Fisheries Division
Federal Aid Job Progress Report

Montana Statewide Fisheries Management

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Project Title:	Statewide Fisheries Management
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Abstract: This report covers selected fisheries work completed by Montana Fish, Wildlife and Parks (MFWP) during the 2001 to 2004 period in the Flathead River System and Drainage covered under the MFWP Project Number 3130, Flathead Lake and River Drainage West. Included are specific activities regarding fish population monitoring, stream habitat surveys and protection, and an angler creel survey. This report contains fish population monitoring activities for Flathead Lake, River and tributaries. Additional surveys were conducted on other area waters that are not included in this report, but will be in future reporting. Fish stocking activities for the project area are also not included, although available in other MFWP reporting. There are three stand-alone reports included with this report. These are the 2002-2003 Angler Creel Survey on the Flathead River, 2003 Coal Creek Sediment Survey and three Flathead Lake and River Fisheries Co-Management Annual Reports (2001-2003).

OBJECTIVES

1) To survey and monitor the characteristics and trends of fish populations, angler harvest and preferences, and to assess habitat conditions on selected waters.

2) To implement fish stocking programs and/or fish eradication actions to maintain fish populations at levels consistent with habitat conditions and other limiting factors.

3) To review projects by government agencies and private parties that have the potential to affect fisheries resources, provide technical advice or decisions to mitigate effects on these resources, and provide landowners and other private parties with technical advice and information to sustain and enhance fisheries resources.

4) To enhance the public's understanding, awareness and support of the state's fishery and aquatic resources and to assist young people to develop angling skills and to appreciate the aquatic environment.

INTRODUCTION

This report contains recent research and long-term monitoring results of fisheries field surveys, updating the 1999 report (Deleray et al 1999). This report summarizes various surveys on Flathead Lake, the Flathead River, and tributaries in an effort to describe changes in the status of fish populations and habitat quality. I will emphasize data collected in the 1999 to 2003 period, since these data were not reported in the previous report. Attached to this report are a number of reports or documents that include additional fisheries work partially or solely conducted under the AFA program. For example, in November 2000 the Confederated Salish and Kootenai Tribes (CSKT) and Montana Fish, Wildlife and Parks (MFWP) completed a 10-year Fisheries Co-management Plan and associated with this plan are annual reports, which list accomplishments. Some of these accomplishments were completed under the AFA program. Three annual Co-management reports (2001-2003) are attached to this report. Also attached to this report are reports for the 2002-2003 Flathead River Angler Creel Survey and the 2003 Coal Creek Sediment Source Survey.

The report follows a standard format, beginning with a background section containing a study area description and a discussion of changes in the lake food web and aquatic community that have occurred in response to introductions of exotic fish species and the establishment of *Mysis relicta* (*Mysis*). Following this section, there are summaries of recent research and monitoring results. Each of these sections contains separate introductions, methods, and results and discussions. These individual sections cover work conducted on Flathead Lake, the North Fork, Middle Fork and main stem of the Flathead River, and tributary streams to the North and Middle forks.

Montana Fish, Wildlife & Parks is not alone in monitoring the aquatic resources of Flathead Lake. The Confederated Salish and Kootenai Tribes co-manage the fisheries of Flathead Lake and conduct monitoring and research studies on Flathead Lake, some of which are included in attached reports. Since the early 1990s, MFWP and CSKT have conducted research activities, habitat enhancements, and experimental fish stocking through mitigation programs associated with Hungry Horse and Kerr dams. Bonneville Power Administration has funded many of these programs. In addition, the University of Montana, through the Flathead Lake Biological Station, has conducted numerous surveys of water quality parameters and described characteristics of lower trophic levels. The survey and inventory data presented in this report are those conducted either solely or largely through AFA funding. Many of the annual surveys are interagency cooperative projects.

Fieldwork conducted within the last two decades encompasses the time period in which *Mysis* entered the Flathead Lake and River System and radically changed food web interactions. Surveys spanning the late 1970s and into the mid-1980s characterize the pre-*Mysis* conditions. More recent surveys (mid-1980s to present) portray resulting changes to and status of the fish community following *Mysis* establishment. At this point in time, we have what appear to be three relatively distinct periods of record that depict the changes to the Flathead System. The 1980's with fish population levels before *Mysis* impacts, the early and mid-1990's showing the immediate impacts of a changing ecosystem, and the late 1990's and early 2000's as the system moves toward a different equilibrium condition. Changes to native fish populations require an extended time period, due to the five to seven year time period between generations. It may take three to four generations (15 to 28 years) following the ecosystem changes to observe relative stability in our monitoring indices.

Recent monitoring efforts are combined and summarized in this report in order to comprehensively describe the known characteristics, changes, and trends in the status of fisheries resources in the Flathead Lake and River System. It has been over 20 years since *Mysis* became established in Flathead Lake, but the resulting changes to the aquatic community are still incomplete. It appears that *Mysis* will persist and the densities of large zooplankton will remain much lower than their levels prior to *Mysis* establishment. Remaining questions include: What will be the resulting composition of the fish community? Will the native bull trout (*Salvelinus confluentus*) and westslope cutthroat trout (*Oncorhynchus clarki lewisi*) persist? And what will be the future recreational fisheries? In 1998, the U.S. Fish and Wildlife Service listed the bull trout as threatened under the Endangered Species Act and the westslope cutthroat trout has been petitioned for listing. Due to the large size of the Flathead Lake Drainage, Flathead Lake native fish populations have historically been important to the overall status and persistence of these species in Montana. MFWP has monitored bull trout spawner escapement in the Flathead Drainage for over 25 years. In addition to this database, stream electrofishing, stream substrate assessments, and lake gillnetting track current and changing trends in status of fish populations and habitat quality. Future surveys will continue to provide the information needed to formulate viable management alternatives to preserve these important native fish species. CSKT and MFWP maintain responsibility for fisheries management and in 2000 completed the Flathead Lake and River Fisheries Co-Management Plan (MFWP and CSKT 2000), which will direct fisheries management for a ten-year period.

BACKGROUND

Description of Study Area

The Flathead Lake and River System located in northwest Montana consists of Flathead Lake, the main stem Flathead River above Kerr Dam, and major tributaries including the Swan River, Whitefish River, and Stillwater River drainages, and the North, Middle, and South forks of the Flathead River and their major tributaries. The Flathead Basin drains an area of roughly 18,400 km^2, which is underlain by nutrient-poor Precambrian sedimentary rock. The drainage is known for its high water quality (Zackheim 1983). The system is managed as one ecosystem due to the migratory nature and complex life histories of many species in the system. Adfluvial fish interact with lake and river stocks, emphasizing the interdependency and connectivity of the lake and river fisheries.

Flathead Lake is oligomesotrophic with a surface area of roughly 510 km^2 (125,250 acres), a mean depth of 50.2 m, and a maximum depth of 113.0 m (Zackheim 1983). The southern half of the lake lies within the Flathead Indian Reservation. Kerr Dam was built in 1938 and is located on the southern end of Flathead Lake, seven km downstream of the natural lake outlet. Kerr Dam regulates the top three meters of water and is operated to provide flood control and power production. Presently, flood control and recreation require the lake level to be dropped to the low pool elevation 879.3 m above sea level (2,883 feet) by April 15, refilled to 881.5 m (2,890 feet) by May 30, raised to full pool elevation of 882.4 m (2,893 feet) by June 15, and held at full pool through Labor Day.

Two major tributaries to Flathead Lake are the Swan and Flathead rivers. The Swan River drains the Swan Valley and Swan Lake. Fish movement upstream from Flathead Lake into the Swan River is blocked by Bigfork Dam, located less than two kilometers above Flathead Lake. The dam was built in 1902 for electrical power production. The three forks of the Flathead River supply roughly 80 percent of the annual discharge (9 million acre-feet) in the Flathead System (Zackheim 1983). The North Fork flows out of British Columbia, defines the western border of Glacier National Park (GNP), and primarily drains forested lands of GNP, the Flathead National Forest, and other managed forestlands. The Middle Fork flows out of the Great Bear Wilderness Area, defines the southern boundary of GNP and drains forested lands of GNP and the Flathead National Forest. The South Fork flows for over 95 km in the Bob Marshall Wilderness Area before impoundment in Hungry Horse Reservoir (56 km in length) located in the Flathead National Forest. Hungry Horse Dam was completed in 1953, located 8.5 km upstream from the confluence of the South Fork and the main stem of the Flathead River. Hungry Horse Dam blocks upstream fish migrations and effectively isolates the South Fork Drainage from fish of Flathead Lake. Hungry Horse Dam provides flood control, electrical power production, and water storage capability for the Columbia River System.

The major sport fish species in Flathead Lake include westslope cutthroat trout, bull trout, lake trout (*S. namaycush*), lake whitefish (*Coregonus clupeaformis*), and yellow perch (*Perca flavenscens*). The major sport fish in the river are westslope cutthroat trout, bull trout, rainbow trout (*O. mykiss*), and mountain whitefish (*Prosopium williamsoni*).

Scattered populations of largemouth bass (*Micropterus salmoides*), yellow perch, and northern pike (*Esox lucius*) occur in old oxbows and lower reaches of the main stem river. Other native fish in the Flathead System include longnose sucker (*Catostomus catostomus*), largescale sucker (*C. macrocheilus*), northern pikeminnow (*Ptychocheilus oregonensis*), peamouth (*Mylocheilus caurinus*), pygmy whitefish (*P. coulteri*), and reside shiner (*Richardsonius balteatus*).

The native trout and char, westslope cutthroat trout and bull trout, have evolved varied life histories to be successful in the Flathead Drainage. There are three life history forms: (1) adfluvial stocks which spawn and rear in river tributaries and move downstream to mature and reside in Flathead Lake; (2) fluvial stocks which spawn and rear in river tributaries then move downstream to mature and reside in the Flathead River, and; (3) tributary or “resident” stocks which spawn, rear, and reside for their entire life cycle in a tributary stream (Shepard et al. 1984, Fraley and Shepard 1989). Westslope cutthroat trout employ all three of these strategies in the Flathead System. It appears bull trout are primarily adfluvial. Individual fish may combine the first two strategies. We have not observed solely tributary residence in bull trout. Juveniles reside in tributaries for 1-3 years before migrating downstream into river or lake habitats (Shepard et al. 1984). Adfluvial fish take advantage of improved forage and growth rates during lake residence and thus reach larger sizes than either fluvial or tributary residents.

The Changing Fish Community of Flathead Lake

From a fish community perspective, Flathead Lake has supported three very different species assemblages. Prior to settlement by European man, the fish community was solely comprised of the native species, which colonized the waters following the last glacial period, roughly 10,000 years ago. Bull trout, westslope cutthroat trout, and mountain and pygmy whitefish were the only salmonids. Bull trout and northern pikeminnow were the dominant piscivores. Most likely, the minnows (northern pikeminnow and peamouth) dominated in fish abundance and biomass (Elrod et al. 1929). Accurate depiction of relative species abundance is difficult due to lack of recorded and quantified surveys or fishery encounters.

In the mid 1880s, Europeans arrived and beginning in the early 1900s, introduced a number of other fish species (Hanzel 1969, Alvord 1991). Federal and state government agencies aggressively introduced game fish, both native and exotic species, into Montana waters. They constructed fish hatcheries and developed fish transport systems incorporating railroads. By the 1920s, a new fish community was established with abundant kokanee, lake trout, lake whitefish, and yellow perch in addition to the native species. Kokanee and yellow perch dominated the recreational fishery. This new fishery composition was relatively stable until the mid 1980s.

In the 1950’s and 1960’s, fisheries management agencies across the western United Sates and Canada introduced the opossum shrimp, *Mysis relicta* into numerous lakes where they did not naturally occur. In 1968, 1975, and 1976 MFWP introduced *Mysis* into four lakes (Ashley, Swan, Tally, and Whitefish) in the Flathead Lake Drainage. Although no

Mysis were stocked directly into Flathead Lake, *Mysis* moved out of these lakes and downstream into Flathead Lake where they were first collected in 1981. By the mid-1980s, *Mysis* established an abundant population and caused the third shift in the fish assemblage in Flathead Lake.

Due to their unique feeding behavior, *Mysis* created unforeseen and far-reaching changes to the Flathead Lake System. *Mysis* eat larger zooplankton; the same forage preferred by fish species including kokanee, and are able to severely deplete zooplankton populations. Thus, *Mysis* become a competitor with fish species dependent on the zooplankton forage base and not forage as managers desired. *Mysis* did provide an abundant food source for benthic fishes, such as lake trout and lake whitefish, and substantially increased survival, recruitment, and abundance of these species.

It has been almost two decades since *Mysis* densities peaked in Flathead Lake and the fish community has changed. In the following sections, we compare sampling results of the 1980s with those of recent surveys; we evaluate these changes and assess the current status of fish populations.

ANNUAL SPRING GILL-NET SURVEYS ON FLATHEAD LAKE

Introduction

The Confederated Salish & Kootenai Tribe (CSKT) and Montana Fish, Wildlife & Parks (MFWP) annually conduct a relative fish abundance survey in Flathead Lake. This survey allows managers to track changes and trends in fish populations over the long term. Nets fish designated areas and depths to provide comparable trend data between years (Shepard and Graham 1983).

In the late 1970s, concerns of potential adverse changes to the Flathead River Drainage associated with coal mining, timber harvest, and other human development established the need for a series of studies to acquire baseline fisheries information. A portion of this effort was focused on Flathead Lake, including seasonal gill-net surveys. From 1980 through 1983, MFWP conducted netting surveys in each of the four seasons. Following this collection period, investigators created a protocol for a standardized spring monitoring program to assess relative fish abundance in five areas of Flathead Lake (Shepard and Graham 1983). In 1981 and 1983, this spring survey was completed and provided a baseline of fisheries information prior to establishment of *Mysis relicta* (*Mysis*). Unfortunately, the spring monitoring program was discontinued until the early 1990s. From 1990 through 1995, MFWP and CSKT conducted only partial sinking net surveys and did not complete the standard monitoring protocol until 1996. However, for the floating net portion of the series, MFWP and CSKT have completed the lake-wide surveys since 1992 (only 1990 and 1991 surveys were incomplete). Complete surveys from 1996 through 2003 represent the current status and allow valid comparison with 1981 and 1983 surveys.

Methods

Agency personnel followed methodology established by previous investigators in the early 1980s (Shepard and Graham 1983). Netting occurred in spring (late April/early May) before spring runoff when the lake temperatures were isothermal. Gillnetting was completed in five areas of the lake. In each area we fished three sets of floating nets and three sets of sinking nets. At sampling sites, we set both sinking and floating multi-strand nylon gill nets, 38.1 m long by 1.8 m deep, consisting of five panels of bar mesh sizes, 19, 25, 32, 38, and 51 mm. Each set consisted of two ganged nets, one sinking net tied end to end to another sinking net, and likewise for floating nets. We set nets perpendicular to the shoreline. Floaters were set with one end close to shore in roughly 2 meters of water, stretching the net out over deeper water. Sinking nets were set at depths greater than 10 meters. Previous years' netting records were consulted to determine depths fished in each area. We fished sets overnight by setting nets in late afternoon and retrieving nets in mid-morning hours.

To calculate catch-per-unit-effort (CPUE), we recorded the number of each species captured in each sinking or floating set and divided by two, in order to report catch per single standard net type. Sinking and floating net catches were reported separately. Percent composition of catch by species was also reported separately by net type. We enumerated, measured total length and weight, and collected age, growth, sexual maturity, and food habits data from captured fish.

Results And Discussion

From 1996 through 2003, we successfully fished all five areas of the lake, for a total of 30 sinking nets and 30 floating nets per year. Catch in sinking nets best describes fish species with benthic orientation, such as lake trout and bull trout, suckers, and lake whitefish. Catch in floating nets best describes the changes in westslope cutthroat trout and minnow populations, species that are more surface or shallow water oriented.

Until the mid-1990's, the sampling protocol established in the early 1980s was not adhered to and gillnetting surveys were either not conducted or incomplete. For example, lake-wide spring gill-net surveys were not conducted at all from 1984 through 1989. Lake-wide spring gillnetting with floating nets has been conducted since 1992. From 1990 to 1994, spring netting with sinking nets using established protocol was only repeated at the northern sampling sites. Therefore, the lake wide sinking series conducted since 1995 are most comparable to the surveys of the early 1980's. Caution should be applied when reviewing species composition and catch per net values from sinking nets for 1990 through 1994 and in comparing these values with results from earlier surveys.

Sinking gill net catch was relatively consistent during the 1999 through 2003 period. Lake whitefish dominated percent composition, ranging from 56 to 76 percent of the total number of captured fish (Table 1). Northern pikeminnow and Lake trout made up the majority of remaining catch. Bull trout comprised 0.4 to 2.5 percent of catch. The 2003 value for bull trout was the lowest in the 1999-2003 period.

Percent composition of species in floating nets has varied widely in the last four years. Native fish dominated the catch from 1999 through 2003 (Table 1). Northern pikeminnow comprised 25 to 57 percent of the catch, followed by peamouth (8 to 50 percent) and westslope cutthroat trout (5 to 23 percent).

Percent species composition of our catch has changed dramatically since *Mysis* became established in the lake. *Mysis* densities began to increase in 1985 and peaked in 1986. For gill-net surveys, sample years 1981 and 1983 describe the pre-*Mysis* fish community and provide baseline fishery information for comparison to current populations. In the sinking nets, there was a shift in species composition from numerical dominance by peamouth (pre-*Mysis*) to lake whitefish (post-*Mysis*) (Table 1). In 1981 and 1983, peamouth comprised 41.1 and 39 percent of catch composition, while lake whitefish comprised only 16.2 and 13.7 percent, respectively. In recent catches, lake whitefish comprised 66 to 76 percent of the catch.

One of the more dramatic transformations was the relative abundance of bull trout and lake trout (Table 1). In 1981 and 1983, bull trout numbers comprised 10 and 13 percent of fish caught in sinking nets, while lake trout numbers comprised only 0.2 and 0.9 percent, respectively. Since 1999, bull trout comprised 0.4 to 2.5 percent, while lake trout comprised 6 to 10 percent of gill-net catch.

We have observed similar declines in mountain whitefish in sinking net catch (Table 1). Mountain whitefish comprised roughly four percent of catch composition in the early 1980s and now have a very low incidence (<1 percent).

Species composition of the floating net catch has not varied as widely between the 1980's and recent years as that of the sinking net catch. Westslope cutthroat trout showed the greatest declines. In the early 1980s, westslope cutthroat trout made up 20 to 40 percent of catch while in recent years less than 20 percent, with the exception of 2001 (23%). Declines in peamouth relative abundance observed in sinking net catch were not as evident in floating nets. Peamouth values have generally remained strong and comprised a large percentage of catch, but not in the 2000 and 2001 catch when northern pikeminnow dominated (Table 1). In 2003, peamouth comprised 50 percent of the catch. The apparent discrepancy between sinking and floating net catch may be explained by the difference between lake whitefish catch in sinking versus floating nets. We did not see as dramatic an increase in lake whitefish catch in the floating nets as we did in the sinking net catch, most likely due to lake whitefish behavior and depth preferences. Northern pikeminnow, another native minnow, has also comprised a large percentage of floating net catch and makes up a greater percentage of recent catches than it did in the 1980's catches (Table 1). In recent years, native peamouth and northern pikeminnow dominated catch composition in floating nets.

Table 1. Percent species composition of fish caught in gill nets in Flathead Lake annual spring monitoring series, 1981- 2003.

Sinking Nets													
Year	# of Nets	Total # of Fish	WCT	BT	LT	LWF	MWF	KOK	NSQ	PM	LNSU	CSU	YP
1981	23	450	0.4	13.3	0.2	16.2	4.4	2.2	15.6	41.1	3.8	0.9	1.8
1983	30	459	0.2	10.7	0.9	13.7	4.1	1.1	11.1	39	8.1	2.2	8.7
1992	18	369	0	2.4	8.4	55.8	0.3	0	12.7	15.7	1.9	1.1	1.6
1993	18	299	0.7	0.7	8.7	46.2	0.3	0	24.1	10.4	4.7	3.3	0.7
1994	18	555	0	0.7	10.1	49.9	0	0	9.5	26.5	2.5	0.2	0.5
1995	24	304	0	0.3	9.2	54.9	0	0	15.5	13.5	2.6	2	2
1996	30	286	0	0.7	13.6	74.8	0	0	6.6	2.1	1.7	0.3	0
1997	30	524	0	1.4	10.3	74.7	0	0	11.1	0.4	1.4	0.6	0
1998	30	633	0.2	0.6	6.3	74.9	0.2	0	12.8	2.1	2.1	0	0.9
1999	30	577	0.2	1.9	10.1	66	0.2	0	14	2.8	2.3	0.5	2.1
2000	30	911	0	1.1	6	75.7	0	0	12.3	2.7	1.3	0.1	0.7
2001	30	636	0	2.5	9.6	56.3	0.3	0	4.3	0.6	0.4	0.2	1
2002	30	426	0	1.2	9.2	68.5	0.2	0	12.9	1.6	2.1	0.7	3.3
2003	30	739	0	0.4	8.7	62.4	0	0	10.7	9.9	1.4	0.1	6.2
Floating Nets													
Year	# of Nets	Total # of Fish	WCT	BT	LT	LWF	MWF	KOK	NSQ	PM	LNSU	CSU	YP
1981	30	232	43.5	10.9	0	1.7	8.7	2.6	14.8	17.8	0	0	0
1983	30	268	22.8	7.1	0	2.6	2.6	4.9	11.9	46.3	0.7	1.1	0
1992	28	149	38.9	3.4	10.1	8.7	6	0	8.1	22.1	0.7	0	0.7
1993	28	102	9.8	0	6.9	19.6	1	0	37.3	20.6	0	3.9	0
1994	30	116	16.4	4.3	8.6	7.8	0.9	0	23.3	37.9	0	0	0.9
1995	24	51	13.7	2	7.8	21.6	0	0	31.4	17.6	2	3.9	0
1996	30	41	17.1	17.1	12.2	2.4	4.9	0	19.5	26.8	0	0	0
1997	30	134	11.2	8.2	4.5	2.2	3	0	37.3	23.9	0.7	8.2	0
1998	30	608	4.3	2.1	1.5	4.1	0.5	0.2	37.7	46.7	0	1.2	0.3
1999	30	304	4.9	3	3	8.2	3.6	0.3	24.7	47.7	0.3	3	0
2000	30	278	17.3	3.6	1.4	5	5.8	0	56.8	9	0	0.7	0
2001	30	172	23.3	5.2	4.1	5.8	7.6	0	39	8.1	1.2	3.5	0.6
2002	30	234	6.8	2.6	3.4	6	3.4	0	33.3	38	0.4	4.3	0
2003	30	413	7.3	2.4	1	1.7	1	0	34.1	50.4	0	0.5	0.2

Key = WCT = Westslope Cutthroat, BT = Bull Trout, LT = Lake Trout, LWF = Lake Whitefish, MWF = Mountain Whitefish, KOK = Kokanee, NSQ = Northern Pikeminnow, PM = Peamouth, LNSU = Longnose Sucker, CSU = Largescale Sucker, YP = Yellow Perch

Table 2. Number of fish per net caught in gill nets in Flathead Lake annual spring monitoring series, 1981-2003.

Sinking Nets												
Year	# of Nets	WCT	BT	LT	LWF	MWF	KOK	NSQ	PM	LNSU	CSU	YP
1981	23	0.1	2.6	0	3.2	0.9	0.4	3	8	0.7	0.2	0.3
1983	30	0	1.6	0.1	2.1	0.6	0.2	1.7	6	1.2	0.3	1.3
1992	18	0	0.5	1.7	11.4	0.1	0	2.6	3.2	0.4	0.2	0.3
1993	18	0.1	0.1	1.4	7.7	0.1	0	4	1.7	0.8	0.6	0.1
1994	18	0	0.2	3.1	15.4	0	0	2.9	8.2	0.8	0.1	0.2
1995	24	0	0	1.2	7	0	0	2	1.7	0.3	0.3	0.3
1996	30	0	0.1	1.3	7.1	0	0	0.6	0.2	0.2	0	0
1997	30	0	0.2	1.7	12.3	0	0	1.8	0.1	0.2	0.1	0
1998	30	0	0.1	1.3	15.8	0	0	2.7	0.4	0.4	0	0.2
1999	30	0	0.4	1.9	12.7	0	0	2.7	0.5	0.4	0.1	0.4
2000	30	0	0.3	1.8	23	0	0	3.7	0.8	0.4	0	0.2
2001	30	0	0.5	2	11.9	0.1	0	4.3	0.6	0.4	0.2	1
2002	30	0	0.2	1.3	9.7	0	0	1.8	0.2	0.3	0.1	0.5
2003	30	0	0.1	2.1	15.4	0	0	2.6	2.4	0.3	0	1.5
Floating Nets												
Year	# of Nets	WCT	BT	LT	LWF	MWF	KOK	NSQ	PM	LNSU	CSU	YP
1981	30	3.3	0.8	0	0.1	0.7	0.2	1.1	1.4	0	0	0
1983	30	2	0.6	0	0.2	0.2	0.4	1.1	4.1	0.1	0.1	0
1992	28	2.1	0.2	0.5	0.5	0.3	0	0.4	1.2	0	0	0
1993	28	0.4	0	0.3	0.7	0	0	1.4	0.8	0	0.1	0
1994	30	0.6	0.2	0.3	0.3	0	0	0.9	1.5	0	0	0
1995	24	0.3	0	0.2	0.5	0	0	0.7	0.4	0	0.1	0
1996	30	0.2	0.2	0.2	0	0.1	0	0.3	0.4	0	0	0
1997	30	0.5	0.4	0.2	0.1	0.1	0	1.7	1.1	0	0.4	0
1998	30	0.9	0.4	0.3	0.8	0.1	0	7.6	9.5	0	0.2	0.1
1999	30	0.5	0.3	0.3	0.8	0.4	0	2.5	4.8	0	0.3	0
2000	30	1.6	0.3	0.1	0.5	0.5	0	5.3	0.8	0	0.1	0
2001	30	1.3	0.3	0.2	0.3	0.4	0	2.2	0.5	0.1	0.2	0
2002	30	0.5	0.2	0.3	0.5	0.3	0	2.6	3	0	0.3	0
2003	30	1	0.3	0.1	0.2	0.1	0	4.7	6.9	0	0.1	0

Key = WCT = Westslope Cutthroat, BT = Bull Trout, LT = Lake Trout, LWF = Lake Whitefish, MWF = Mountain Whitefish, KOK = Kokanee, NSQ = Northern Pikeminnow, PM = Peamouth, LNSU = Longnose Sucker, CSU = Largescale Sucker, YP = Yellow Perch

We observed similar changes in catch-per-unit-effort (CPUE) for individual fish species as in the percent species composition (Table 2). In sinking net sets, bull trout and lake trout showed opposite trends, where the number of bull trout has dropped from 2.6 and 1.6 fish per net in 1981 and 1983 to a range of 0.1 to 0.5 from 1999 to 2003. Conversely, lake trout catch has increased from 0.0 and 0.1 fish per net in 1981 and 1983 to a range of 1.3 to 2.1 fish per net from 1999 to 2003. Lake whitefish catch has also increased. Lake whitefish catch increased from 3.2 and 2.1 fish per sinking net in 1981 and 1983 to a range of 9.7 to 23 fish per net. The 2000 CPUE was the highest on record for lake whitefish. Peamouth CPUE was lower in recent years than in the early 1980s. The 2003 catch of 2.4 fish per net was the highest peamouth catch in sinking nets since the early 1990's. Northern pikeminnow CPUE appears unchanged during the sampling period (Table 2).

Floating net catch best depicts changes in westslope cutthroat trout abundance. A decreasing trend similar to bull trout has been evident. In the early 1980s, catch of cutthroat trout was two to three fish per net. In the last five years, catch has ranged from 0.5 to 1.6 fish per net.

In an effort to summarize and compare CPUE between pre- and post-*Mysis* establishment, we calculated means for the number of fish per net, combining 1981 and 1983 for pre-*Mysis* values and 2001 through 2003 for post-*Mysis* values (Figure 1). There has been over a ten-fold increase in lake trout CPUE, conversely there has been a large decrease in bull trout CPUE. Lake whitefish CPUE has increased, while westslope cutthroat trout CPUE has decreased.

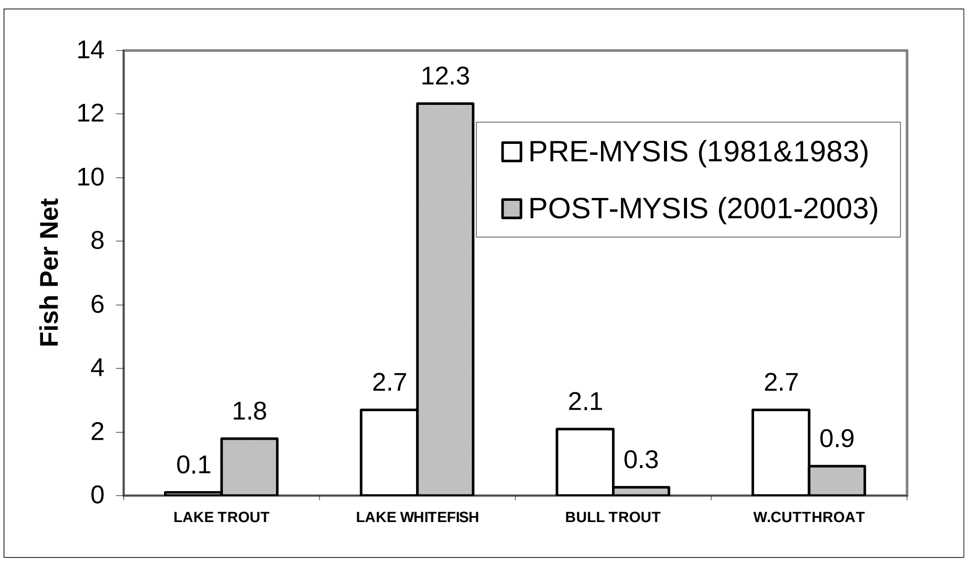

Figure 1. Mean number of fish caught per net set in Flathead Lake.

ANGLER CREEL SURVEYS ON THE FLATHEAD RIVER

MFWP conducted an angler creel survey on the Flathead River from May 2002 to June 2003. See attached report for results (Deleray, M. 2004. Flathead River Angler Creel Report, 2002-2003. Montana Fish, Wildlife and Parks, Kalispell, MT).

WESTSLOPE CUTTHROAT TROUT ABUNDANCE ESTIMATES

Introduction

MFWP assessed westslope cutthroat trout abundance through population estimates in the upper Flathead River Drainage. Investigators had limited success assessing population status with standard electrofishing techniques due to low water conductivity, access limitations, and wilderness restrictions. Consequently, MFWP created a population monitoring strategy for sections of the South, Middle, and North forks of the Flathead River. This strategy relies on multiple-day, hook-and-line marking runs followed by a snorkel recapture run. The following report will discuss only the North Fork estimates since they fall within the project boundaries.

Description of the Drainage and Fishery Characteristics

Graham et al. (1980) described the North Fork Drainage. The North Fork of the Flathead River originates in the Rocky Mountains of British Columbia, Canada and flows south across the U.S. and Canadian border into Montana. The North Fork crosses the boundary at an elevation of 1201 m and flows approximately 92 km south to it's confluence with the Middle Fork immediately above Blankenship Bridge located between the towns of West Glacier and Coram, Montana. The upper portion of the river flows through a broad glaciated valley approximately 12.9 km wide and was classified in 1976 as a Scenic River under the National Wild and Scenic River's Act.

The only cutthroat trout monitoring section for the North Fork is located 22 km south of the border and is designated the Ford section. The section begins at the USFS river access at Ford and extends downstream for 4.25 km to immediately above the mouth of Whale Creek. For the 1999, 2002 and future surveys, the section was shortened to 3.27 km. We reduced the length of the section to improve access to the section and to improve our ability to mark fish throughout the section.

Westslope cutthroat trout, bull trout, and mountain whitefish are the native game fish species found in the North Fork of the Flathead River and their tributaries. Three distinct life history forms of westslope cutthroat trout commonly occur within the Flathead River System. Adfluvial cutthroat trout spend one to three years as juveniles in tributaries before moving downstream to a lake. They generally reside in a lake for one to three years, mature and return to their natal stream for spawning. By far the majority of cutthroat trout in the North Fork exhibit this life history. Fluvial westslope cutthroat trout have a similar life cycle except they grow and mature in a river rather than a lake prior to spawning in their natal stream. The resident form of westslope cutthroat trout completes its entire life cycle solely in headwater tributaries. Resident cutthroat trout seldom reach lengths greater than 200 mm, whereas fluvial and adfluvial fish may attain lengths up to and exceeding 450 mm.

Methods

To allow comparisons between forks, we developed a single method for use in all population estimates. We did not conduct annual surveys in each river section, but instead alternated between sections. We completed a survey on each section once every three years. We conducted surveys during similar time periods in July or August, recognizing similar flow conditions and the return of adult westslope cutthroat trout to the river from tributaries after spawning. We used a mark and recapture sample design to assess fish abundance and size distribution. To conduct estimates, we captured cutthroat trout through angling. Small cutthroat trout less than 254 mm in length (TL) were marked with a blue crustacean tag; fish measuring 254 to 305 mm received a red crustacean tag; fish greater than 305 mm received a yellow crustacean tag. Crustacean tags were needle inserted under the flesh in the anterior rays of the dorsal fin. After measuring and marking, fish were released within the stream feature where they were captured. Angling times were recorded to develop catch-per-effort. We marked cutthroat trout for two to three days when previously caught and marked fish comprised a portion of the total daily catch.

In the afternoon of the third or fourth day we conducted the recapture run by snorkeling in the downstream direction. To estimate the population size by snorkeling, we used the total number of angler caught fish as the number of marked fish at large (M) and then snorkel observations to estimate the ratio of tagged (R) to untagged (C) cutthroat trout for each size class. The number of experienced snorkelers was dependent on water clarity, underwater visual distance, and river width. The visual distance was the length at which the size-class and species could no longer be determined. Snorkel counts were conducted mid-day during optimal light conditions. Snorkelers recorded the number and size-class of marked and unmarked cutthroat trout on diving slates. Divers floated in designated lanes to survey all available habitats. Generally, there was a diver near each bank and two to three divers spread across the remaining channel width. Frequent stops at riffle breaks were necessary to maintain a relatively even line of snorkelers throughout the section length. Other fish species observed were also recorded.

To estimate the total population for the section, we added all snorkel lane counts and utilized the Adjusted Petersen Estimate technique (Ricker 1975). In addition, we calculated mean length, length range, percent size composition, and catch rate for all fish handled during the marking runs.

Results and Discussion

Results from five years of population estimates for the Ford section are shown in Table 3. From 1990 to 1996, overall cutthroat trout numbers appeared to drop dramatically from 428 to 146 per kilometer. Small (<254 mm) cutthroat trout comprised 94 percent of total cutthroat trout abundance with mid-size (254 to 305 mm) representing five percent and large (>305 mm) cutthroat trout only one percent. The majority of the decline occurred in the small cutthroat trout with mid and large size fish maintaining low numbers in all three years. From 1990 to 1996, catch data for the Ford section demonstrated an increase in the average size (from 192mm to 214mm) and a decrease in catch rates (6.0 to 4.0 fish per hour) (Table 4).

Table 3. Snorkel/Petersen population estimates for the number of westslope cutthroat trout per kilometer (+/- 95% confidence interval) in the Ford section, North Fork of the Flathead River.

Date	< 254 mm (<10")	254-305 mm (10-12")	> 305 mm (>12")	All Sizes Combined
8/3/90	411 (79)	16 (17)	0	428 (82)
8/18/93	232 (44)	15 (9)	1 (1)	249 (46)
8/30/96	133 (30)	10 (5)	3 (2)	146 (31)
8/18/99	412 (128)	27 (16)	5 (2)	444 (116)
8/8/2002	204 (77)	8 (6)	3 (1)	215 (72)

Table 4. Angler catch data for the marking runs on westslope cutthroat trout in the Ford section, North Fork of the Flathead River.

Year	N	Mean Length (mm)	Length Range (mm)	Percent >254 mm	Percent >305 mm	Catch Rate (fish/hour)
1990	386	192	103-292	2	0	6.0
1993	296	201	110-315	6	0	5.7
1996	165	214	172-375	10	2	4.0
1999	416	206	102-396	8	3	6.1
2002	166	206	102-396	10	3	3.0

The 1999 estimate showed an increase in density of smaller westslope cutthroat trout and also the highest estimates for densities of mid-sized and larger fish. Although the highest estimates on record for the mid-sized and larger fish, these densities remained low and comprised a small percentage (roughly 7%) of the estimate, (Table 3). The 2002 estimate showed a return to lower densities for both the small and mid-sized fish (Table 3). It is difficult to determine if the variation in these estimates are indicative of actual changes to the population or just a manifestation of conducting a point-in-time estimate of a population that is in migration. Although the estimate was conducted at roughly the same time each year, population abundance at this site could vary between years and/or weekly across a season.

During the 2002 estimate, incidence of hook scars was recorded for all captured fish. We observed scars on eight percent of the small (< 254 mm) cutthroat trout, 11 percent of the mid-size fish (254 to 305 mm), and 29 percent of the large (> 305 mm) cutthroat trout. This monitoring section has a relatively high incidence of hook scars, which is not surprising since the North Fork has the easiest angler access of all three forks of the Flathead River. Angling pressure estimates for the North Fork have increased in recent years. Angler pressure increased form 5763 angler-days in 1995 to 7287 angler-days in 1997, to 6590 angler-days in 1999, and to 9438 angler-days in 2001. In 1998, MFWP established catch and release fishing regulations for westslope cutthroat trout in Flathead Lake, River and North and Middle forks. To date, this regulation has not lead to an obvious increase in the number or size of cutthroat trout in the Ford Section, likely due to the life history strategy of cutthroat trout using the North Fork. Tagging and movement studies (Graham 1980) suggested that the majority of cutthroat trout using the North Fork were adfluvial fish using Flathead Lake. This is a migratory population with few adults if any reaching maturity within the Ford Section. This explains the low proportions of larger fish in the estimates. Reducing harvest in the lake and river would not result in a greater number of adults in the Ford Section during the summer months, since the adult fish would have moved back downstream to Flathead Lake by mid-summer. The life history also explains the high proportion of smaller fish, since many of these smaller fish are juveniles leaving the rearing tributaries on their way to downstream habitats where they will grow to larger sizes. Figure 2 shows the length frequency of angler caught westslope cutthroat trout in the 2002 estimate. The chart shows that the majority of the fish caught are six to eight inches in length and likely three to four years of age, based on results of scale age analysis in previous studies (Fraley et al 1981).

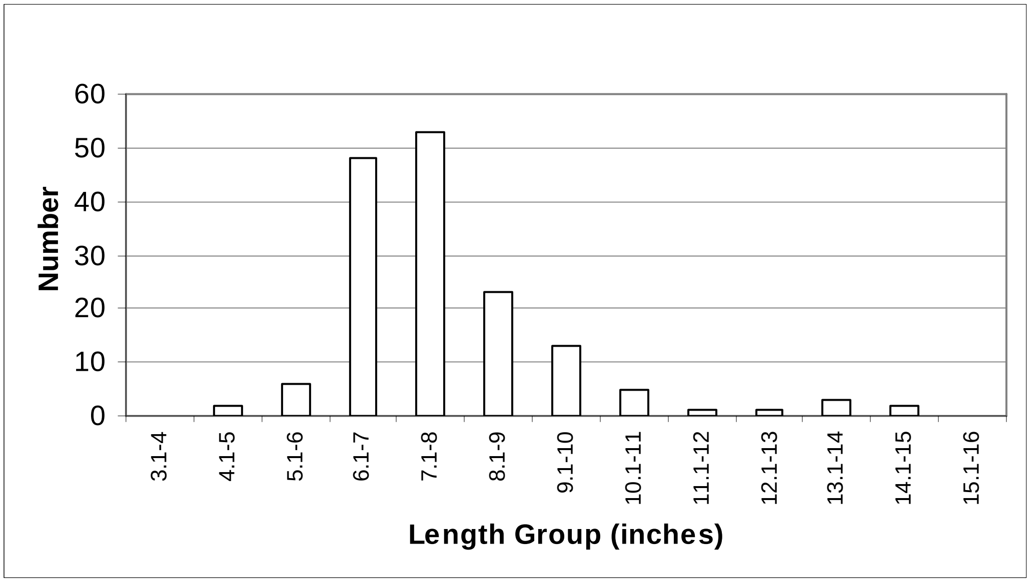

Figure 2. Length frequency of angler caught westslope cutthroat trout on marking runs in the Ford section, North Fork of the Flathead River, 2002.

JUVENILE BULL TROUT DENSITY ESTIMATES USING STREAM ELECTROFISHING

Introduction

Estimating fish population abundance is necessary for understanding basic changes in numbers, species composition and year class strength. In the Flathead Basin, we developed a protocol to assess fish abundance for juvenile bull trout greater than or equal to one year of age using electrofishing techniques (Shepard and Graham 1983). Monitoring surveys quantify yearly variation in fish abundance in stream sections that are consistently sampled year after year (See Deleray et al 1999 for a more detailed report on sampling locations and data collected up to 1998 or Tom Weaver (MFWP) unpublished data). This report will focus on data collected from 1999 to 2003 and will include only the density estimates and not the data and abundance estimates from which these were determined.

Methods

We used a two-pass electrofishing estimation technique. In these small streams adequate numbers of fish were captured using backpack electrofishing units. We installed a block net at the downstream end of the 150 m section. We electrofished the section, working from the upstream boundary down to the lower block net. Between the first and second pass, we recorded length and weight measurements for all trout and kept them outside the section. We sampled the same stream sections each year, during the summer months, generally in August or September.

We used the formula for two-pass estimates of population abundance from Seber and LeCren (1967). If $p \geq 0.6$ we completed the estimate; otherwise, more fishing effort was expended, a third removal pass. When completing additional passes, we computed a multi-catch estimate using formulas presented in Zippin (1958). When reporting the estimates of fish numbers computed by electrofishing, we reported the estimate, the 95% confidence interval, the probability of capture (p), the area of the section surveyed, the date, the number of mortalities, and the density (for these data see Deleray et al 1999 or Tom Weaver, MFWP, unpublished MFWP data).

We calculated fish density by dividing the population estimate by the surface area of the stream section. We estimated the surface area by taking 15 stream widths measurements, evenly spaced from top to bottom of the section, calculating the mean width and multiplying it by the 150 m length. This report includes only the final density point estimates. We assessed trends in mean densities using linear regression analysis with a 95% confidence interval.

Results and Discussion

Table 5 depicts the density estimates (#/100m^2) for juvenile bull trout in select North and Middle Fork tributaries. Most of these stream sections have been monitored annually since the early 1980's. Morrison, Ole, Granite and Bear Creeks are tributaries to the Middle Fork of the Flathead River, while the remaining are tributaries to the North Fork. The last two columns are composite values, mean densities after combining values from specific streams. We calculated composite values in an effort to generalize what juvenile bull trout densities were for tributaries in the Flathead River System. We combined estimates from Big, Coal, Red Meadow and Whale Creeks; all of these are North Fork tributaries, and Morrison Creek, a tributary of the Middle Fork, since we had extensive data for these streams over the 20-plus year period. "Mean 5 Combo" is the mean density for these five streams. We did not include the North and South Coal Creek estimates due to the concern of including multiple estimates from one tributary in the composite value. In 2001, we increased the number of Middle Fork tributaries in the composite value, so we continued surveys of Morrison and Ole Creeks and started surveying Granite and Bear Creeks. Our goal was to include four North Fork and four Middle Fork tributaries in the composite value. We have yet to find a suitable stream reach in Bear Creek and the remote locations of other tributaries limit our ability to conduct annual sampling. "Mean 7 Combo" is the mean density for the combination of the original five streams with the addition of Ole and Granite Creeks. Thus, the "Mean 7 Combo" includes four North Fork and three Middle Fork tributaries.

Table 5. Juvenile (age 1+) bull trout densities (#/100m^2) in tributaries of the North and Middle Forks of the Flathead River.

YEAR	BIG	COAL	N. COAL	S.COAL	RED MEADOW	WHALE	MORRISON	OLE	GRANITE	BEAR	MEAN 5 COMBO	MEAN 7 COMBO
1980							13.5					
1981						4.7						
1982		4.9	1.3				15.5	2.1				
1983		3.2	1.6		5.9	2.4	11.4					
1984		4.3	4.2									
1985		4.4	3.7	5.9			11.3					
1986	2.8	6.6	3		5.7	2.2	17.5	2.9			7.0	
1987	3	8.3	4	1.2	3	3.8	17.5	3.1			7.1	
1988	4.2	4.9	4.1	2.5	1.9		13.2				6.1	
1989	4.9	4.1	4.9	1.7	1.9	2.1	11.9	3.6			5.0	
1990	4	3	2.8	4.4	4.1	2.3	2.2				3.1	
1991	2.9	4.8	0.7	4.4			7.6				5.1	
1992	3.1	3.3	1.5	5.4		6.2	3.2				4.0	
1993	1.6	2.1	0.6	1.5		3.4	6.3				3.4	
1994	0.2	2.3	0.2	0.8	0.4	5.1	1.5				1.9	
1995	0.3	2	0.2	3.8	0.2	4.4	8.1				3.0	
1996	0.7	0.3	0.1	0.4	0.3	2.1	2.7				1.2	
1997	1.2	0.1	0.1	2		0.6	3.5				1.4	
1998	2.5	0.4	0.1	0.2	1	8.5	3.9	3.9			3.3	
1999	2.1	0.6	0.2	1.2	0.9	3.2	4.8	0.8			2.3	
2000	1.7	0.3	0.4	1	0.4	3	5.7	2.9			2.2	
2001	3.1	1.3	0.8	1.5	0.6	4.3	8.2	3.3	6	1.7	3.5	3.8
2002	7.8	0.6	0.5	2.6	0.6	6.3	5.9	2.5	4.1	0.0	4.3	4.0
2003	6.7	1.3	0.3	5.0	1.7	4.0	10.0	1.9	4.7		4.7	4.3

Mean juvenile bull trout densities in the composite values have varied over the surveyed time period (Figure 3). Dependent on which time period we consider, there were trends in mean juvenile densities. Over the 1986 to 2003 period, there was no significant trend in the "Mean 5 Composite" value (R^2 = 0.1063, P-value = 0.3010). However, if we break the entire period into shorter timeframes, we observed significant trends. For example, looking only at the 1986 to 1997 period, there was a significant negative trend in mean density (slope = -0.532, R^2 = 0.874, P-value = 8.27E-06). This decline corresponds directly to the reduction in bull trout redd numbers over this time period (see following section) and poor spawning and rearing habitat conditions (Tom Weaver, unpublished MFWP data). Considering only the 1997 to 2003 period, we observed a positive trend in mean juvenile density (slope = 0.475, R^2 = 0.734, P-value = 0.014). This increase resulted from increased redd numbers and improved spawning and rearing habitat conditions during this time period (Tom Weaver, unpublished MFWP data).

If we consider streams individually, we see similarities and differences in trends in juvenile density over time (Table 5). Big, Whale and Morrison Creeks showed similar trends during the 1986 to 2003 period. These streams had relatively high juvenile densities in the 1980's and early 1990's and declines in densities in the mid-1990's, followed by increased densities in the late 1990's and 2000's. Big and Whale Creeks currently have juvenile densities at the high levels of the 1980's and early 1990's. Changes in juvenile bull trout densities in Coal and Red Meadow Creeks were different. These streams suffered similar declines in the early 1990's as we observed in the other three streams, but have not had increased juvenile densities in recent years (Table 5). This was likely due to habitat conditions within these individual drainages (Tom Weaver, unpublished MFWP data).

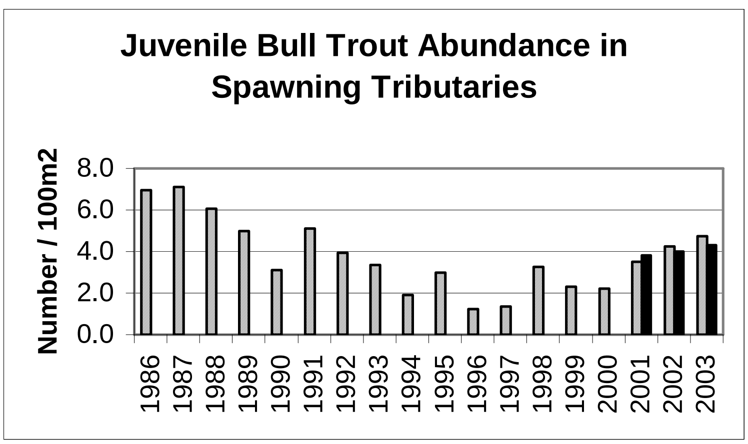

Figure 3. Mean juvenile bull trout density for five streams in the Flathead River Drainage, 1986-2003. Black bars represent mean for seven streams.

With additional sampling in upcoming years, we will be able to construct a relationship between the "Mean 5 Combo" composite and the "Mean 7 Combo" composite. We believe the increase in the number of streams included in the composite value will likely better depict juvenile bull trout densities in the Flathead River tributaries.

BULL TROUT REDD COUNTS

Introduction

Montana Fish, Wildlife and Parks has counted bull trout redds in Flathead Drainage since the late 1970's. Redd counts are a valuable element of the fisheries monitoring program. MFWP uses these counts to assess bull trout status and population trends. Flathead bull trout have migratory life histories. Adults migrate to and spawn in tributaries where the juveniles will rear. Juveniles migrate downstream to Flathead Lake and River to grow to adulthood. Flathead Lake bull trout spawned in 28 percent of the 750 km of available stream habitat surveyed in 1978-1982 (Fraley and Shepard 1989). As a result of specific spawning habitat requirements, bull trout spawn in a small portion of the available habitat, making these areas critical to bull trout production.

Over the past 24 years, we have monitored high density spawning areas in four tributaries to both the North and Middle forks of the Flathead River. In addition to our work in these annual index sections, we have periodically surveyed all known bull trout spawning areas presently available to Flathead Lake bull trout. Over the 24 years on record we have completed these basin-wide counts during nine years. These counts provided information on trends in adult escapement and spawning in upper basin tributaries. Through repeated annual index surveys we obtain valuable trend information to use in monitoring bull trout populations.

Methods

Experienced field crews surveyed specific stream reaches by walking the channel in the downstream direction. They visually identified redds by the presence of a pit or depression and associated tail area of disturbed gravel. Surveyors counted their paces while walking through the section. When the surveyors encountered a redd, they recorded its location in paces from the start of the survey. We conducted counts immediately following the completion of spawning.

For "index" counts, we walked the same reaches of stream each year. During a basin-wide count, we surveyed all stream habitats in the drainage that was suitable for bull trout spawning. Basin-wide counts were done every 3-5 years.

Results And Discussion

A large decline in bull trout redd numbers began in 1991 (Table 6, Figure 4). Indices showed this change resulted from alterations in the trophic dynamics in Flathead Lake following the establishment of *Mysis* (see Flathead Lake gill-net section of this report), likely combined with poor tributary habitat resulting from multiple years of drought and land management activities (Deleray et al 1999, Tom Weaver, MFWP, unpublished MFWP data). From 1980 to 1990, index bull trout redd counts averaged 384 redds per year (Table 6). From 1992 to 1997, counts averaged 120 redds per year. From 1992 to 2003, counts averaged 160 redds per year. Since 1992, there was a gradual increase in redd numbers; however, since 2000 there has been a declining trend. All three of the

Table 6. Bull trout redd counts for index reaches in tributaries of the North and Middle Forks of the Flathead River.

YEAR	BIG	COAL	WHALE	TRAIL	MORRISON	GRANITE	LODGEPOLE	OLE	Index	Basin-wide	Index %
1980	20	34	45	31	75	34	14	19	272	564	48
1981	18	23	98	78	32	14	18	19	300	705	43
1982	41	60	211	94	86	34	23	51	600	1156	52
1983	22	61	141	56	67	31	23	35	436		
1984	9	53	133	32	38	47	23	26	361		
1985	9	40	94	25	99	24	20	30	341		
1986	12	13	90	69	52	37	42	36	351	850	41
1987	22	48	143	64	49	34	21	45	426		
1988	19	52	136	62	50	32	19	59	429		
1989	24	50	119	51	63	31	43	21	402		
1990	25	29	109	65	24	21	12	20	305		
1991	24	34	61	27	45	20	9	23	243	624	39
1992	16	7	12	26	17	16	13	16	123	291	42
1993	2	10	46	13	14	9	9	19	122		
1994	11	6	32	15	21	18	6	6	115		
1995	14	13	28	28	28	25	9	16	161		
1996	6	3	35	8	9	4	8	10	83		
1997	13	5	17	9	39	12	5	14	114	236	48
1998	30	14	40	17	35	22	7	22	187		
1999	34	7	49	21	30	37	11	26	215		
2000	32	3	68	42	44	26	3	33	251	555	45
2001	22	0	77	27	40	18	17	29	230		
2002	12	0	71	26	30	18	12	21	190		
2003	12	1	34	14	21	17	10	21	130	297	44
AVG1980-1990	20	42	120	57	58	31	23	33	384		
AVG1992-2003	17	6	43	21	28	19	9	19	160		
AVG1992-1997	10	7	28	17	21	14	8	14	120		

above trends in redd numbers for the time periods 1980 to 2003, 1992 to 2003, and 2000 to 2003 were significant using linear regression analysis at the 95% confidence level.

Coal Creek redd numbers have dropped the greatest of all index reaches (Table 6). Redd numbers in Coal Creek dropped in the early 1990's, as they did in all index reaches. However, Coal Creek redd numbers did not increase in the late 1990's and 2000's, as redd numbers did in the other reaches.

Surveyors have documented bull trout spawning in 30 tributaries in the Flathead basin. When comparing our annual index counts with the basin-wide counts during the nine years on record we see that our annual index has ranged from 39 to 52 percent of the basin-wide number (Table 6). These eight stream sections on average contained 45 percent of all Flathead Lake bull trout spawning. It appeared that trends observed in the annual index counts accurately reflected basin-wide trends.

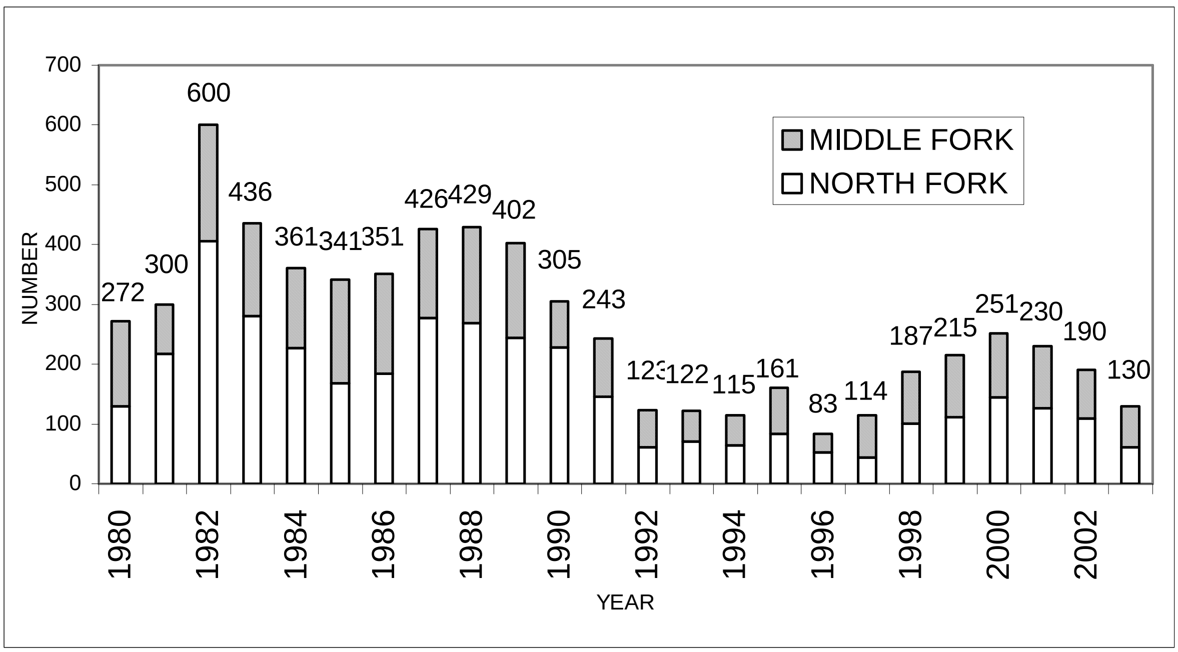

Figure 4. Bull trout redd counts in index reaches of eight tributaries in the North and Middle Forks of the Flathead River.

COAL CREEK SEDIMENT SURVEY

MFWP personnel conducted a visual survey of sediment sources and storage in the Coal Creek Drainage. See attached report for project specifics and results (Cavigli, J. et. al 2003. Coal Creek Channel Survey Preliminary Overview 2003. Montana Fish, Wildlife and Parks, Kalispell, Montana).

LARGEMOUTH BASS AGE AND GROWTH ESTIMATES

In 1997, Montana Fish Wildlife and Parks worked with a volunteer angler to conduct an age and growth survey of largemouth bass in sloughs connected to the Flathead River. The angler caught bass using hook-and-line methods, measured the total length, and collected scales. The angler successfully collected scales and lengths from 270 bass in Fennon, Church and Rose sloughs. These sloughs comprised a large portion of Section 5 in the Flathead River Creel Survey (see previous section in this report). Tagging studies have shown that bass move between these sloughs through the connected river (unpublished MFWP files). These sloughs are relatively shallow waters that warm in the summer months to temperatures warmer than the main stem Flathead River, providing suitable habitat for largemouth bass. The water temperatures in the main stem river and majority of Flathead Lake appear to be too cold to support an abundant largemouth bass population.

MFWP personnel made acetate impressions of the scales, measured growth intervals between annuli, and back calculated lengths at annulus formation (Table 7, Figure 5). Growth rates are relatively slow; however, anglers annually catch fish to over 20 inches in length.

Table 7. Largemouth bass age and total length (inches) at annulus formation in three sloughs connected to the Flathead River, 1997.

Slough	1+	2+	3+	4+	5+	6+	7+	8+	9+ (N=4)	10+ (N=3)
Rose (N=23)	2.6	5.5	9.1	11.5	13.9	15.6	17.4	19.3		
Church (N=57)	2.1	5.3	8.1	10.3	12.4	14.3	18.1	19.7		
Fennon (N=190)	2.6	6.0	9.0	11.4	13.2	15.1	16.3	17.2	18.4	19.9
Average (N=270)	2.5	5.7	8.8	11.0	12.9	15.0	16.5	17.4	18.4	19.9

MFWP personnel found 48 largemouth bass scale samples in unreported file data for Spencer Lake. The samples were collected in 1987. Spencer Lake is 32 surface acres in size and shallow with a maximum depth less than 20 feet. We back calculated age at annulus formation and included the data in this report for comparisons to bass growth in the river sloughs (Figure 6). Growth rates in Spencer Lake appeared to fall behind those in the sloughs after the second year. Temperature in the small lake should be warmer than the sloughs but the forage base, especially small forage fish, was likely less abundant since the minnow species that are abundant in the sloughs were not present in Spencer Lake.

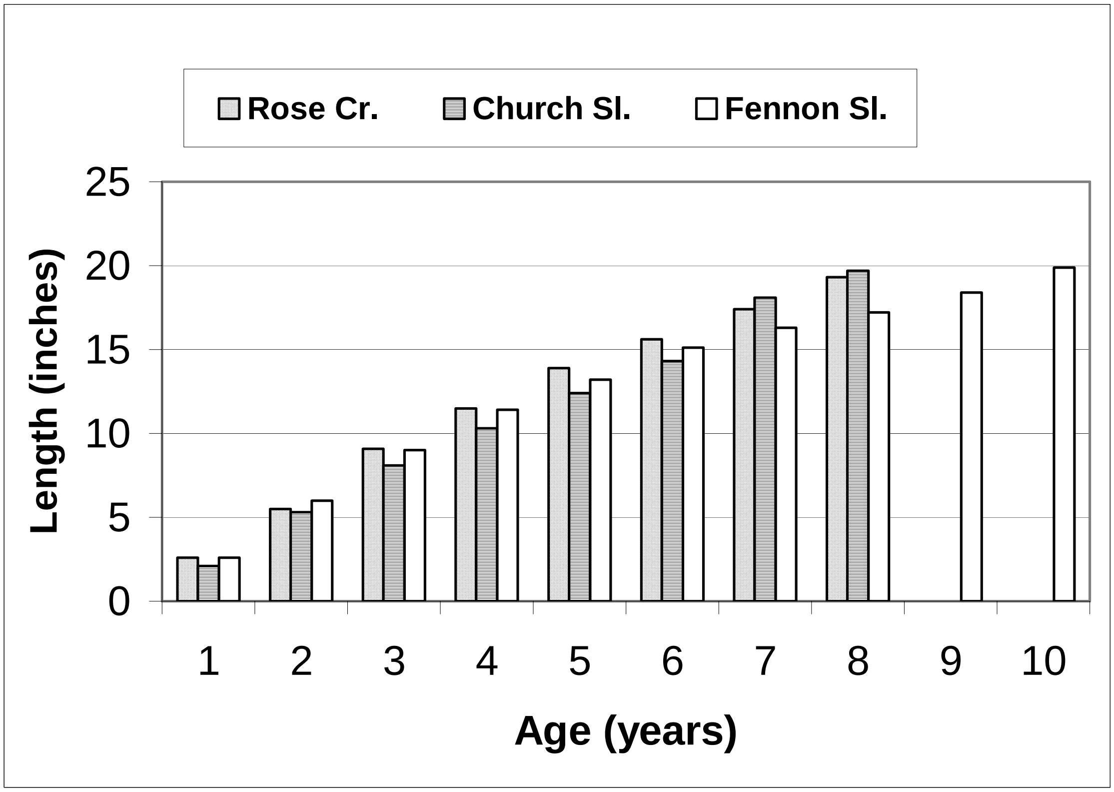

Figure 5. Largemouth Bass age and mean length at annulus formation in three sloughs connected to the Flathead River, 1997.

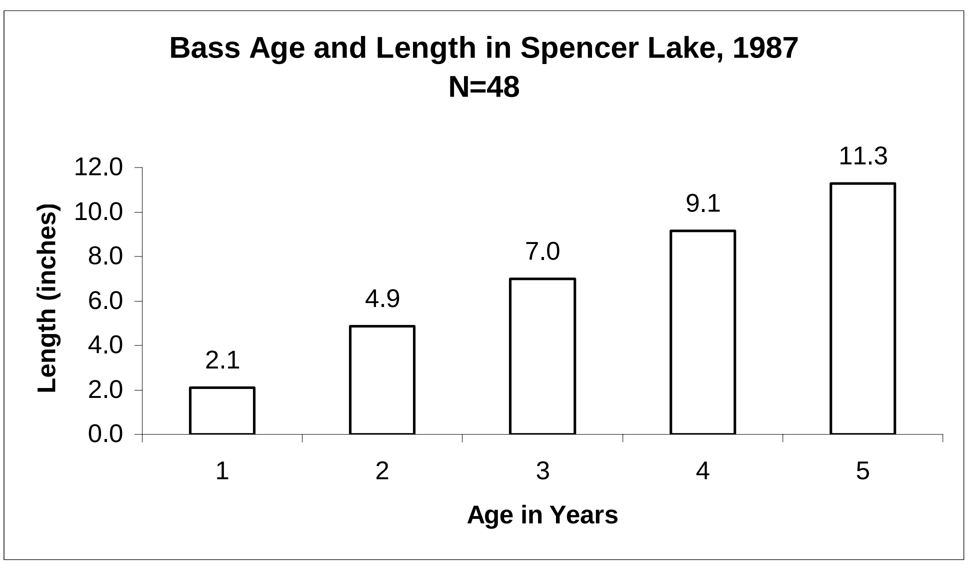

Figure 6. Largemouth bass age and mean length at annulus formation in Spencer Lake, 1987.

LITERATURE CITED

Alvord, B. 1991. A history of Montana's Fisheries Division from 1890 to 1958. Montana Fish, Wildlife & Parks, Helena, Montana.

Cavigli, J. et al. 2003. Coal Creek Channel Survey Preliminary Overview 2003. Montana Fish, Wildlife and Parks, Kalispell, Montana.

Deleray, M. 2004. Flathead River Angler Creel Report, 2002-2003. Montana Fish, Wildlife and Parks, Kalispell, Montana.

Deleray, M., L. Knotek, S. Rumsey, and T. Weaver. 1999. Flathead Lake and River System Fisheries Status Report. DJ Report No. F-78-R-1-5, SBAS Project No. 3131, Montana Fish Wildlife and Parks Kalispell, Montana.

Elrod, M. J., J. W. Howard, and G. D. Shallenberger. 1929. Flathead Lake--millions of dew drops. The fishes, chemistry and physics of Flathead Lake, Montana Wildlife 2(1): 5-15.

Fraley, J. J., D. Read, and P. J. Graham. 1981. Flathead River fisheries study. Montana Department of Fish, Wildlife and Parks. Kalispell, Montana.

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

Graham, P. J., D. Read, S. Leathe, J. Miller, and K. L. Pratt. 1980. Flathead River Basin fishery study. Montana Department of Fish, Wildlife & Parks, Kalispell, Montana.

Graham, P. J. 1980. Flathead River Basin Fishery Study. Environmental Protection Agency, Region VIII, Water Division, Denver, Colorado.

Hanzel, D. A. 1969. Flathead Lake, investigations of its fish populations and its chemical and physical characteristics. Project F-33-R-3, Job No. 1, final report. Montana Fish, Wildlife & Parks, Kalispell, Montana.

Hanzel, D. A., and T. Weaver. 1991. Survey and inventory of coldwater and warm water ecosystems: Flathead Lake - River System study. Project Number F-46-R-4. Job Number V-a. Montana Department of Fish, Wildlife and Parks. Kalispell, Montana. 32 pp.

MFWP and CSKT. 2000. Flathead Lake and River Fisheries Co-Management Plan 2001-2010. Montana Department of Fish, Wildlife and Parks, Kalispell, Montana and Confederated Salish and Kootenai Tribes, Pablo, Montana.

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

Seber, G. A. F. and E. D. LeCren. 1967. Estimating population parameters from large catches relative to the population. Journal of Animal Ecology 36:631-643.

Shepard, B. B. and P. J. Graham. 1983. Fish Resource Monitoring Program for the Upper Flathead Basin. Prepared for the Environmental Protection Agency, Contract Number R008224-01-4. Montana Fish, Wildlife & Parks, Kalispell, Montana.

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. Prepared for Environmental Protection Agency, Contract No. R008224-01-5. Montana Fish, Wildlife & Parks, Kalispell, Montana.

Zackheim, H. 1983. Final report of the steering committee for the Flathead River Basin Environmental Impact Study. Funded by EPA under grant number R00822201, Kalispell, Montana, USA.

Zippin, C. 1958. The removal method of population estimation. Journal of Wildlife Management 22(1): 82-90.