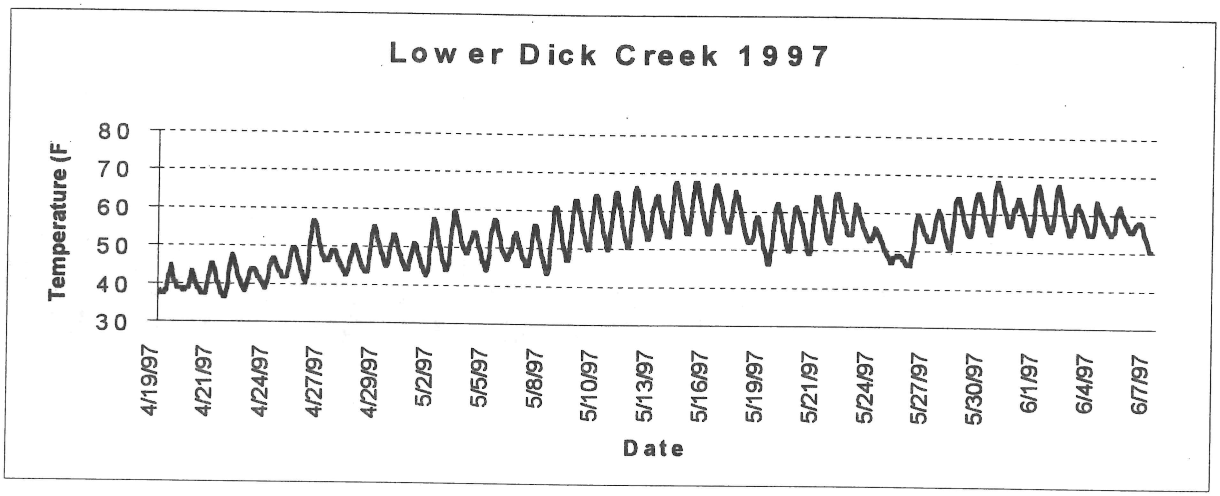
	June	July	August
Minimum	41.7	43.2	41.0
Maximum	59.4	71.1	75.3
Mean	49.1	51.9	55.5
Standard Deviation	3.7	5.3	7.1



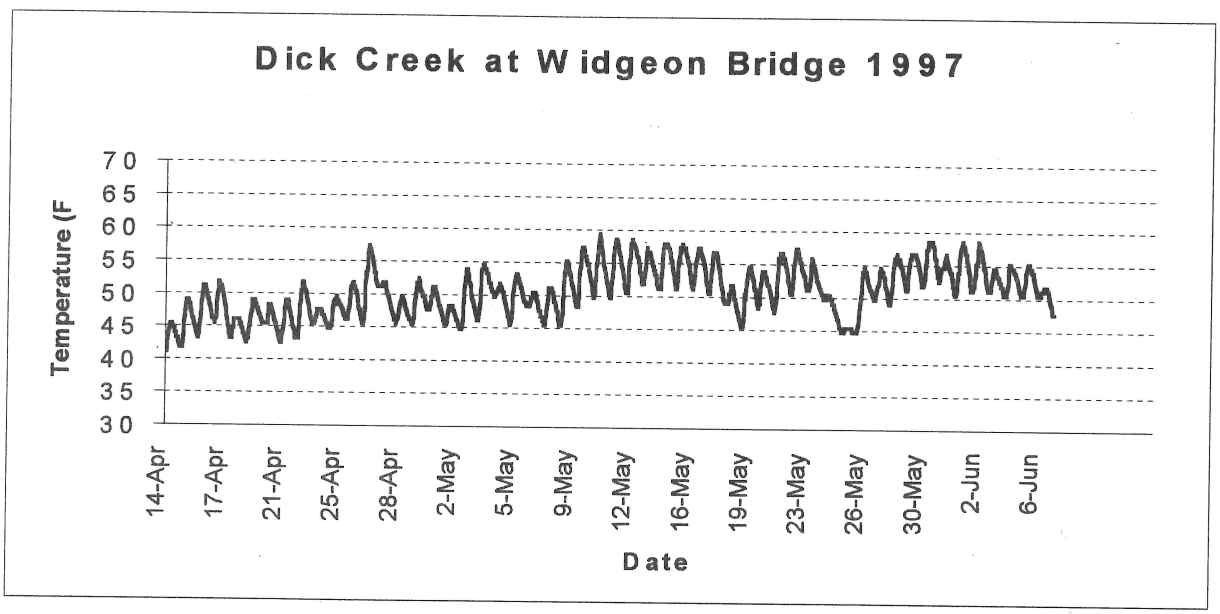
	June	July	August
Minimum	42.50	44.70	45.40
Maximum	61.50	70.40	59.40
Mean	49.59	52.33	53.12
Standard Deviation	3.53	4.58	3.34



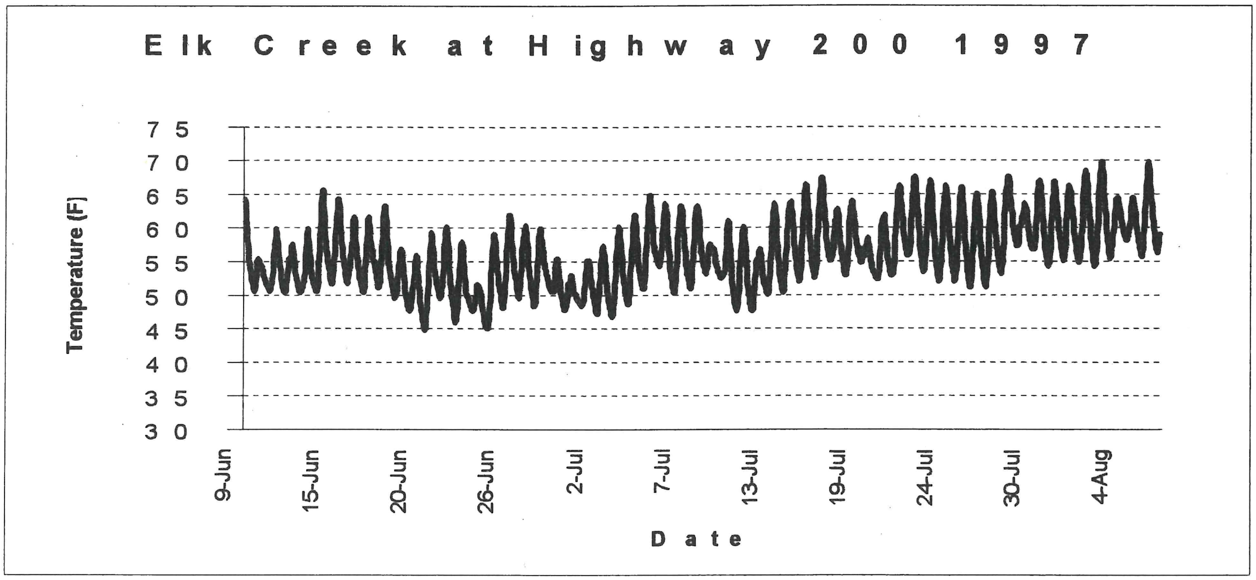
	June	July	August
Minimum	49.0	51.1	56.7
Maximum	66.3	74.6	76.7
Mean	57.5	63.9	66.3
Standard Deviation	3.8	5.3	4.4



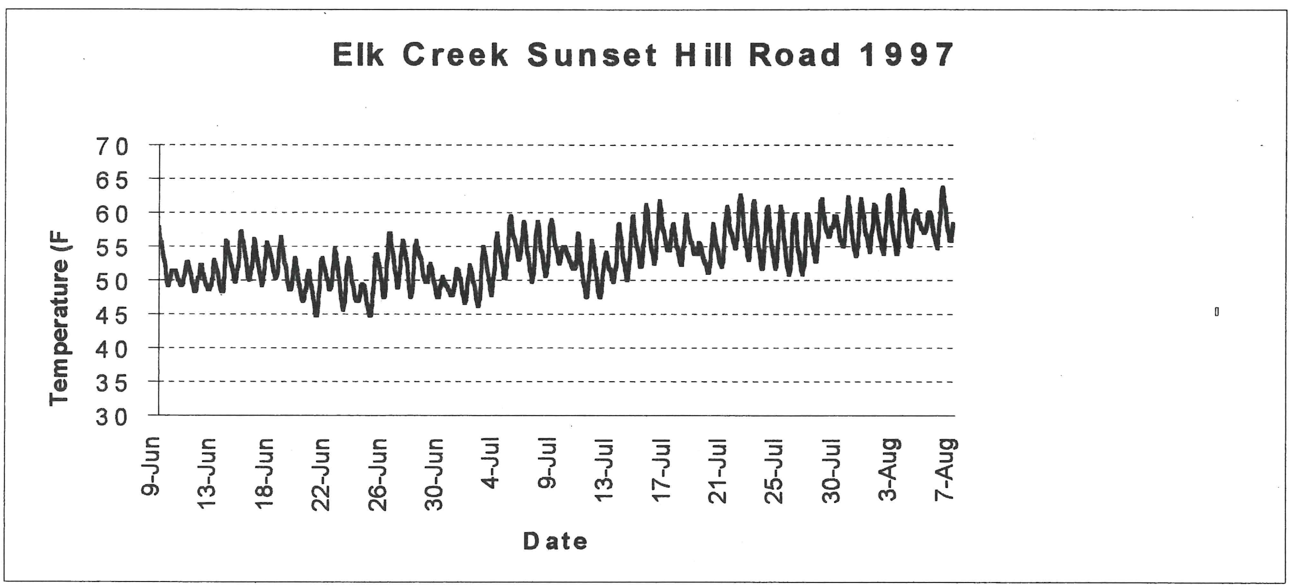
	April	May	June
Minimum	36.40	42.50	50.40
Maximum	56.70	68.40	67.70
Mean	43.81	54.97	58.72
Standard Deviation	4.68	5.94	3.66



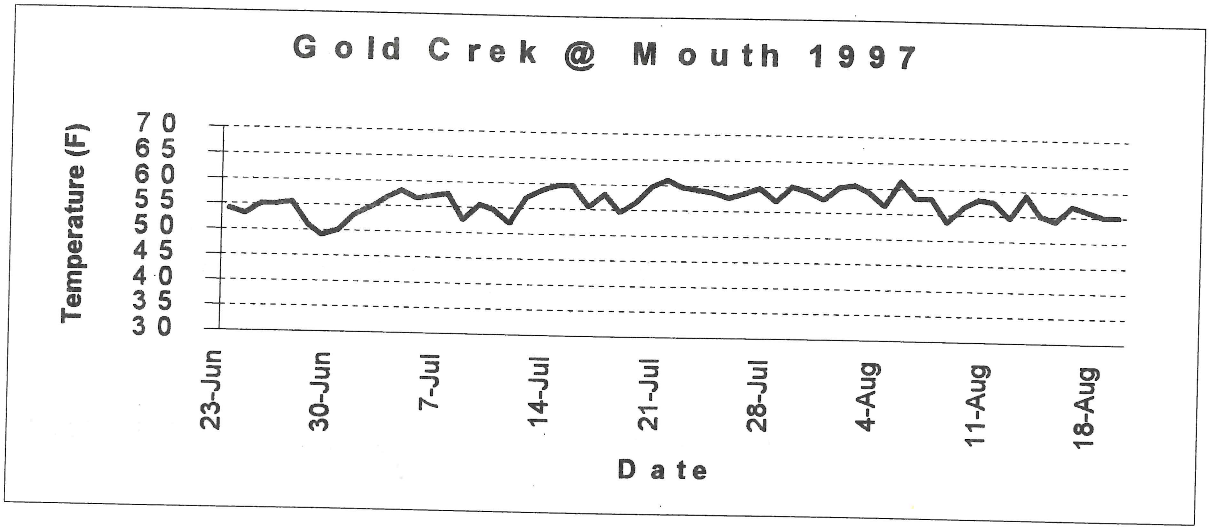
	April	May	June
Minimum	41.0	44.7	47.6
Maximum	57.4	59.4	58.7
Mean	47.4	51.8	53.3
Standard Deviation	2.9	3.6	2.4



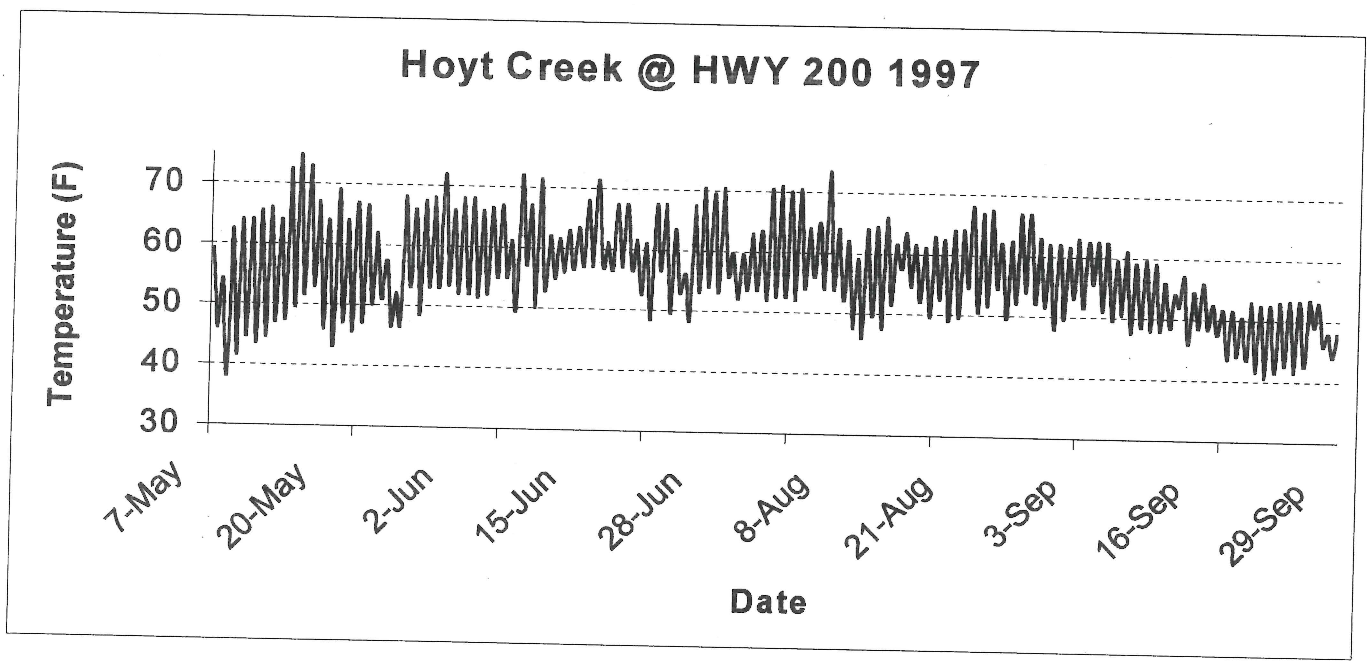
	June	July	August
Minimum	44.8	46.7	54.2
Maximum	65.6	67.6	69.7
Mean	53.7	56.7	60.7
Standard Deviation	4.2	5.0	4.5



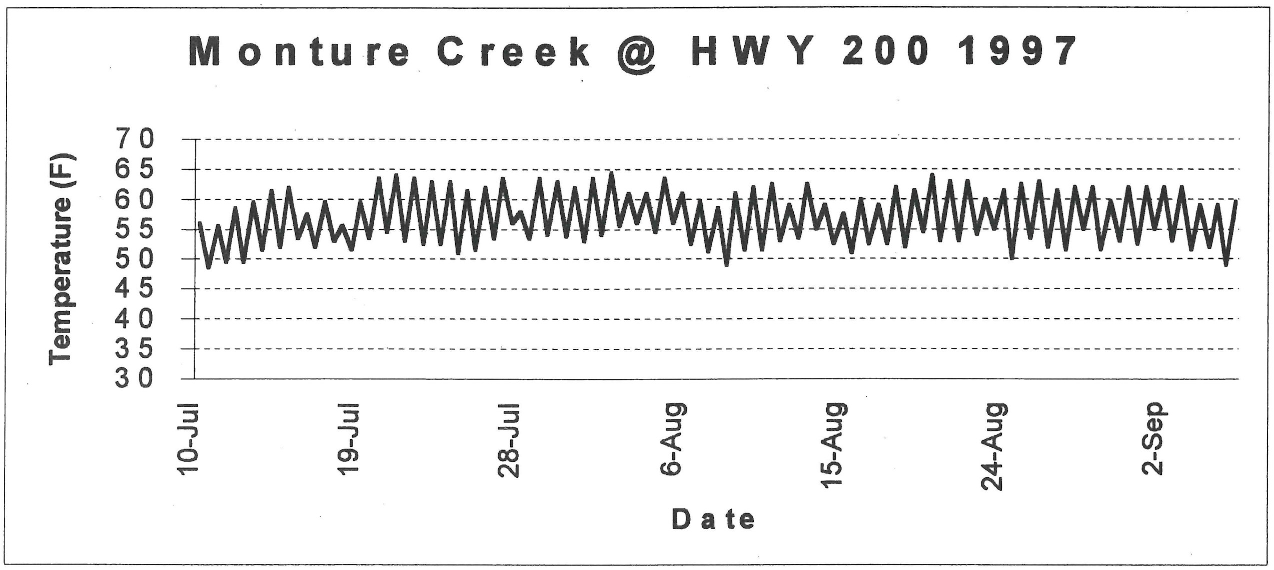
	June	July	August
Minimum	44.71	46.10	53.62
Maximum	57.81	62.65	63.80
Mean	51.02	54.42	58.00
Standard Deviation	2.65	3.59	2.53



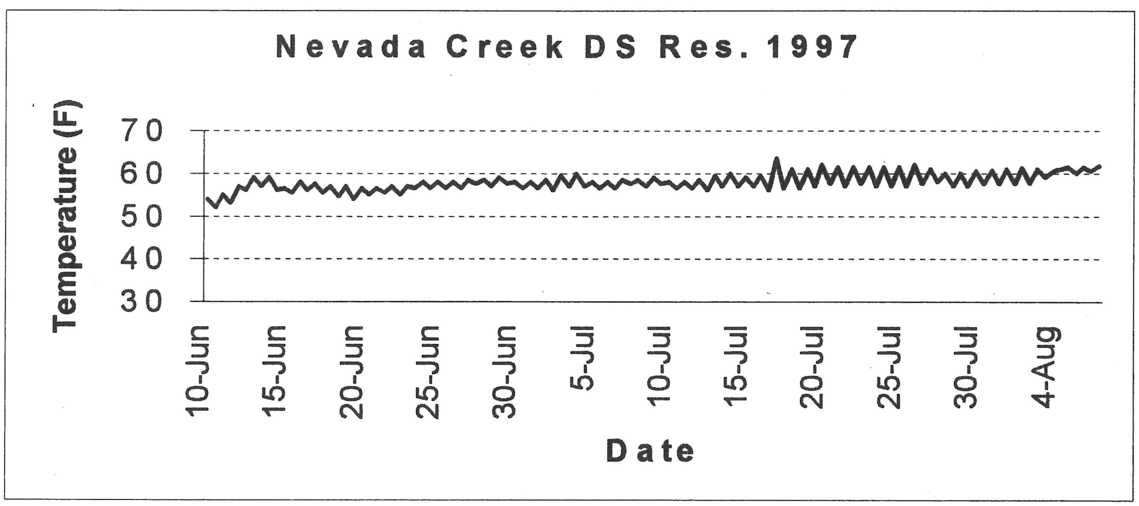
	June	July	August
Minimum	44.5	44.0	45.0
Maximum	55.5	61.0	61.5
Mean	49.9	52.8	53.6
Standard Deviation	4.0	4.8	4.3



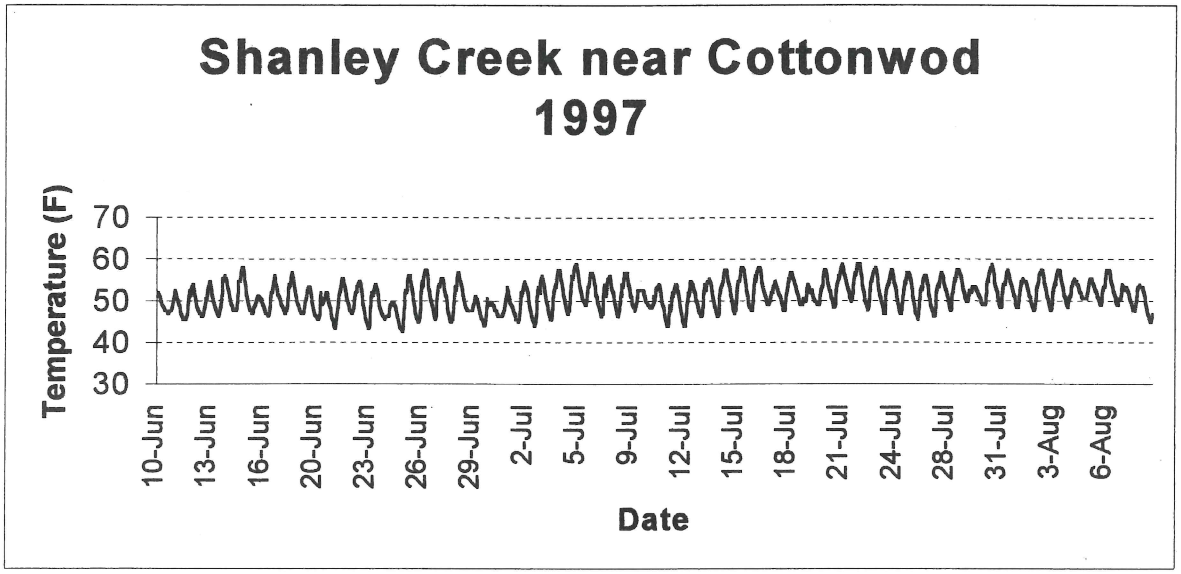
	May	June	July	August	September
Minimum	38.0	48.5	52.0	46.0	40.5
Maximum	75.0	72.0	71.0	73.5	63.0
Mean	56.4	59.8	59.2	58.1	51.2
Standard Deviation	10.1	7.0	7.5	7.2	6.1



	July	August
Minimum	48.5	49.0
Maximum	64.0	64.5
Mean	56.5	57.2
Standard Deviation	4.8	4.6

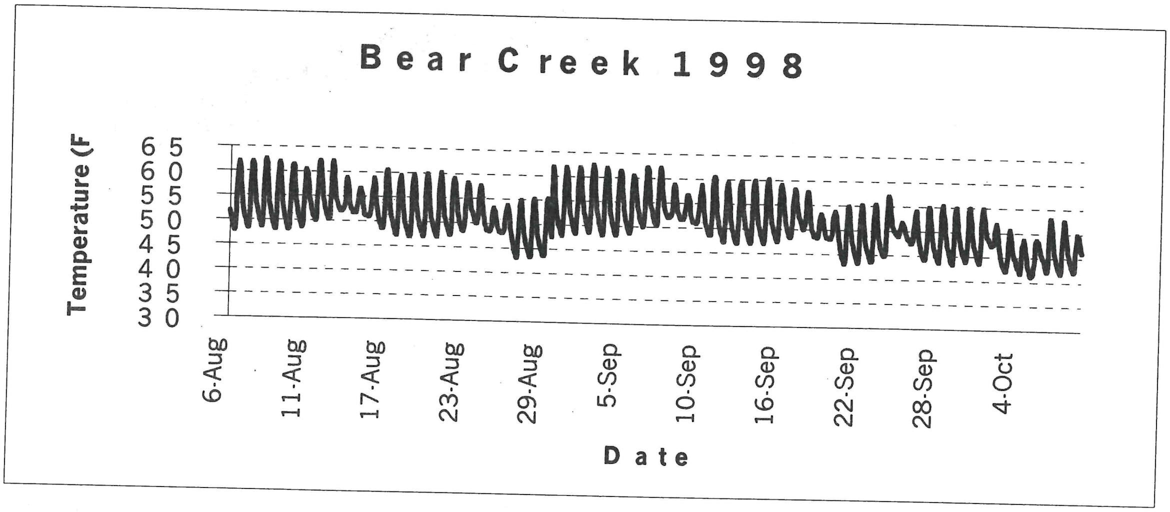


	June	July	August
Minimum	52.0	56.0	57.5
Maximum	59.0	63.5	61.8
Mean	56.5	58.4	60.2
Standard Deviation	1.6	1.9	1.4

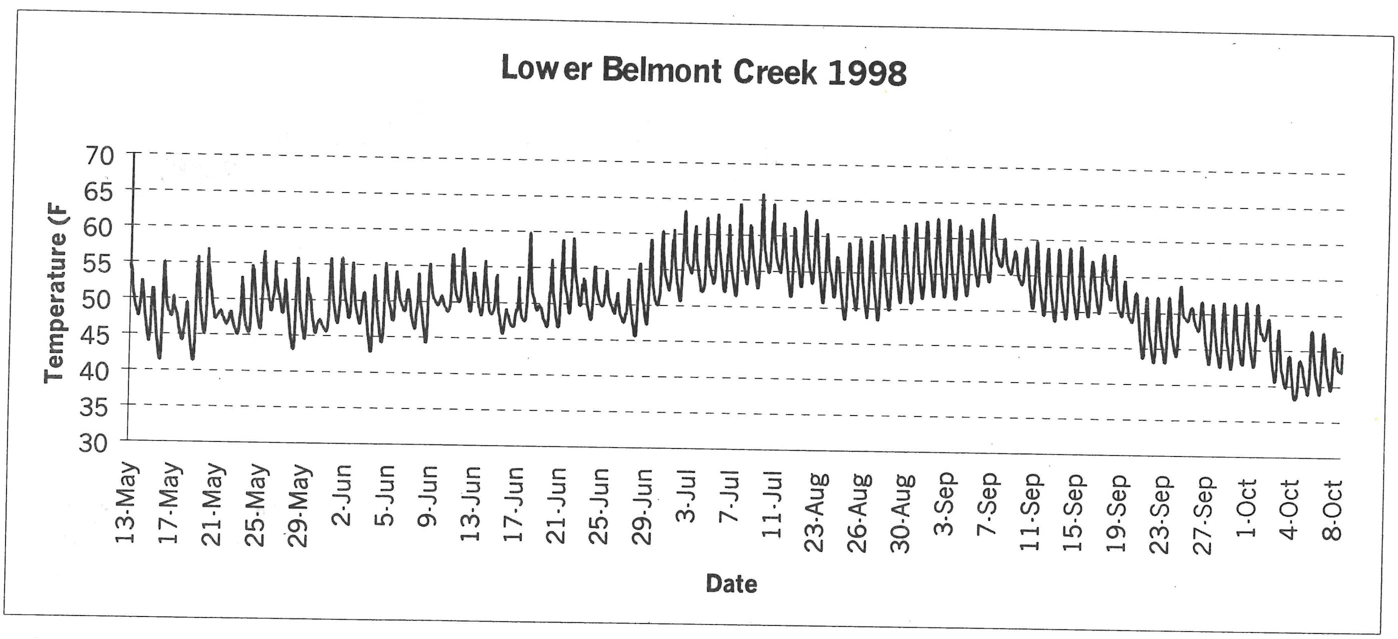


	June	July	August
Minimum	42.5	43.9	44.7
Maximum	58.0	58.0	57.4
Mean	49.7	49.7	52.0
Standard Deviation	3.3	3.3	2.9

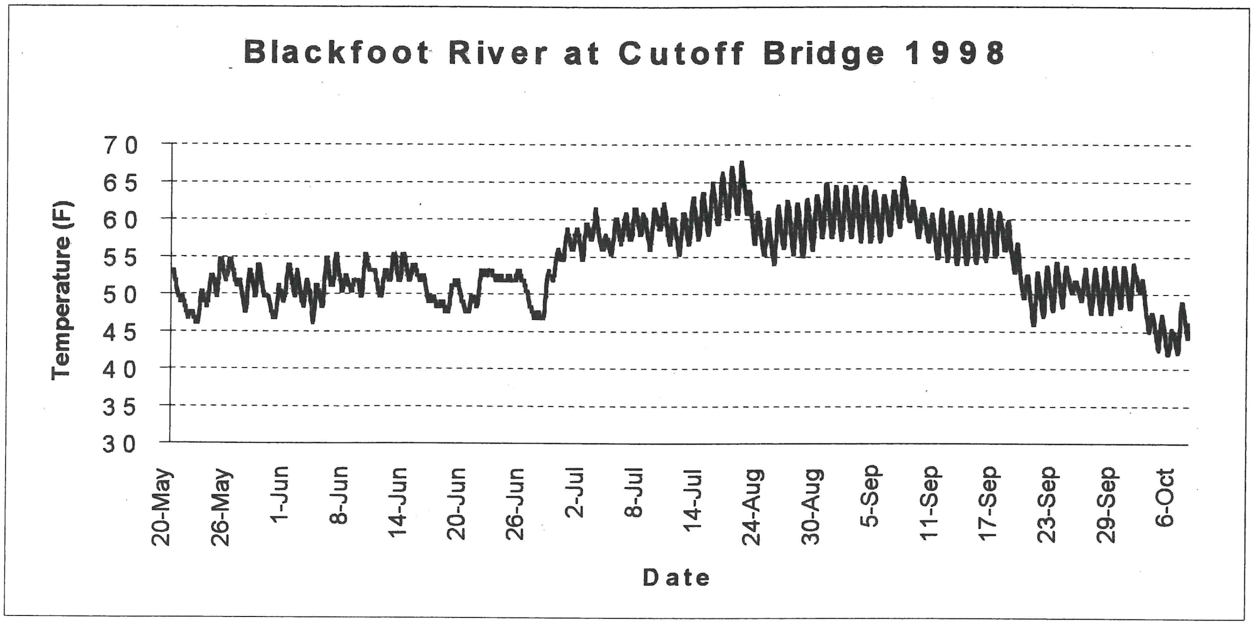
Exhibit E: Continued



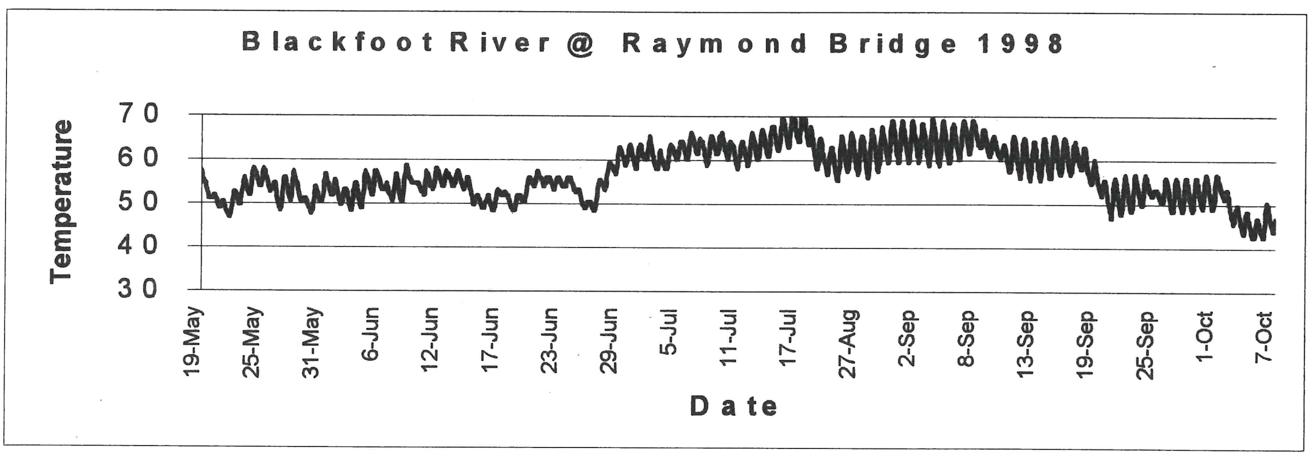
	August	September	October
Minimum	46.1	43.1	41.1
Maximum	63.5	62.4	54.8
Mean	55.2	51.7	46.5
Standard Deviation	4.8	4.3	3.3



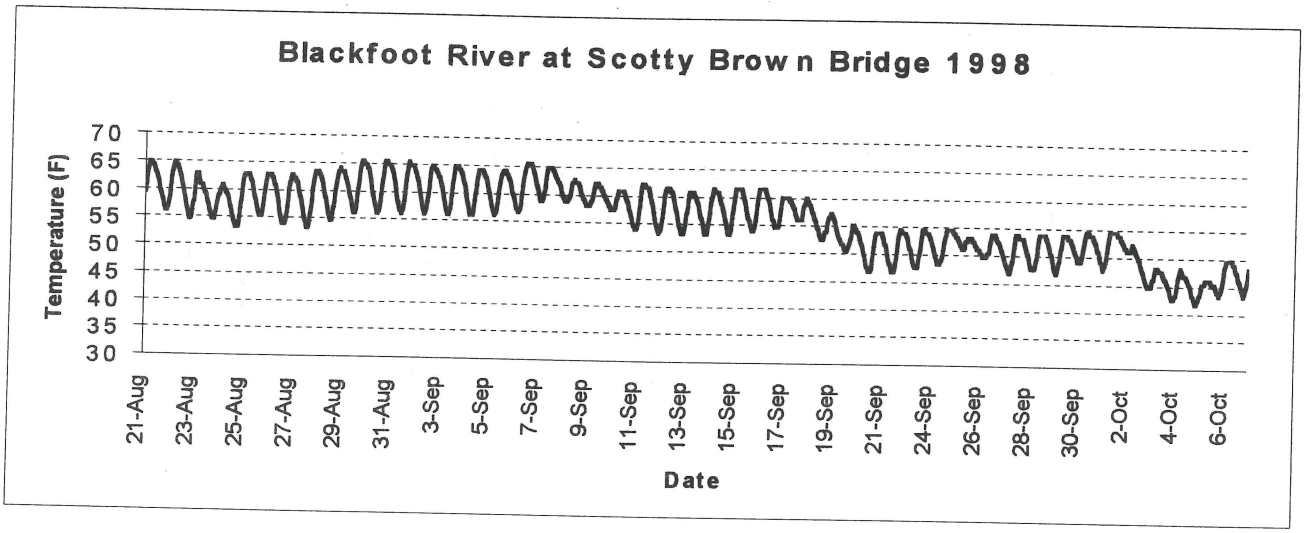
	May	June	July	August	September	October
Minimum	41.3	42.8	50.0	48.3	42.2	38.0
Maximum	57.0	59.8	65.8	63.5	63.5	51.7
Mean	48.3	50.1	56.0	54.9	52.6	43.7
Standard Deviation	3.1	2.9	3.4	3.6	4.8	3.2



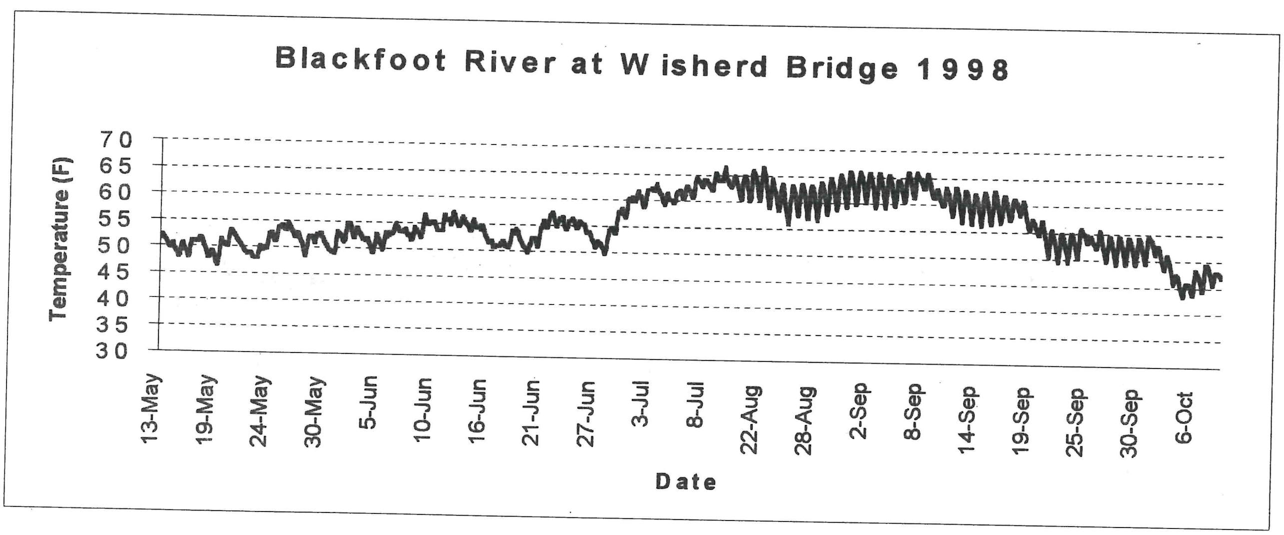
	May	June	July	August	September	October
Minimum	46.1	46.1	54.6	54.0	45.9	42.0
Maximum	54.6	56.0	67.7	64.7	65.6	54.0
Mean	50.6	51.1	59.5	59.0	56.4	47.5
Standard Deviation	2.2	2.2	2.8	2.5	4.7	3.3



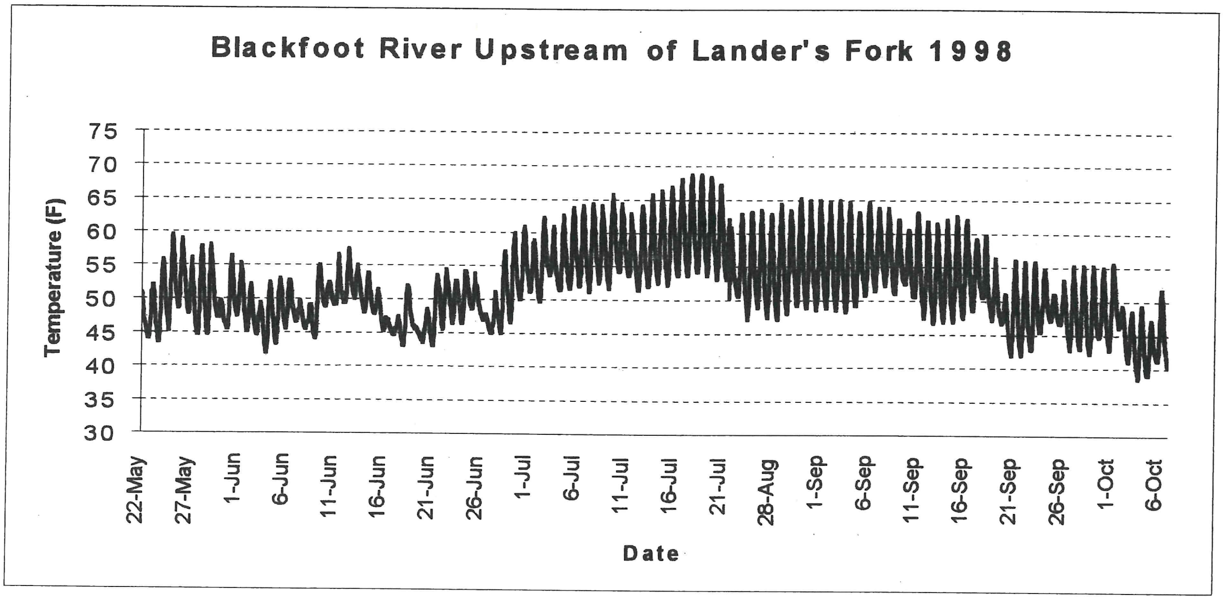
	May	June	July	August	September	October
Minimum	46.8	48.3	58.0	55.3	46.8	42.5
Maximum	58.0	62.9	71.8	69.0	69.7	56.7
Mean	52.4	53.6	63.1	61.7	59.0	48.6
Standard Deviation	2.7	2.8	3.0	3.3	5.7	4.0



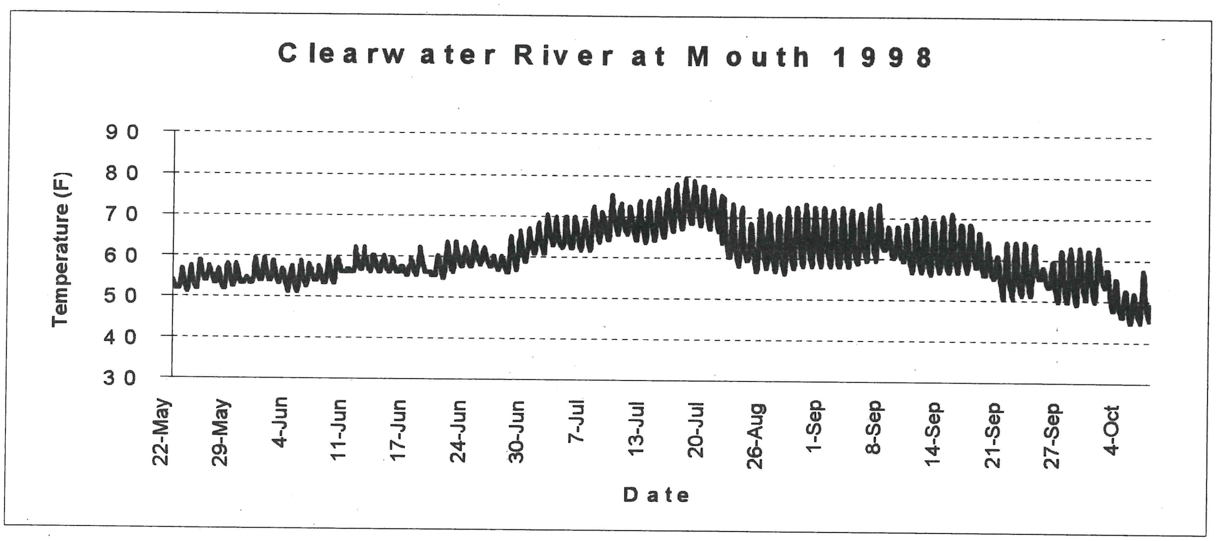
	August	September	October
Minimum	53.2	46.8	41.7
Maximum	65.6	65.6	54.6
Mean	59.6	56.8	48.2
Standard Deviation	3.3	4.8	3.6



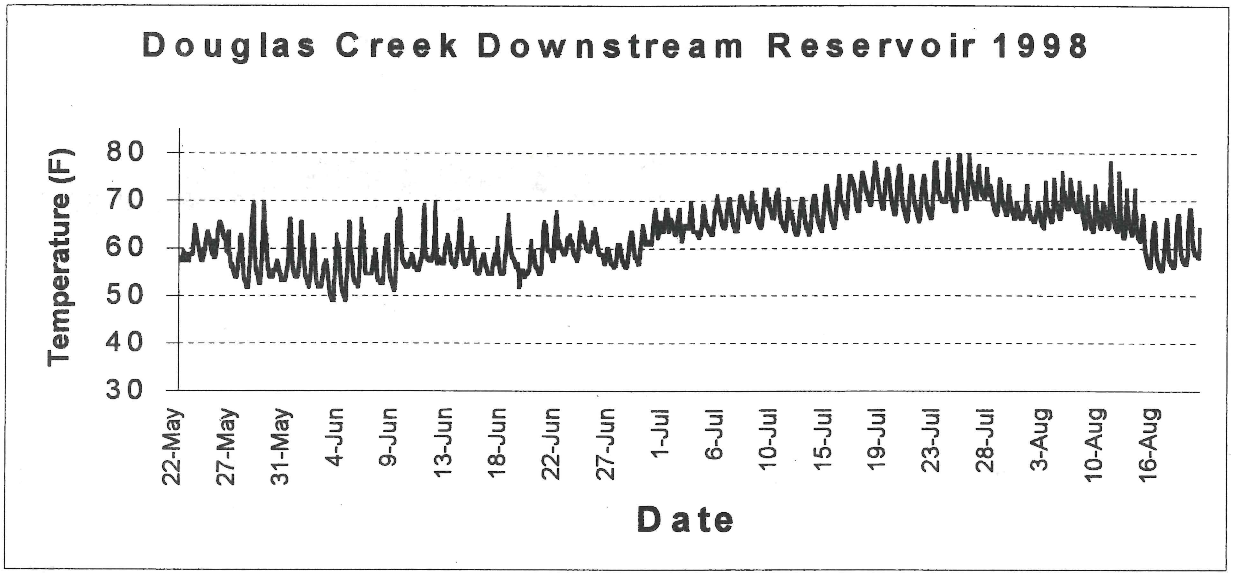
	May	June	July	August	September	October
Minimum	46.4	48.9	56.7	56.7	49.2	43.3
Maximum	54.7	57.8	66.7	66.7	66.1	54.5
Mean	50.7	53.4	61.8	61.8	58.7	48.7
Standard Deviation	1.7	2.0	1.9	1.9	4.5	3.0



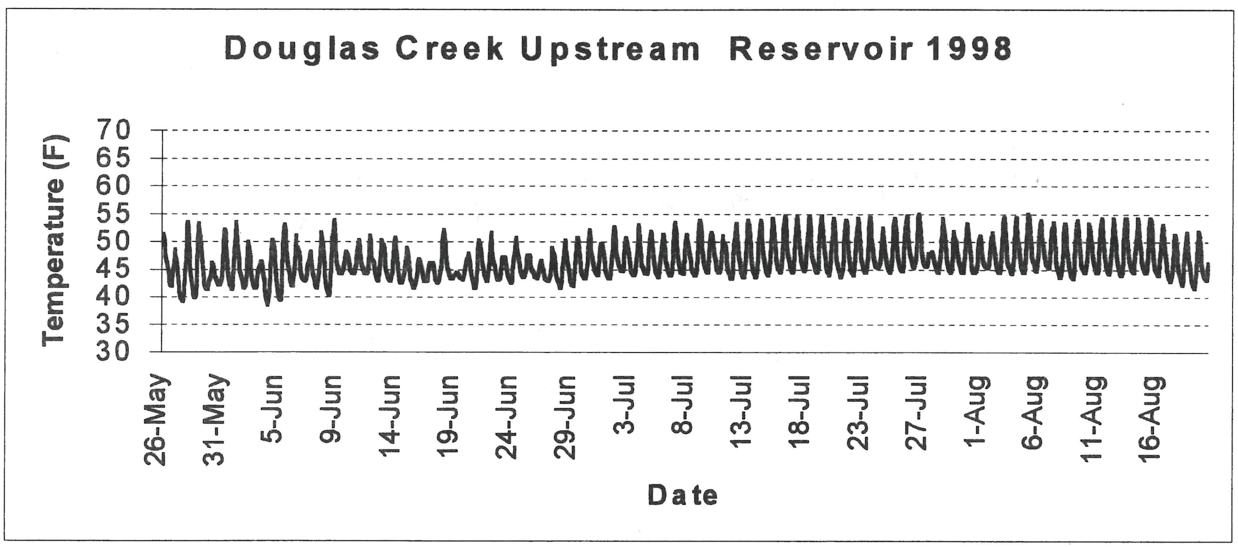
	May	June	July	August	September	October
Minimum	43.6	41.9	49.7	47.2	41.9	38.5
Maximum	59.5	60.1	68.7	65.2	65.0	55.6
Mean	50.2	49.0	57.7	55.1	52.7	45.5
Standard Deviation	4.1	3.3	5.8	5.1	5.4	4.0



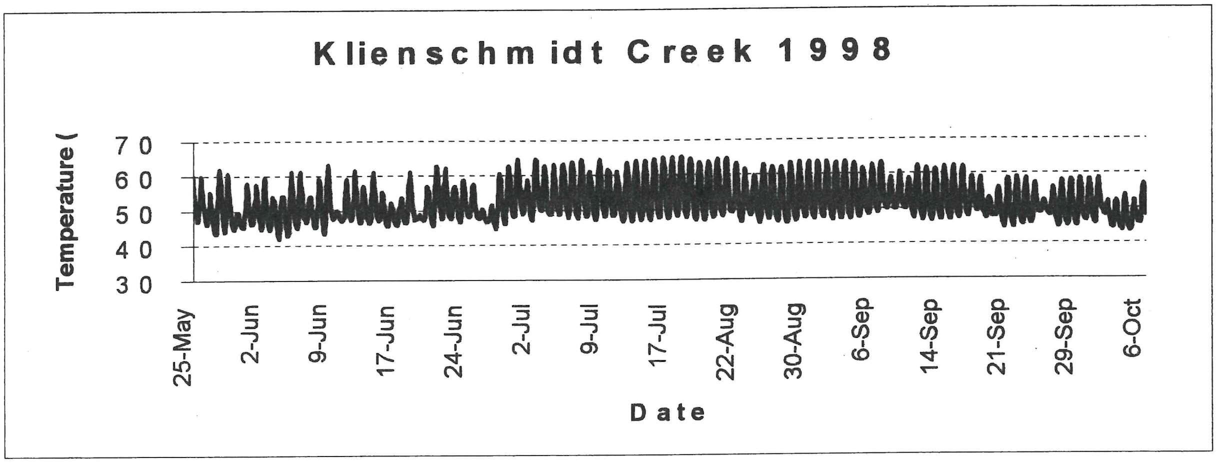
	May	June	July	August	September	October
Minimum	51.1	51.1	58.7	56.0	49.0	44.7
Maximum	58.7	66.3	79.5	74.6	73.2	62.9
Mean	54.3	57.2	68.0	63.9	60.7	51.6
Standard Deviation	1.8	2.6	4.3	5.0	5.4	4.6



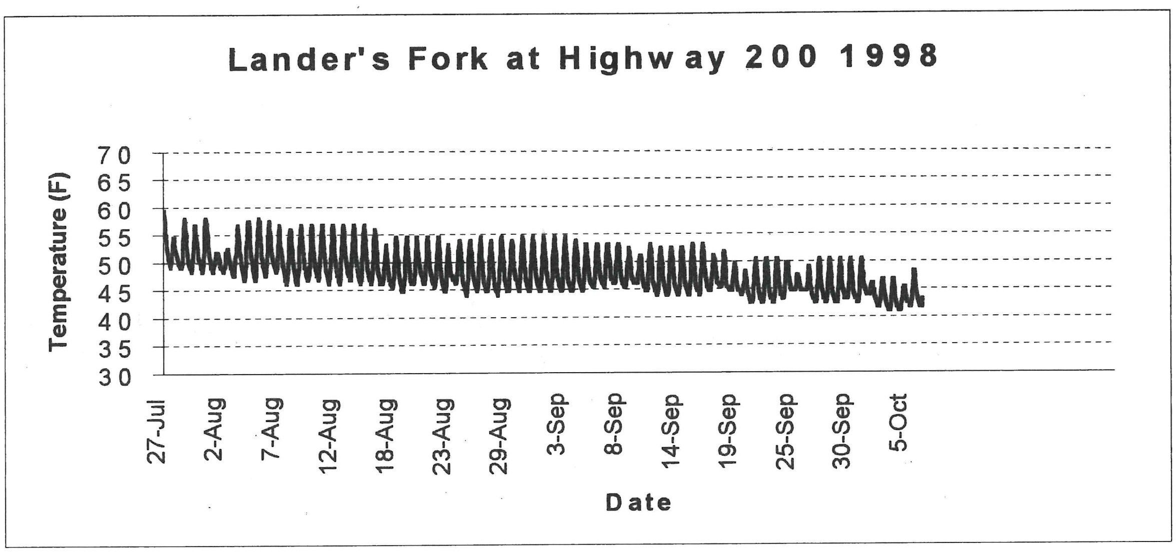
	May	June	July	August
Minimum	51.8	49.0	61.5	55.3
Maximum	69.7	69.7	79.5	78.1
Mean	58.6	58.1	69.0	65.0
Standard Deviation	4.0	3.8	3.8	4.8



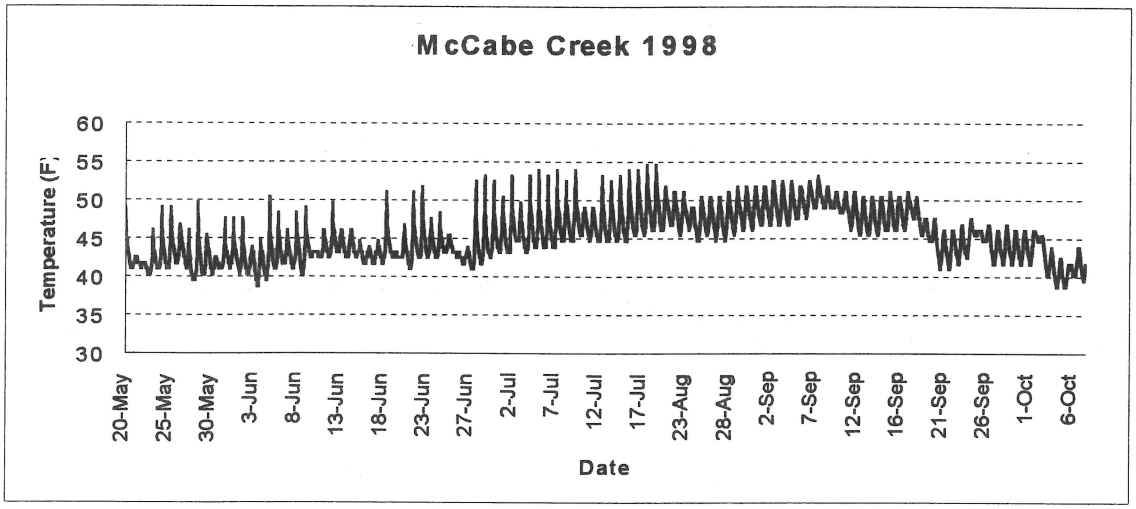
	May	June	July	August
Minimum	39.1	38.5	43.3	41.6
Maximum	67.3	53.9	55.0	55.0
Mean	51.8	45.3	47.7	47.6
Standard Deviation	8.4	2.8	3.2	3.4



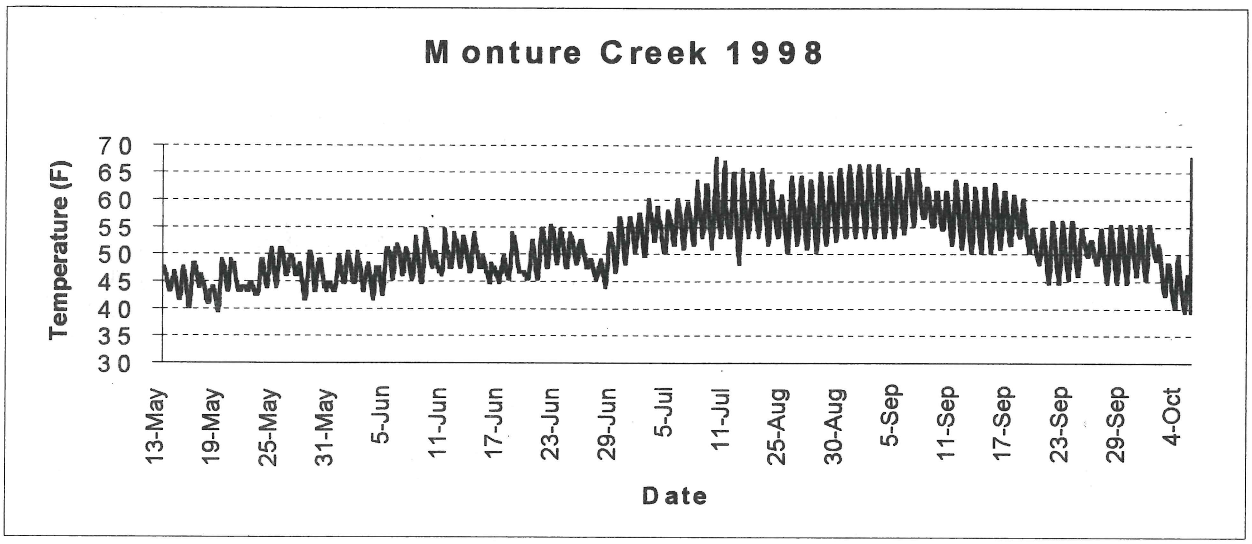
	May	June	July	August	September	October
Minimum	43.31	41.9	46.65	46.1	44.4	43.3
Maximum	61.7	63.2	65.2	63.5	63.5	58.4
Mean	50.3	50.7	54.4	53.4	52.2	48.8
Standard Deviation	4.8	4.4	5.6	5.4	4.7	3.7



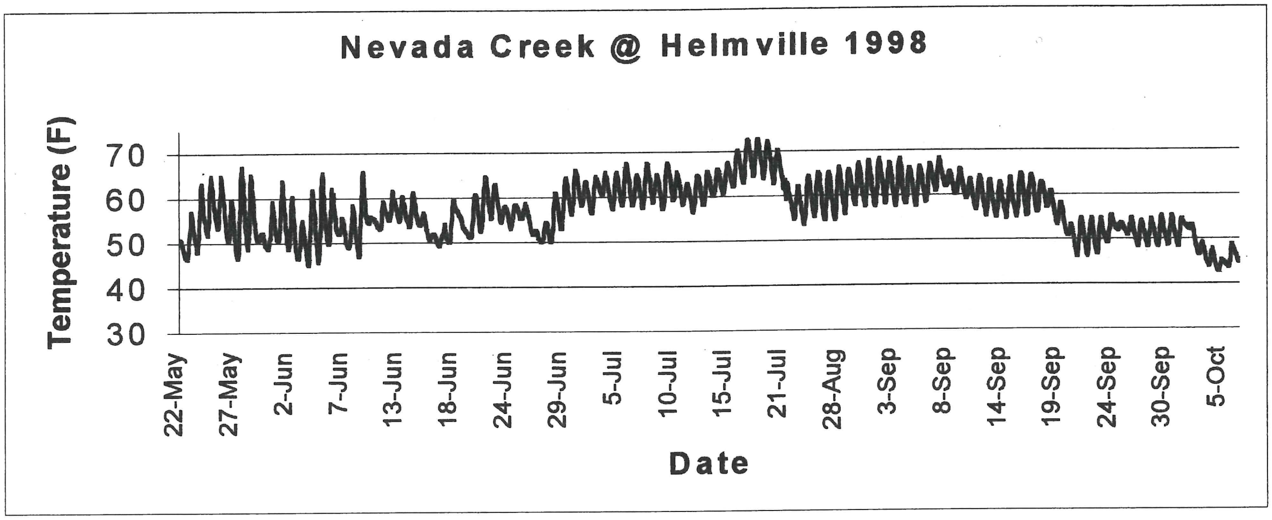
	July	August	September
Minimum	48.3	43.9	42.5
Maximum	59.4	58.0	54.6
Mean	52.4	49.9	47.1
Standard Deviation	3.0	3.4	3.0



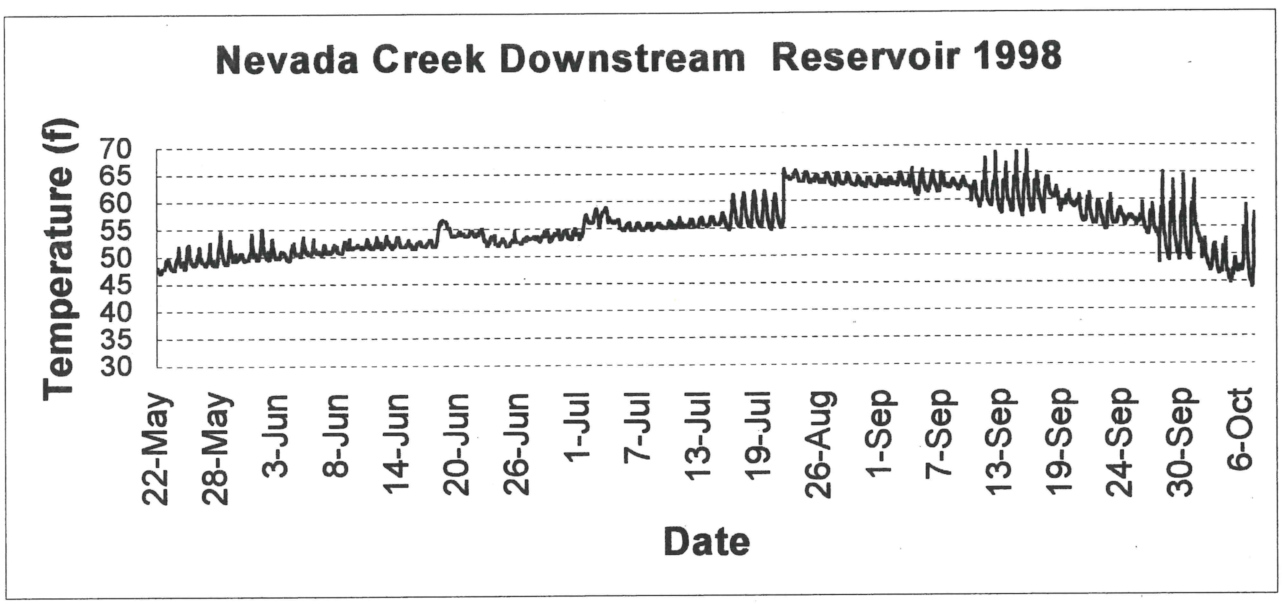
	May	June	July	August	September
Minimum	39.50	38.70	42.50	44.70	41.00
Maximum	49.70	53.20	54.60	51.80	53.20
Mean	42.35	43.32	47.22	48.04	47.37
Standard Deviation	1.87	1.93	2.39	1.85	2.72



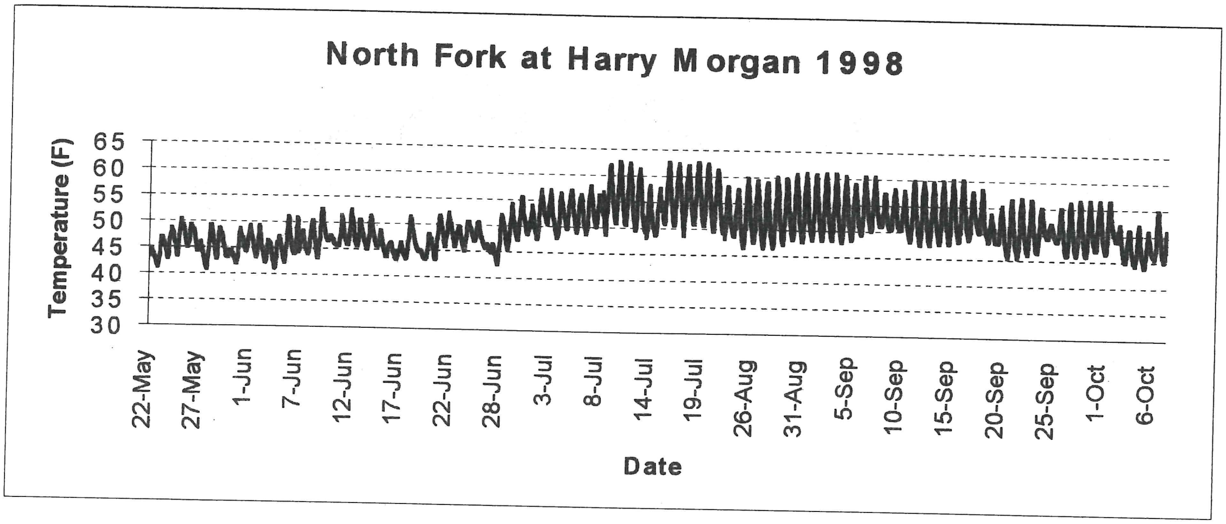
	May	June	July	August	September	October
Minimum	39.5	41.7	48.3	50.4	44.7	39.5
Maximum	51.1	56.7	67.7	65.6	66.3	55.3
Mean	45.4	48.7	55.8	57.9	55.3	47.3
Standard Deviation	2.5	2.8	3.8	4.1	5.1	4.0



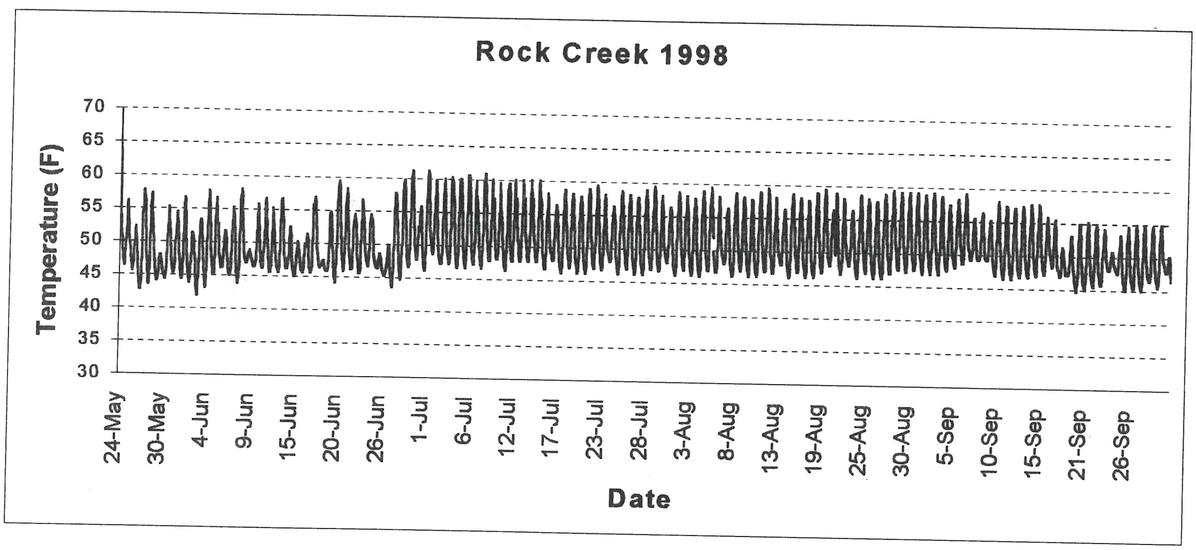
	May	June	July	August	September	October
Minimum	46.4	45.0	56.4	53.6	46.1	42.8
Maximum	67.0	66.1	72.6	67.9	68.2	54.5
Mean	54.4	55.1	63.3	60.5	57.5	47.7
Standard Deviation	5.2	4.2	3.8	3.6	5.5	3.3



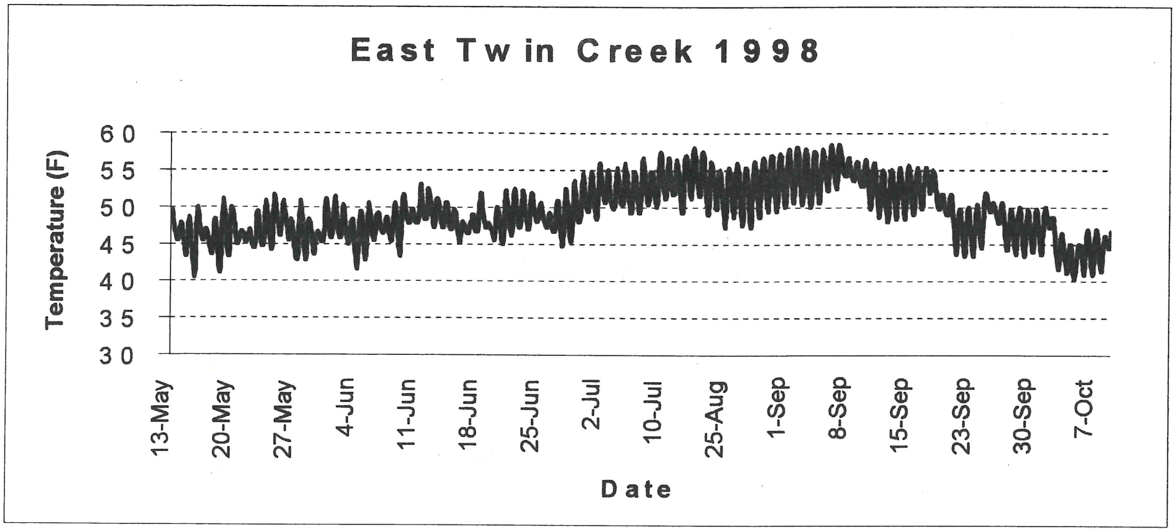
	May	June	July	August	September	October
Minimum	46.9	49.2	53.1	62.4	48.6	43.9
Maximum	54.5	56.7	61.8	65.8	69.0	63.5
Mean	49.5	52.4	56.2	63.8	59.9	49.7
Standard Deviation	1.4	1.5	1.6	0.8	3.6	3.6



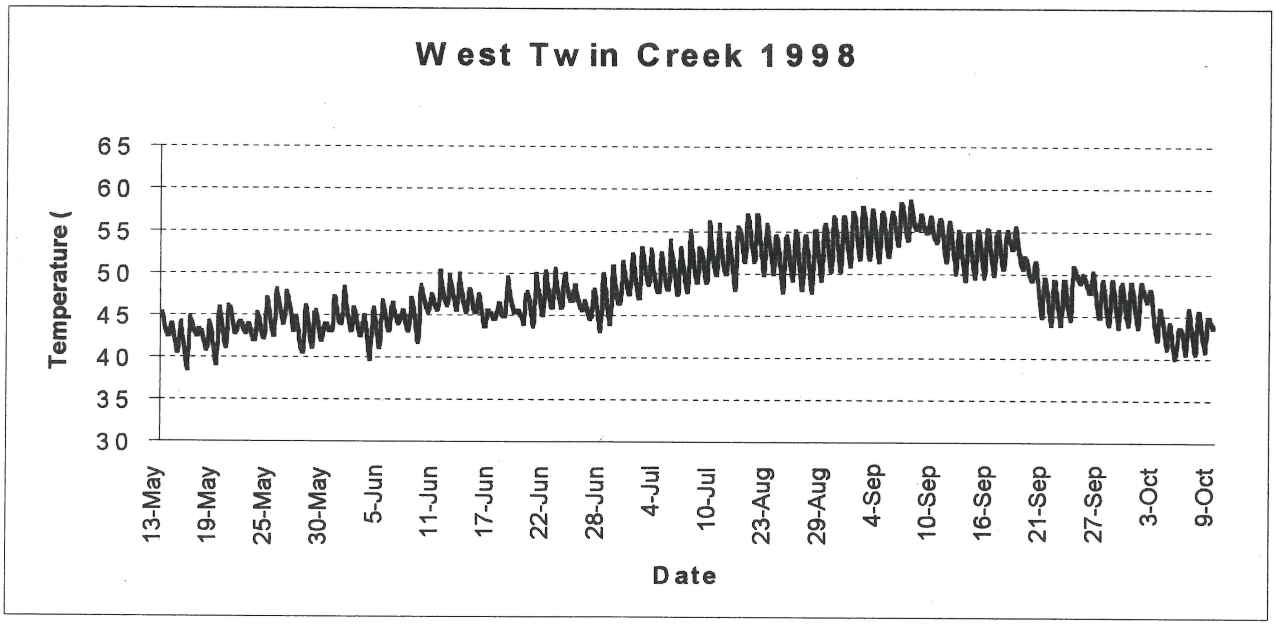
	May	June	July	August	September	October
Minimum	40.8	41.1	47.2	46.4	45.3	43.9
Maximum	50.3	54.2	62.7	60.7	61.0	56.5
Mean	45.4	46.7	53.9	52.7	52.2	48.8
Standard Deviation	2.2	2.4	3.9	4.2	3.8	3.1



	May	June	July	August	September
Minimum	42.8	41.9	46.1	46.1	44.7
Maximum	57.8	61.2	61.2	59.5	59.2
Mean	48.9	49.4	52.1	51.7	50.7
Standard Deviation	3.9	3.9	4.3	4.1	3.5



	May	June	July	August	September	October
Minimum	40.5	41.6	48.0	47.2	43.3	40.2
Maximum	51.7	53.6	57.5	58.1	58.4	50.0
Mean	46.4	48.2	52.3	53.0	51.6	44.8
Standard Deviation	2.2	2.1	2.3	2.8	3.6	2.4



	May	June	July	August	September	October
Minimum	38.5	39.7	46.4	47.8	43.6	40.0
Maximum	48.1	50.9	56.2	57.0	58.7	48.9
Mean	43.4	45.9	50.4	52.8	51.9	44.2
Standard Deviation	1.8	1.9	2.1	2.3	3.7	2.3

Exhibit F: Table of restoration streams and activities through 1996

Stream name	Fish passage barrier removal	Prevent irrigation ditch losses	Spawning habitat protection	Channel restoration	Fish habitat improv.	Riparian vegetation improv.	Improve instream flow	Improve wetlands	Improve range/ riparian habitat	Improve irrigation	Conserv. easements	Remove streamside feedlots
Basin Spring				X	X	X	X	X	X		X	
Bear	X	X		X	X				X	X		
Belmont	X		X						X			
Blanchard	X	X				X	X		X			X
Chamberlain	X	X		X	X		X	X	X	X	X	X
Cottonwood	X	X					X		X	X	X	X
Dick	X	X		X	X	X	X	X	X	X	X	X
Dunham		X		X						X		
E. Twin	X											
Elk	X			X	X	X		X	X			
Gold	X				X							
Grentier	X			X	X	X		X	X			
Hoyt	X								X	X	X	
Kleinschmidt	X			X	X	X						
Monture			X		X	X		X	X	X	X	X
Nevada						X			X			X
Nevada Spring					X	X			X			X
N. Fork		X		X	X	X	X		X	X	X	
Pearson	X	X	X	X	X	X	X	X	X	X	X	
Rock	X	X		X	X	X	X	X	X	X		X
Salmon	X	X	X	X	X	X	X	X	X			X
Shanley		X				X	X		X	X	X	
Warren	X					X			X	X	X	X
West Twin	X											

Exhibit G: Table of restoration streams and activities from 1997-1998

Stream name	Fish passage barrier removal	Prevent irrigation ditch losses	Spawning habitat protection	Channel restoration	Fish habitat improve.	Riparian vegetation improve.	Improve instream flow	Improve wetlands	Improve range/ riparian habitat	Improve livestock irrigation	Conserv. easements	Remove streamside feedlots
Bear				X	X	X			X	X		
Beaver										X	X	
Blackfoot River							X			X	X	
Blanchard						X			X	X		
Chamberlain	X	X	X	X	X	X	X		X	X		
Cottonwood		X					X			X		
Dunham		X										
E. Twin	X											
Johnson	X											
Kleinschmidt				X	X	X			X			
McCabe										X		
Monture					X	X			X	X		
Nevada Creek	X					X			X			
Nevada Spring				X								
N. Fork		X			X	X			X	X	X	
Rock/ Dry				X	X	X						
Salmon	X	X		X	X	X	X	X	X	X		X
Shanley		X										
Spring	X						X			X		
Wasson	X					X			X	X		

Exhibit H: Table of restoration streams and cooperators in projects through 1996.

Stream name	MFWP	USFWS	BLM	US EPA	MT DEQ	N. Powell CD	Private landowner	BBCTU	National F&W foundation	DU	MPC	DNRC	MDOT	Plum Creek
Bear	X	X					X	X			X			X
Belmont	X						X	X						X
Blanchard	X	X	X				X	X				X	X	
Chamberlain	X	X	X				X	X	X					X
Cottonwood	X	X	X				X					X		
Dick	X	X					X	X	X	X				X
Dunham	X	X					X	X						
E. Twin	X													X
Elk	X	X	X	X			X	X	X	X				
Gold	X	X					X							X
Grentier	X	X					X	X						
Hoyt	X	X					X	X						
Kleinschmidt	X	X					X	X	X					
Monture	X	X					X	X	X					
Nevada	X	X		X	X	X	X	X	X					
Nevada Spring	X						X	X						
N. Fork	X	X					X	X						
Pearson	X	X					X	X		X				
Rock	X	X				X	X	X	X			X	X	
Salmon	X	X					X	X						
Shanley	X	X					X							
Warren	X	X					X	X						
West Twin	X	X											X	

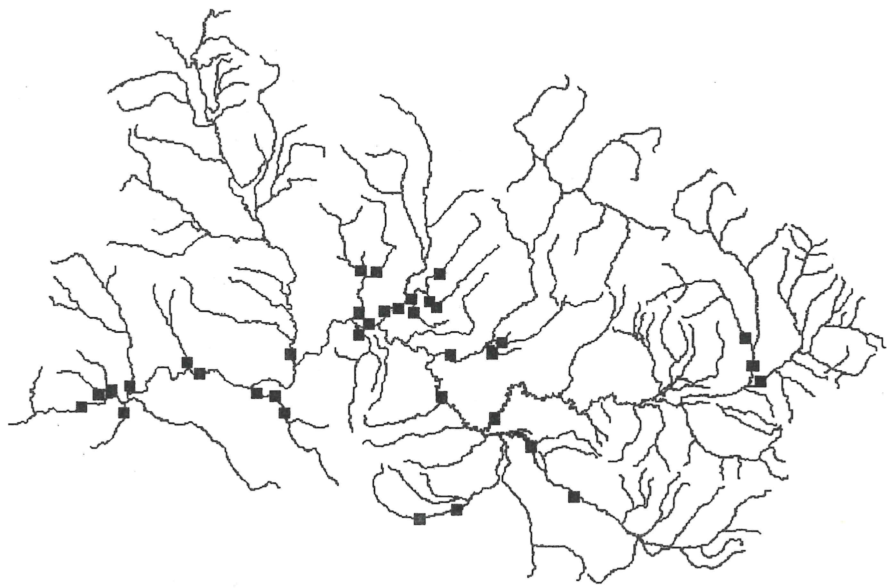
Exhibit I: Table of restoration streams and cooperators in projects completed in 1997 and 1998.

Stream name	MFWP	USFWS	BLM	USFS	Chutney	N. Powell CD	Private landowner	NRCS	BBCTU	National F&W foundation	MPC	DNRC	DOT	Plum Creek
Bear	X	X					X	X	X		X			X
Beaver		X					X		X					
Blackfoot River	X	X				X	X	X	X					
Blanchard	X	X	X				X		X			X		
Chamberlain	X	X	X				X		X					X
Cottonwood	X	X					X		X			X		
Dunham	X	X		X			X		X					
E. Twin	X	X		X					X		X			X
Elk	X	X	X				X		X	X		X		
Gold	X	X							X			X		X
Johnson	X	X					X		X		X			
Kleinschmidt	X	X					X		X				X	
McCabe		X					X							
Monture	X	X			X		X	X	X					
Nevada	X	X				X		X	X					
Nevada Spring	X	X				X	X	X						
N. Fork	X	X		X			X		X	X				
Rock/ Dry	X	X			X		X		X	X		X		
Salmon	X	X					X		X	X				
Shanley	X	X					X	X	X					
Spring	X	X					X	X	X	X				X
Wasson	X	X				X	X							
Warren	X	X		X			X	X	X					

Exhibit J. Whirling disease sample locations and results through 1997.

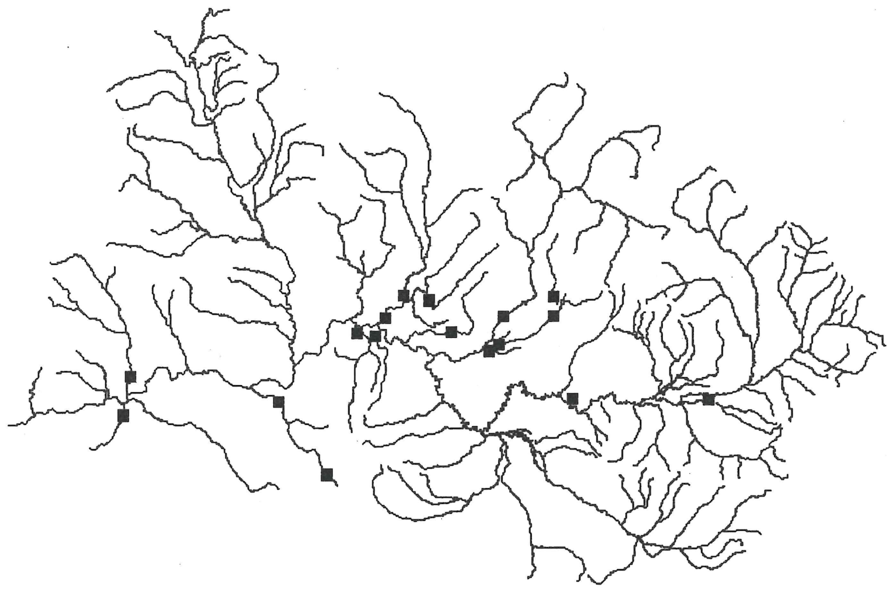
WATER NAME	LOCATION	YYMMDD	SITE DESC.	#FISH	RB	CT	LL	EB	AGE	WADDL_REMA
Blackfoot River	15N14W25	971015	Russell Gates FAS	65	58		7		1	9/65 positive 14%(grade 1,2,3)
Blackfoot River	14N07W08	971104	Hogum Creek Bridge	59		39	3	17	0,1,2,3	negative
Blackfoot River		970906	Marco Flats FAS	8	8				0,1	negative
Blackfoot River		970916	Above junction of Clearwater River	2			2		0	negative
Boles Creek		970714	Below Spook Lake at USFS road crossing	71				71	1,2,3,4,5,6	negative
Chamberlain Creek	14N13W09	971105	Immed. above East Fork	60		60			0-3	one "suspect" fish noted
Clearwater River	19N16W01	970903	above Rainey Lake at HWY 83 crossing	65		65			1,2,3,4	negative
Clearwater River	16N15W25	970916	Below Seeley Lake, USFS road 349 at cross	51			51		0,1,2,3,4	negative
Clearwater River	18N16W24	970904	Below Lake Alva	53		17		36	1,2,3,7	negative
Clearwater River	19N15W11	970904	above Lake Alva	51		14		36	1,2,3,4,5	negative
Clearwater River		970714	Canoe trail fishing access	10		3	6	1	1, 3-7	negative
Colt Creek	16W19N11	970903	1.5 miles above mouth	49				49	1,2,3,7	negative
Cottonwood Creek	16N14W24	971031	Dryer diversion	59		57		2	0,1,2,3	negative
Cottonwood Creek	16N13W31	971030	south of Woodworth Road (State Lease)	60			18	42	0,1,2	negative
Cottonwood Creek	15N13W29	971031	Below Highway 200	30	11		17	2	0-4	27% fish infected with WD (grade 2-4)
Cottonwood Creek	16N13W31	971030	On state lease South of Woodworth road	60			18	42	0-3	negative
Deer Creek		970811	At FR 77 road crossing 1 mi. above mouth	41		14		27	0-7	negative
Elk Creek	14N15W26	971015	from mouth upstream .5 miles	38	36		2		1,2,3	negative
Gold Creek	14N16W30	971110	1.5 miles from mouth	54	46	5	3		0,1,2	negative
Gold Creek	14N16W30	971110	1st Bridge, 1.3 miles from mouth	54	46	5	3		0-2	negative
Granter Spring Creek	14N8W30	971125	near Granter House	61	0		31	30	0,1	negative
Kleinschmidt Creek	14N11W06	970916	near mouth	50			50		0,1,2	22/50 positive 40%
Landers Fork		971104	upstream of HWY 200	60		15	4	41	0,1,2,3	negative
Lincoln Spring Creek	14N09W22	971202	.5 miles west of Lincoln	61			35	26	1,2,3	1 fish positive (grade 1)
Monture Creek	15N13W24	971105	upstream HWY 200	59	38	10	9	3	0,1,2,3	negative
Monture Creek	15N13W12	971202	private bridge	57	3	18	5	33	0,1,2,3	negative
Morrell Creek		970714	At Hiway 83 Crossing	63	1		5	57	1-7	negative
N. F. Blackfoot River	14N12W09	970906	200m upstream of River Junction	45	7		38		0,1	11/45 positive 24%
Nevada Spring Creek	13N11W910	970926	south of homestead, Frank Pott's place	1			1		1	negative
Salmon Creek	14N11W06	971106	downstream of Spawn Lake	60				60	0,1	negative
Shanley Creek	15N15W04	971031	near mouth	61		5	12	34	0,1,2,3,4	negative
Shanley Creek	15N15W04	971103	Above confluece with Cottonwood	60		5	12	43	0-3+	negative
Warren Creek	14N12W01	971030	0.5 mi. upstream of Blackfoot River	58	2		18	38	1-4	21% infection-all species (grade 1 and 3)
Wasson Creek	13N11W11	971027	from Nevada Spring Creek upstream	31			31		1,2,3	negative
West Fork Clearwater River		970714	Below Marshall Cr. at USFS road crossing	27		1		25	2-5	negative

Exhibit K: Maps of monitoring and project locations in the Blackfoot River Watershed.

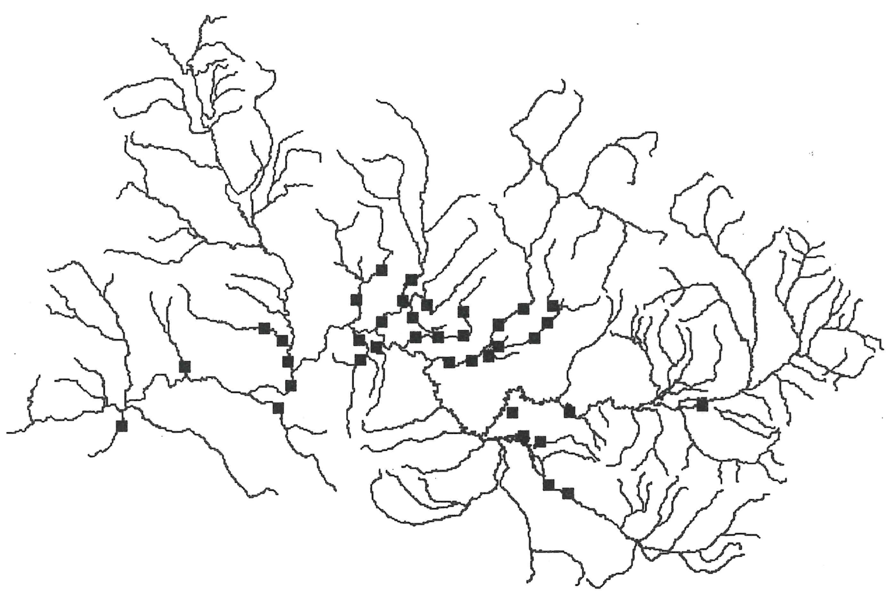


Temperature monitoring locations in the Blackfoot Watershed in 1997 and 1998

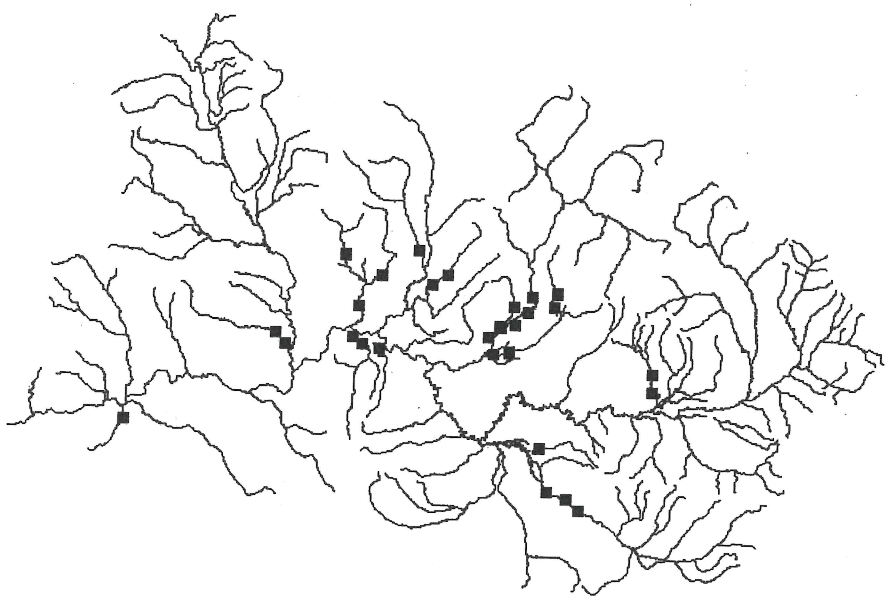
Road crossing upgrades in the Balckfoot watershed from 1989-1998.



Habitat Restoration work in the Blackfoot River watershed from 1989-1998



Locations of livestock management areas in the Blackfoot River watershed, 1989-1998



Irrigation upgrades in the Blackfoot Watershed, 1989-1998