FISHERIES INVENTORY OF THE BOB MARSHALL WILDERNESS COMPLEX

Limits of Acceptable Change Management Plan

Montana Department of Fish, Wildlife and Parks
1420 East Sixth Avenue
Helena, MT 59620

In cooperation with the U.S. Forest Service

September 1990

SUMMARY

The fisheries resource within the Bob Marshall Wilderness Complex (BMWC) is extensive and unique. More than 500 miles of stream and 35 lakes support populations of native and introduced species of salmonids. Waters within the BMWC represent a genetic stronghold for two native fish species of special concern, bull trout and westslope cutthroat, and provide thousands of angler days of recreation.

South Fork Flathead Drainage

The South Fork Flathead River drainage supports a fish assemblage similar to that of the Middle Fork. However, the river is isolated from the Flathead system by Hungry Horse Dam. Bull trout and some westslope cutthroat migrate between Hungry Horse Reservoir and the South Fork drainage within the BMWC. Information from tag returns has indicated that most cutthroat in the upper South Fork are fluvial residents of the river. Westslope cutthroat in the upper portion of the river were genetically tested and found to be genetically pure.

The ten productive lakes in the drainage support mostly rainbow and yellowstone cutthroat. MDFWP Region 1 is presently testing fish in these lakes for genetic characteristics and planting westslope cutthroat in some of these lakes.

A 1983 survey on the South Fork Flathead River indicated that anglers fish an average of 3.7 hours and kept 0.26 cutthroat per day. The total harvest estimate for the river was 4,382 cutthroat. About one-fourth of the anglers fished from boats. Anglers caught cutthroat at a rate of 4.1 and 2.6 fish per hour on the South Fork Flathead River in 1988 and 1989, respectively.

Lengths of westslope cutthroat caught by MDFWP anglers in the South Fork between Independence Park and the headwaters averaged 228 and 230 mm (9.0 in) in 1960 and 1981. Cutthroat averaged 240 (9.4), 258 (10.2) and 273 mm (10.7 in) in the same river section in 1984, 1985 and 1986. This apparent increase in average length may be due to the angling limits of three fish, none over 12 inches established in 1984.

Population estimates for cutthroat on several sections of the river ranged from 183-680 fish per km (293-1,090 fish per mile). Highest densities of cutthroat were found in the Black Bear and Mid Creek sections. Catch rates of cutthroat by MDFWP anglers were highest near the headwaters. Populations of cutthroat in tributaries of the South Fork averaged 3.43 fish/100 m2 water surface area (approximately 40 fish/100 m of stream length). Upper Gordon Creek supported the highest densities of westslope cutthroat.

Middle Fork Flathead Drainage

The Middle Fork Flathead River drainage supports a unique complex of migratory and resident native species including the bull trout, westslope cutthroat trout and mountain whitefish. Westslope cutthroat trout in the Middle

Fork Flathead River are less numerous than in the South Fork. Estimates of mountain whitefish in the Middle Fork were greater than 1,000 fish per mile. An estimate conducted in the 1.5-mile long Gooseberry section of the Middle Fork in 1988 showed 216 (±62) westslope cutthroat. Catch rates of cutthroat by anglers in the river ranged from 1.21 to 1.68 fish/hour from 1979-1981. Catch rates in 1988 and 1989 were less than 1.0 fish per hour.

Tributaries in the Middle Fork drainage supported from 0.2 to 27.2 westslope cutthroat per 100 m^2 water surface area (approximately 1-100 fish per 100 m (328 ft) of stream length). Juvenile bull trout densities ranged from 0.1 - 7.2 fish/100 m^2, or approximately 1-30 fish per 100 m of stream length. The Middle Fork tributaries represent important nursery areas for migratory westslope cutthroat trout populations from the Middle Fork Flathead River, and migratory bull trout populations in Flathead Lake. Catch rates of westslope cutthroat in tributaries by MDFWP anglers averaged 4.4 fish/hour. These cutthroat averaged 200 mm (7.9 in) in length.

Bull trout spawning sites or redds in Middle Fork tributaries ranged from 237 to 523 in years when nearly complete surveys were conducted. Major tributaries used by spawning bull trout in the drainage within the BMWC include Strawberry, Trail, Bowl, Clack, Schafer, Dolly Varden, Morrison, Lodgepole and Granite creeks.

Cutthroat populations (genetically untested) exist in 12 mountain lakes in the Middle Fork drainage within the BMWC. Populations are maintained by planting in six lakes and natural reproduction in six lakes.

Blackfoot Drainage

The Blackfoot River drainage within the BMWC provides some of the best spawning habitat available for large, fluvial bull trout which inhabit the Blackfoot and North Fork Blackfoot rivers. Other species in the drainage include westslope cutthroat, rainbow, hybrids of rainbow and westslope cutthroat, yellowstone cutthroat, brook trout and mountain whitefish.

Little information is available for major tributaries in the drainage within the BMWC. Major drainages include the North Fork Blackfoot, Landers Fork of the Blackfoot, the East Fork of the North Fork Blackfoot River and Monture Creek. Seven mountain lakes support yellowstone or cutthroat populations of undetermined genetic origin. A baseline study to collect fisheries information for management is needed in the drainage.

East Front Drainages

Streams draining the East Front within the BMWC support an important fishery for rainbow, cutthroat and eastern brook trout. Major East Front drainages include the North and South forks of the Sun River, the Dearborn River and streams in the Great Bear Addition (within the Teton and Marias River drainages).

Most available information has been collected on the North and South forks of the Sun River. Average lengths of rainbow trout in the forks from 1975-1989 have ranged from 249-322 mm (9.8 to 12.7 in). Approximately one-half of these rainbow (caught by MDFWP anglers) exceeded 12 inches in length. Fish reach 254 mm (10 in) during their third year of life. Three mountain lakes in the Sun River drainage support populations of yellowstone cutthroat. A baseline fisheries inventory to provide data necessary for management is needed.

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

INTRODUCTION

The Bob Marshall Wilderness Complex (BMWC) includes the Bob Marshall, Great Bear and Scapegoat wildernesses within the Flathead, Lewis and Clark, Helena, and Lolo National Forests. In 1985, the USDA Forest Service released a draft management plan for the BMWC based on the concept of Limits of Acceptable Change (LAC) (USDA 1985). The management plan, developed by a diverse task force, did not include a discussion of fish and wildlife populations or management.

In 1986, the LAC Task Force responded to public comment and asked the Montana Department of Fish, Wildlife and Parks to develop a chapter for the LAC plan that would include a discussion of fisheries and wildlife values. This chapter addresses the unique fisheries resource of the BMWC and includes a summary of available fisheries and habitat information, a discussion of sensitive fish species and habitat. Recommendations for managing and monitoring important fish populations, and recommendations for further work needed to improve fisheries management in the complex are detailed in the chapter on management and monitoring standards.

Information in this chapter is organized by the four major drainages within the BMWC: South Fork Flathead, Middle Fork Flathead, Blackfoot, and East Front (includes North and South forks of the Sun, Dearborn, Marias and Teton). Fisheries information for each drainage includes fish habitat, life histories of important fish species, fish populations, age and growth, important spawning sites, and angler use.

Most of the information in this chapter is based on previous fisheries work conducted within the BMWC. The section on the Middle Fork Flathead drainage was adapted from Fraley et al. (1981) and several other reports produced during the Flathead River Basin Studies from 1980 through 1983 (MDFWP 1982, Shepard and Graham 1983). The section on the South Fork Flathead drainage was adapted from a draft fisheries consolidation by Ray Zubik, Shepard et al. (1982), and recent unpublished data collected by Region 1, MDFWP. The section on the Blackfoot drainage was based largely on unpublished data collected by Region 2, MDFWP. The section on the East Front drainages was based on unpublished data collected by Region 4, MDFWP and several job progress reports (MDFWP 1976 and MDFWP 1980). Lack of fisheries information on the Blackfoot and East Front drainages limited the recommendations that could be made for monitoring and management.

SOUTH FORK FLATHEAD RIVER

Description of the Drainage

The upper South Fork Flathead River originates at the junction of Danaher and Young's creeks and flows in a northerly direction for 95 km before entering Hungry Horse Reservoir (HHR) (Figure 1). The upper 66 km lies entirely within the Bob Marshall Wilderness Area. The upper 84 km of the South Fork from its headwaters to the Spotted Bear River is classified a Wild River under the National Wild and Scenic Rivers Act of 1976 and downstream to HHR the South Fork is classified as a Recreational River. The average annual discharge into the reservoir (1964 to 1980) was 2,301 cfs with a maximum discharge of 30,200 and a minimum of 127 cfs. Hungry Horse Dam lies at the foot of the 4,403-km^2 South Fork drainage basin. No fish passage structures were installed in the dam and, consequently, access to approximately 38 percent of the total drainage area available for spawning salmonids migrating upstream from Flathead Lake was permanently blocked.

The South Fork Flathead River has been divided into different management units depending on the type of activity surveyed and the kinds of information desired. Zubik and Fraley 1987 distinguished three primary fish habitat types in the South Fork River. The upper area included the confluence of the South Fork to Independence Park which was typified by the 2.2-km long Gordon section (Figure 1). This section meandered through an open valley floor with the banks frequently lacking vegetation during low summer flows. The river channel has shifted many times and there are some braided sections. The typical channel cross section was a flat, bowl-shape with shallow edges and a deeper mid channel. Substrate primarily consisted of cobble and large gravel. Average stream width was 31.3 m and there were about 1.8 riffle:pool complexes per kilometer. The gradient was about 0.20 percent for this section of river.

The middle area of the river began below Independence Park and ended at Meadow Creek Gorge. This area is typified by the 4.4-km Black Bear section (Zubik and Fraley 1987). This section meandered through a narrower valley floor than the upper area with a more defined channel and very little braiding. The stream banks frequently lacked vegetation during low summer flow. The typical channel cross section was a flat, bowl shape with shallow edges and a deeper mid channel with substrate that consisted of cobble and large gravel. Average stream width was 42.3 m and this section contained 3.3 riffle:pool complexes per kilometer. Gradient averaged 0.28 percent per kilometer.

The lower river area begins immediately below Meadow Creek Gorge and runs downstream to Spotted Bear River. The 2.2-km Harrison section typifies this area (Zubik and Fraley 1987). This section of river flows through a canyon with a very defined channel and a cross section that was characterized as a steep "U" shape with deep edges and mid channel. Substrate consisted primarily of boulder and cobble. Average stream width was 45.1 m and there were about 1.8 riffle:pool complexes per kilometer. The gradient for this section of stream was 0.28 percent.

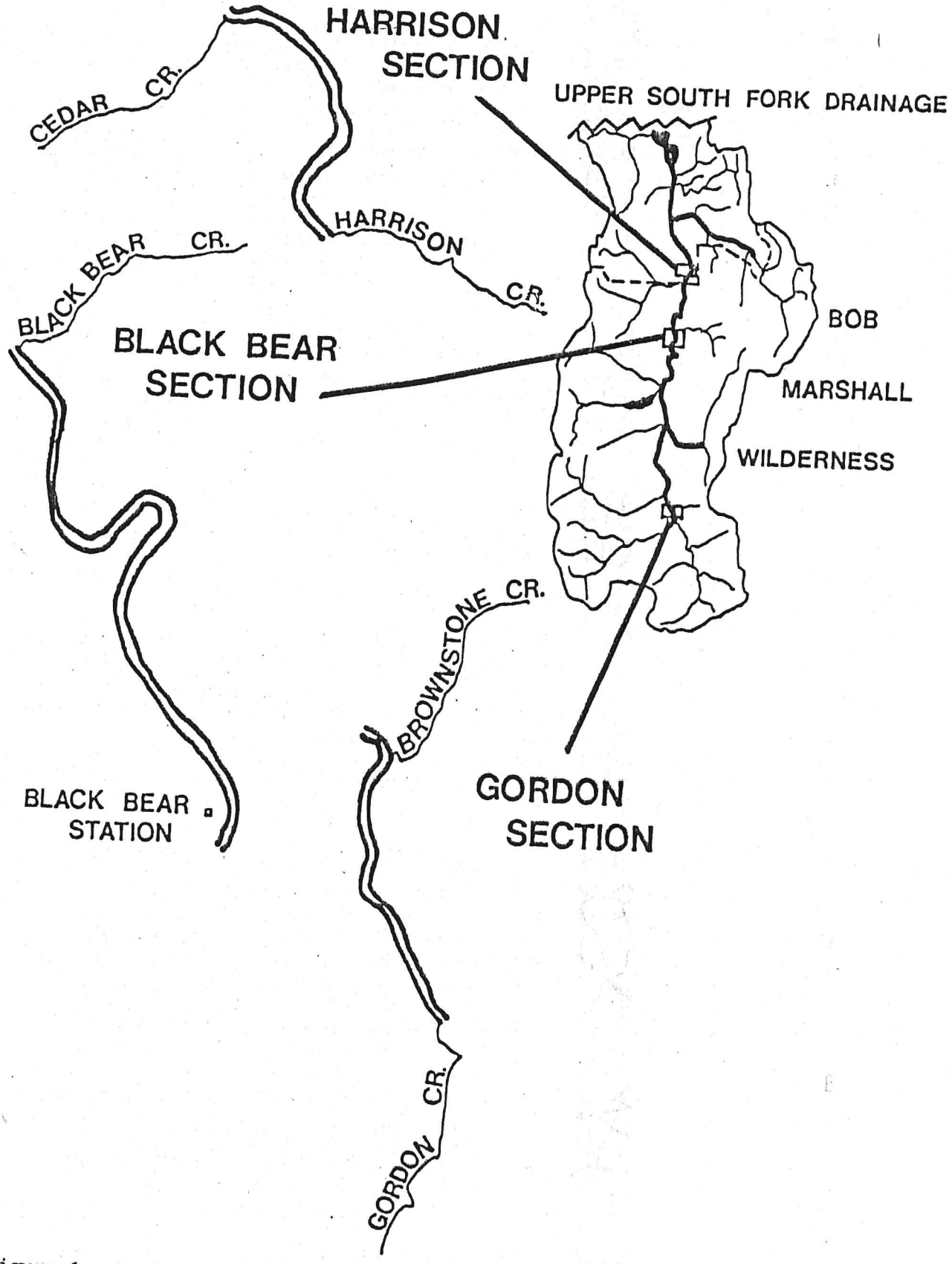

Figure 1. Map of the Upper South Fork Drainage.

For the 1983 creel survey, MDFWP divided the South Fork River into three sections: The upper South Fork from the confluence of Young's and Danaher creeks to Meadow Creek Gorge; the middle South Fork from Meadow Creek Gorge to the Spotted Bear River; and the lower South Fork from Spotted Bear River to Hungry Horse Reservoir.

McLaughlin et al. (1982) divided the South Fork of the Flathead into three management units for the floater survey which were similar to the MDFWP creel survey management units: the upper South Fork from the confluence of Young's and Danaher creeks to the wilderness boundary at Meadow Creek Gorge; the central South Fork management unit from the wilderness boundary to Spotted Bear River; and the lower South Fork management unit from Spotted Bear River to Hungry Horse Reservoir.

The USFS floater survey used two general management units: the upper South Fork from the confluence of Young's and Danaher creeks to Meadow Creek Gorge and the central South Fork from Meadow Creek Gorge to the Spotted Bear River.

Nutrient-poor and transparent water are characteristic of the South Fork drainage because the area is underlain by precambrian sedimentary rock which is frequently deficient in carbonates and nutrients. The geomorphic processes that shaped the area include alpine and continental glaciation as well as fluvial and gravitational processes associated with stream dissection and structural faulting.

Elevation ranges from 3,560 ft at HHR during full pool to mountain peaks nearly 10,000 feet high in the wilderness complex. Precipitation ranges from about 30 inches annually around HHR to more than 90 inches on the higher mountain ridgetops. The wider valleys of the upper South Fork and the "rain shadow effect" of the Mission Mountain range result in progressively drier climates moving upriver from the reservoir.

Fish Populations

Methods used to census and analyze fish populations are included in the Appendix Report.

RESULTS

Historic Status

Westslope cutthroat (Salmo clarki lewisi), bull trout (Salvelinus confluentus) and mountain whitefish (Prosopium williamsoni) are the major game fish species found in the South Fork Flathead River and its tributaries above Hungry Horse Reservoir. Westslope cutthroat and bull trout are both classified as species of special concern in Montana because of declines in abundance and distribution statewide.

Prior to construction of Hungry Horse Dam, the South Fork drainage was considered the major spawning area for adfluvial fish stocks from Flathead Lake.

Substantial numbers of bull trout and westslope cutthroat trout spawned in the South Fork drainage along with smaller numbers of mountain whitefish and kokanee salmon (Oncorhynchus nerka). Zubik and Fraley (1987a) estimated that potential habitat which would produce about 65,000 cutthroat juveniles to Flathead Lake annually was lost due to dam construction. They also estimated that potential spawning habitat which would support about 2,000 adult bull trout was lost due to blocked access to the South Fork drainage from Flathead Lake.

Other native fish species that used the South Fork drainage prior to dam construction included pygmy whitefish (Prosopium coulteri), northern squawfish (Ptychocheilus oregonensis), largescale sucker (Catostomus macrocheilus), longnose sucker (Catostomus catostomus), and sculpins (Cottus sp.). The fish species presently inhabiting the reservoir are native and nonnative riverine and migratory fish from Flathead Lake trapped behind Hungry Horse Dam when it impounded the South Fork. Exotic species which include yellowstone cutthroat (Salmo clarki bouvieri), rainbow trout (Salmo gairdneri) and arctic grayling (Thymallus arcticus) are present in the reservoir, but rarely collected.

Life History

Three distinct life history patterns of westslope cutthroat commonly occur throughout their native range (Graham et al. 1980). Juvenile adfluvial cutthroat spend one to three years in the tributaries before emigrating to a lake or reservoir. They generally reside in a lake or reservoir system for one to three years, mature and return to their natal stream in June and July to spawn and complete the life cycle. Some repeat spawners have been found, but most are alternate-year spawners. Fluvial westslope cutthroat trout are found in the main stem of the South and Middle Forks. These fish have a life cycle similar to the adfluvial strain, except that they grow and mature in a large river rather than a lake or reservoir. The resident strain of westslope cutthroat trout completes its entire life cycle in small headwater streams. Residents seldom reach total lengths greater than 200 mm, whereas fluvial and adfluvial cutthroat trout attain lengths up to 400-450 mm (Shepard et al. 1984).

Bull trout populations also exhibit the adfluvial fluvial and resident patterns. Bull trout in the South Fork drainage are primarily adfluvials and migrate from HHR to spawn in tributary streams. The initial spawning migration of adult bull trout peaks during May and June during high river flows. Adult bull trout spawners apparently move slowly upriver through early summer and probably hold near the mouths of their spawning tributary. The majority enter tributaries during August when stream temperatures drop to approximately 10°C. Repeat and alternate-year spawners have been found. Eggs hatch in January compared to July and August for cutthroat trout. Bull trout live longer, grow larger and are much more piscivorous (fish-eating) than cutthroat.

Fish Stocking

Cutthroat trout were periodically stocked in the South Fork, its tributaries and high mountain lakes. These fish were classified as undesignated cutthroat but for the most part were probably Yellowstone cutthroat trout (Huston, MDFWP pers. comm.). These fish were planted in various sections of the

South Fork Flathead River from 1926 through 1947 (Table 1). Unfortunately, specific plant locations were not designated during that time period. MDFWP also stocked 17 South Fork tributaries in the wilderness complex primarily from 1938 to 1941 (Table 2). These undesignated cutthroat trout were last planted in 1950.

All lakes in the South Fork drainage were probably barren except for Big Salmon Lake prior to artificial fish planting which began in the late 1920's. Westslope cutthroat, Yellowstone cutthroat and rainbow trout were stocked by MDFWP in nine South Fork drainage wilderness lakes through 1965 (Table 3). All of these lakes were planted at one time, but today most maintain themselves through natural reproduction (Table 4).

Although numerous plants have been made in various waters within the drainage, the South Fork Flathead River still contains pure westslope cutthroat. Electrophoretical testing of 23 suspected westslope cutthroat trout collected in 1981 from the Big Prairie area of the South Fork of the Flathead River indicated that these trout were pure westslope cutthroat typical of other populations throughout the range of this species (MDFWP, unpublished data). Thirty suspected cutthroat collected in 1985 from the Big Prairie area of the South Fork were tested electrophoretically (Leary, U of M, pers. comm.). He found that 29 were pure westslope cutthroat and the other a yellowstone-westslope cutthroat hybrid. He felt this single hybrid was probably a migrant from another tributary or lake and not a river resident. It is quite possible this single fish may have drifted out of one of the lakes into the South Fork or may have come up the South Fork from somewhere below the wilderness boundary, possibly from Hungry Horse Reservoir. Testing of 26 fish from lower Gordon Creek and 26 fish from Danaher Creek in 1989 indicated these stream sections supported pure westslope cutthroat trout.

MDFWP sampling found that previously stocked tributaries to HHR that had high mountain lakes at their origin generally had hybrid populations of cutthroat trout in the stream system below the lake. Conversely, those previously planted tributaries without high mountain lakes at their origin contained pure westslope cutthroat trout. In other words, planted nonnative fish did not establish in streams without lakes in their system but did in those tributaries with established lake populations. It is possible that nonnative lake fish probably drift downstream and hybridize with resident fish.

Recent management of westslope cutthroat in the South Fork Flathead drainage has placed emphasis on maintaining and improving genetic integrity of populations. beginning in 1986, MDFWP planted pure westslope cutthroat in several lakes with non-native species to "swamp out" or dilute the non-native genes/ The Department of Fish, Wildlife and Parks made these plants in lakes draining into Hungry Horse REservoir and the South Fork Flathead River. For these and other efforts, MDFWP developed a pure brood stock comprised on fenetically tested westslope cutthroat, mostly from tributaries to Hungry Horse REservoir. Lakes within the wilderness planted with this new westslope cutthroat brood stock include: Lena (1988-1990), Koessler (1988-1990), Lick (1988-1990), Pyramid (1988-1990), Smokey Creek #4 (Necklace) (1990), Sunburst (1989, 1990) and Woodward (1989, 1990).

Table 1. Known MDFWP planting of various sizes of undesignated cutthroat trout in the South Fork of the Flathead River.

Year	Number
1926	40,000
1936	124,048
1939	50,000
1940	14,000
1942	139,000
1943	50,000
1944	65,000
1945	50,000
1946	114,360
1947	100,000

Table 2. Known MDFWP planting of various sizes of undesignated cutthroat trout for tributaries to the South Fork of the Flathead River in the Wilderness Complex

Area	Stream	Year Planted	Number Planted
West Side	Gorge Creek	1941	20,000
	Hungry Creek	1939	20,000
		1941	44,000
	Pendant Creek	1938	9,400
	Holbrook Creek	1938	9,400
	Burnt Creek	1938	35,000
	Gordon Creek	1938	14,100
	Shaw Creek	1938	9,400
East Side	Lower Twin	1948	10,000
		1949	10,000
		1950	10,000
	Twin Creek	1940	10,000
		1948	10,000
		1949	15,000
		1950	15,000
	Dean Creek	1940	18,200
	Silver Tip	1940	22,500
		1948	5,000
	Harrison	1941	30,000
	Mid Creek	1939	30,000
		1941	15,000
	Black Bear Creek	1939	30,000
		1941	10,000
	Helen Creek	1939	20,000
		1941	10,000
	Pentagon	1938	8,000
		1939	23,500
		1940	11,500
		1948	5,000

Table 3. High mountain lakes and known planting of various fish species and sizes in the South Fork drainage of the wilderness complex[a/].

Area	Lake	Last Year Planted	Species	Number Planted
Westside	Inspiration			
	Olor Lakes (2)	1939	002	58,000
	Sunburst	1939	002	42,000
		1950	002	51,640
	Picture			
	Recluse			
	Palisade			
	Big Salmon			
	Woodward	1936	002(012, 1986)	18,900
		1939	002	14,000
	Necklace Lakes (3)			
	Pendant	1940	001	24,000
	Lena	1928	001(012, 1986)	
	Lick	1930	002	
	Koessler	1965	002	5,200
	Doctor	1940	002	24,960
	George	1965	002	5,200
	Crimson			
	Pyramid	1950	002	10,000
Eastside	Dean			
	Hart			
	Christopher			
	Diamond			
	Prisoner			

a/ 001 = Rainbow trout
002 = Undesignated cutthroat trout
012 = Westslope cutthroat trout

Table 4. Fisheries information for lakes in the South Fork drainage within the BMWC from 1987 and past surveys.

Lake	Species Planted[a] (by Department records)	Species Present	Natural Reproduction	Common Size Range
		South Fork Flathead Drainage		
Sunburst	YCT	YCT, YCTxRB[b]	Excellent	10 - 20"
Olor	YCT	None caught	Limited	--
Palisade	--	None caught	Limited	--
Big Salmon	--	WCT, RB, WCTxRB	Excellent	10 - 16"
Woodward	RB, YCT	RB[b]	Poor	14 - 20"
Necklace (3)	RB	RB[b]	Good	8 - 12"
Lena	RB	RB, RBxWCT[b]	Poor	9 - 14"
Doctor	YCT	WCT[b]	Good	8 - 11"
Koessler	YCT	YCTxWCT[b]	Good	9 - 11"
George	YCT	YCTxWCT[b]	Good	8 - 13"
Lick	YCT	YCT[b]	Excellent	7 - 13"
Pyramid	YCT	YCT[b]	Good	9 - 15"
Otis	--	None Caught	--	--
Crimson	--	None caught	--	--
Ross	--	EBT	Good	7 - 9"
Marshall	--	WCT	Good	6 - 10"
Bartlett	--	WCT?	Present	?
Gill	--	non-native	Present	?

[a] Records are incomplete.
[b] Electrophoretically tested.

MDFWP has documented the fish species present and genetic purity of cutthroat trout found in high mountain lakes of the South Fork drainage (Table 4).

Trout Movements

During 1985 and 1986, MDFWP personnel tagged 790 juveniles and 916 adults using hook-and-line sampling in the South Fork Flathead River above Bunker Creek. Approximately 76 percent of the 71 cutthroat recaptured by anglers during the summer months moved less than one km. Only ten cutthroat moved more than ten km with 37 km (23 miles) downstream the maximum distance documented. A single cutthroat adult tagged below Meadow Creek Gorge in the lower South Fork was recaptured about 1.2 km (0.75 mile) above Meadow Creek Gorge. None of the cutthroat tagged in the upper South Fork were recaptured in Hungry Horse Reservoir. None of the cutthroat tagged in Hungry Horse Reservoir were recaptured in the upper South Fork. From 1983 through 1986, MDFWP personnel marked 386 juveniles and 71 adult cutthroat trout in the lower South Fork from Bunker Creek downstream to Lower Twin Creek primarily using traps and secondly by hook-and-line sampling (May and Weaver 1987). One cutthroat adult tagged in the lower South Fork Flathead River was recaptured in Hungry Horse Reservoir.

The MDFWP found no angler returns of cutthroat trout in the upper South Fork River that were tagged in Hungry Horse Reservoir. During the summer of 1960, MDFWP personnel tagged 80 cutthroat in the South Fork but none were captured in HHR. Huston did obtain angler returns from four adult bull trout in various sections of the upper South Fork and its tributaries above Meadow Creek Gorge. May (1986) obtained a single adult bull trout return that was marked in Hungry Horse Reservoir and returned from the South Fork River at the Meadow Creek foot bridge. Some fish tagged in the South Fork headwaters have demonstrated substantial downstream movement (Table 5).

Fishing Pressure

Accurate estimates of fisherman use for the South Fork River are extremely difficult to obtain due to the vastness of the area, the many entry and exit points, and the high costs involved for a detailed survey. MDFWP has periodically estimated fishing pressure for state waters since 1958. Unfortunately, these estimates have wide confidence intervals when looking at a specific river such as the South Fork due to the low number of interviews. This river does not receive high use compared to other much more popular and accessible blue-ribbon trout streams in Montana.

Generally, pressure has progressively increased from 2,702 fisherman-days for the entire South Fork River in 1958, to 6,493 for 1976, to an estimated high of 11,828 fisherman-days during the 1982 fishing season. Lucas (1985), who conducted a much more detailed study of recreational use in the wilderness complex, estimated that visitor use in the Bob Marshall wilderness complex increased from 114,500 visitor-days in 1970 to 178,200 in 1982, a 56 percent increase. Also, he found that about the same percentage of wilderness complex visitors fished in 1970 and 1982; 61 and 57 percent, respectively. Unfortunately,

Table 5. Tag return information: South Fork headwaters, 1985 to 1989. Tagging locations: lower 1.25 miles of Youngs Creek (1), lower 1.25 miles of Danaher Creek (2), upper two miles of the South Fork (3).

Tag No.	Date Tagged	Tag Location	Length	Date Recpatured	Recapture Location	Length	Recapture Method	Distance Moved (miles)
5803	7/18/85	1	275	7/14/86	Same	318	Fraley	0
5814	7/18/85	3	284	8/15/85	Same	---	Angler	0
5819	7/19/85	1	253	8/15/85	Same	---	Angler	0
5821	7/19/85	1	250	7/13/86	S. Fork near Holbrook	300	Angler	-26
5822	7/19/85	3	253	7/14/86	Same	310	Fraley	0
5825	7/19/85	3	344	8/15/85	Same	---	Angler	0
5830	7/19/85	2	246	8/15/85	S. Fork below Big Prairie	--	Angler	-7
5846	7/19/85	3	320	7/15/86	Same	---	Angler	0
5874	7/18/85	1	305	7/12/86	Same	---	Angler	0
7885	7/16/86	3	285	8/12/86	S. Fork downstream	---	angler	-32
7892	7/16/86	2	300	6/26/87	Danaher	---	Angler	+5
7906	7/14/86	3	295	7/87	S. Fork near Big Prairie	---	Angler	-5
7915	7/16/86	3	340	8/08/86	S. Fork below Big Prairie	---	Angler	-8
7916	7/16/86	3	350	7/86				
7918	7/16/86	3	330	7/86	S. Fork, no location	---	Angler	?
7919	7/16/86	3	300	7/86	S. Fork, no location	---	Angler	?
7920	7/16/86	3	350	7/86	S. Fork, no location	---	Angler	?
7929	7/15/86	2	288	7/28/87	Danaher	300	Fraley	0
7931	7/15/86	2	270	7/28/86	Mouth of Danaher	---	Angler	0
7936	7/15/86	2	288	10/08/86	Same	---	Angler	0
7968	7/14/86	1	234	5/24/87	S. Fork near Gorge Hole	---	Angler	-55
7752	7/27/87	1	252	7/02/88	S. Fork Gorge Hole	---	Angler	-41
7755	7/27/87	1	315	8/08/87	Same	---	Angler	0
7756	7/27/87	1	295	7/12/88	Same	336	Fraley	0
7765	7/28/87	2	230	8/10/89	S. Fork Big Salmon	---	Angler	-22
7773	7/28/87	2	275	?	Same	---	Angler	0
7774	7/28/87	2	256	7/12/88	Same	300	Fraley	0
7788	7/28/87	2	294	8/08/87	Same	---	Angler	0
7823	7/29/87	1	270	8/04/87	S. Fork Gordon Creek	---	Angler	-7
7837	7/29/87	3	340	7/11/88	Same	358	Fraley	0
7845	7/30/87	3	240	9/15/87	1 mile above Big Prairie	---	Angler	-5
5629	7/10/88	3	230	8/14/89	White River	---	Angler	22
5636	7/10/88	3	225	10/16/89	S. Fork Gordon Creek	---	Angler	-3
5638	7/10/88	3	254	7/31/88	?	---	Angler	?

(no recaptures from 1989 fish)

the portion of visitor trips that were spent fishing was not included.

No information exists on float fishermen prior to the 1980's, except for the fact that Lucas (1985) estimated that about three percent of wilderness complex visitors "ran rivers" in both 1970 and 1982.

The USFS estimated that about 291 individuals floated the upper South Fork in 1986, similar to 1985 (Table 6). About 60 percent of these people floated with outfitters in both years. Of those people in outfitted boats, about 38 percent were guests and the remaining portion boatmen and others. About 14 percent of all floaters made drop trips (packed in and out by outfitters, but floated alone). Twenty-seven percent of the total number of people that floated were not outfitted in the upper South Fork.

In the central South Fork, the total number of floaters increased from 102 individuals in 1985 to 148 in 1986 (an increase of 46 percent). USFS reported that the majority of this increase was attributed to the removal of use limitations on the floating permittees in this section of river (the number outfitted increased from 50 to 75 percent of the total floaters). Non- outfitted floaters dropped from 150 people in 1985 to 108 in 1986 for the central South Fork.

McLaughlin et al. (1982) estimated that about 194 and 301 individuals floated in the upper and central South Fork in 1980 and 1981, respectively. However, the USFS felt that they underestimated floater use by one-half. For the upper South Fork, McLaughlin et al. (1982) reported that one percent of the total floaters were outfitted and 59 percent were non-outfitted during 1980 and 1981. For the central South Fork, they reported that 64 percent were outfitted while 36 percent were non-outfitted floaters during 1980 and 1981. The USFS felt that these percentages did not reflect a true ratio of the total floaters since the survey did not include boatmen and others for outfitted float trips. It does, however, represent the percentage of non- outfitted to outfitted clients. In 1986, the USFS found that 21 and 24 percent of the use on the upper and central South Fork were related to boatmen, guides and "others" (nonpaying friends). The USFS found that about 90 percent of the use occurred during July and August in the upper and central South Fork during 1985 and 1986. The remainder was split between late June and early September in both sections.

Fishing Regulations

Cutthroat. Prior to the 1983 fishing season, cutthroat trout limits for the South Fork Flathead River were the same as the general state-wide stream limit. From 1939 through 1954 the general stream limit was 15 fish. From 1955 through 1958, there could be no more than ten cutthroat in the 15 fish limit. From 1959 through 1981, the general stream limit for cutthroat trout was 10 pounds and one fish or ten fish, whichever was reached first. The 1982 general daily stream limit was changed to five cutthroat with no size restriction. For the 1983 season, the general statewide stream limit was changed to five cutthroat with only one greater than 14 inches. After 1983, more restrictive regulations were applied to the South Fork in an effort to limit harvest and reduce the effects of increased pressure on the cutthroat fishery. Beginning with the 1984

Table 6. Upper and central South Fork floater use estimates for the 1985 and 1986 season, calculated by the USFS.

Area	Year	Number Craft	Number Parties	Total No. People	No. People Outfitted (inc. boatmen)	Drop Floats	No. People Non-outfitted
Upper							
	1985	89	44	266	163 (61%)	31(12%)	72 (27%)
	1986	96	51	291	168 (58%)	43 (15%)	80 (27%)
Central							
	1985	102	68	300	150 (50%)	------	150 (50%)
	1986	148	76	437	329 (75%)	------	108 (25%)

fishing season, Montana Fish and Game Commission established catch and release fishing in the central South Fork area and a three fish less than 12 inches limit for the upper South Fork.

Bull Trout. From 1939 through the 1950 fishing season, bull trout fishing limits for the South Fork were the same as for cutthroat. From 1951 through 1975, bull trout could be no less than 18 inches. From 1976 through 1981, the bull trout limit was the same as the cutthroat limit. From 1982 through the 1984 fishing season, bull trout limits in the Flathead drainage were reduced to one fish greater than 18 inches and after 1984 to one fish of any size.

Creel Survey

During the summer of 1983, MDFWP conducted a partial creel survey of the entire South Fork Flathead River from the Meadow Creek check station. Ninety-four percent of the fishermen surveyed entered the South Fork River from this access point. Based on total angler hours, 53 percent of those interviewed fished the South Fork below the wilderness boundary while 47 percent fished within the wilderness complex and most of these from the lower middle area of the South Fork, especially shore anglers. Therefore, this creel survey may not accurately represent the entire South Fork within the wilderness complex but is representative of the South Fork below the wilderness boundary.

Wilderness anglers fished 0.8 hour longer than nonwilderness anglers on a daily basis (Table 7). South Fork anglers caught about 2.8 times as many cutthroat per hour in the wilderness complex as those outside the wilderness although fishing pressure (hours fished) was about the same (Table 8). Nonwilderness fishermen kept 0.33 cutthroat per hour while wilderness anglers kept 0.19 cutthroat per hour. Therefore, nonwilderness anglers kept over five times as many cutthroat that they caught compared to wilderness anglers although nonwilderness anglers only caught a third as many cutthroat.

From the 1983 statewide pressure survey, MDFWP calculated that there were about 4,555 ($\pm$3,058) fisherman-days of use for the entire South Fork River above Hungry Horse Reservoir. Since South Fork anglers fished an average of 3.7 hours and kept 0.26 cutthroat per day, we estimated that about 4,382 cutthroat trout were actually harvested from the entire South Fork River or 74 cutthroat per mile during the summer of 1983.

Vashro (MDFWP, unpublished data) found that angler harvest was greatly skewed toward larger fish. The average length for the cutthroat population in the Mid Creek section during 1983 was 214 mm (8.4 in) while the average length for cutthroat harvested primarily in the central South Fork was 269 mm.

Seventy-six percent of the individual South Fork anglers surveyed were bank fishermen, while 24 percent were float fishermen. Lucas (1985) found that three percent of all wilderness complex visitors rafted in 1970 and 1982. McLaughlin et al. (1982) found an average floater party size of 6.5 individuals for the upper South Fork. He found that 81 percent of these individuals actually fished resulting in a mean party size of 5.2 fishermen. McLaughlin et al. (1982) found that float fishermen expended an average of 18.4 hours and caught 16.3 cutthroat

Table 7. Actual fishing pressure for 326 anglers surveyed at the Meadow Creek check station from June 15 through September 1, 1983.

	Total Days	Total Hours fished	Mean Hours fished per day
Nonwilderness	334	1,089	3.3
Wilderness	224	978	4.1
Total	558	2,067	3.7

Table 8. Numbers of cutthroat caught, kept and estimated catch rate (number per hour) for wilderness and nonwilderness anglers in the South Fork of the Flathead River during the summer of 1983.

Section	Number caught	Number kept	Catch rate (caught)	Percent kept
Nonwilderness	861	359	0.8	42%
Wilderness	2,160	181	2.2	8%
Total	3,021	540	1.5	18%

per trip for a catch rate of 0.9 cutthroat per hour. Boat anglers kept 28 percent of cutthroat caught.

The USFS estimated that 566 and 728 people floated the South Fork in the wilderness during 1985 and 1986, respectively. By averaging these estimates and assuming a similar number floated in 1983, then float anglers would have harvested a total of 2,426 cutthroat or 41 cutthroat per mile annually. Therefore, float anglers would have kept about 55 percent of the estimated annual cutthroat harvest for the South Fork on a fish per mile basis.

During 1983, nonwilderness anglers caught 75 bull trout and kept 53 percent of these fish. Wilderness anglers surveyed from the Meadow Creek station only caught 20 bull trout and kept 30 percent of those captured. Of the 20 bull trout caught in the wilderness, all but one was taken from the lower wilderness section (Black Bear Creek to the wilderness boundary). During 1980 and 1981, boat anglers caught 0.1 bull trout per person per trip in the wilderness complex (McLaughlin 1982).

Fisherman Characteristics and Preferences. Lucas (1985) found that 61 and 57 percent of all wilderness complex visitors fished in 1970 and 1982, respectively. Young (1986) found that about 80 percent of the anglers that responded to his survey fished the South Fork of the Flathead River. Of those surveyed, Lucas (1985) found that fishing ranked first in ten various appeals in 1970 and dropped to sixth by 1982. He speculated that there seemed to be a shift from the consumptive, activity-oriented appeals (hunting and fishing) to more contemplative appeals (scenery, relaxation, escaping civilization). Fishing was still very important since Lucas (1985) found that the second most satisfying factor contributing to overall satisfaction in 1970 and 1982 was good hunting and good fishing. Also, McLaughlin et al. (1982) found that 60 percent of the South Fork floaters interviewed felt that fishing was either extremely or very important to them and that floaters rated fishing as the most important recreational activity in the upper South Fork.

Most respondents considered fishing an important part of their wilderness visit. Young (1986) found that only 34 percent of the respondents that expressed an opinion felt that the fishery was in worse shape in 1985 than in previous years. These included long- term respondents (6+ years). However, Young speculated that the greatest declines in the fishery may have occurred prior to this time period.

Sixty percent of the anglers that visited the South Fork from the Meadow Creek check station were locals from Flathead county. Another 19 percent were Montana residents (other than Flathead county) and 21 percent were nonresidents (out of state). The MDFWP statewide fishing pressure survey estimated that nonresident anglers for the entire South Fork ranged from a low of six percent to a high of 34 percent and this percentage generally increased from the late 1950's to early 1980's. Lucas (1985) found that nonresidents comprised 34 percent for the Bob Marshall complex visitors in 1970 and 39 percent in 1982.

The 1983 MDFWP creel survey estimated that 33 percent of South Fork fishermen used bait exclusively, 20 percent used lures exclusively, 16 percent used flies exclusively and 31 percent used a combination of the above based on

total number of interviews. These estimates are probably more representative of the lower South Fork and not in the wilderness since only one access point was surveyed and about half of the anglers interviewed fished the South Fork outside the wilderness complex only.

Put-in and take-out points for floaters were limited to a few specific sites in the South Fork except on the upper South Fork where the major put-in points were Danaher-Young's Creek, Big Salmon and Gordon Creek (Table 9). Almost all the floaters that accessed the upper South Fork took out above the Gorge due to the difficulty and danger involved with floating through this section. The Gorge in general is rated as class 4 white water with some class 6 sections. Almost all those who floated the central South Fork put in at Harrison Creek and took out at either Spotted Bear River, South Fork foot bridge, or one of the Twin creeks. Almost all the floaters on the lower South Fork put in at Spotted Bear River.

In 1988 and 1989, MDFWP, in cooperation with the USFS, surveyed anglers on the South Fork Flathead within the Bob Marshall Wilderness (Table 10). Anglers caught 2.6 to 4.1 cutthroat per hour of fishing. About one-fourth of these fish were greater than 12 inches in length. Anglers kept seven percent of their catch. Catch rates for bull trout were .01 to .02 fish per hour; however, most anglers were not fishing for bull trout specifically. Anglers caught .09 mountain whitefish per hour and kept 31 percent of their catch. Most anglers on the South Fork Flathead River use flies, lures, or a combination of tackle, and about two-thirds reside in Montana.

The fishery in Hungry Horse Reservoir is supported by a native fish assemblage, unique for a man-made water body. Fish populations in the reservoir are interconnected with populations in the South Fork Flathead River and tributaries within the BMWC. The Montana Department of Fish, Wildlife and Parks surveyed anglers in 1985, 1988, and 1989, and found that westslope cutthroat supported most of the angling pressure. Anglers caught cutthroat at a rate of .16 to .26 fish per hour. Bull trout and mountain whitefish catch rates ranged from .03 to .08 fish per hour. Catch rates of cutthroat and whitefish in tributaries to the reservoir were more than double these figures.

Westslope cutthroat, bull trout, and mountain whitefish caught in the reservoir averaged 12.7, 18.3, and 12.1 inches, respectfully. Anglers kept most of the fish they caught. About two-thirds of all anglers boated; most anglers use lures, bait, or a combination of the two. Over 95 percent of all anglers reside in Montana.

According to statewide creel surveys, Hungry Horse Reservoir supports from 5,000 to 10,000 angler-days each year. Reservoir drawdown significantly reduces recreational use on the Reservoir.

Angler Attitudes. Young (1986) found that anglers supported the current regulations and that these regulations would lead to increases in the average size and abundance of trout and quality of fishing. Catch-and-release regulations were less appealing to anglers. Although most felt angling quality would improve in the South Fork Flathead River, only slightly more than 50 percent would continue to fish under catch-and-release regulations. Conversely,

Table 9. Put-in and take-out points for the upper, central and lower areas of the South Fork Flathead River during 1980 and 1981 (percentages are those who put in or took out in that area).

Area	Put-in Point	Percent	Take-out Point	Percent
Upper South Fork	Danaher-Young's Creek	23	Gorge	81
	Hahn Creek	6	Mid Cr.	19
	Big Salmon Creek	18		
	Big Prairie	10		
	Gordon Creek	18		
	White River Scarface	13		
	Bartlett Creek	11		
Central South Fork	Gorge	4	Spotted Bear	100
	Harrison Creek	96		
Lower	Spotted Bear	93	S. Fork bridge	42
	South Fork bridge	7	Twin Creek	58

Table 10. Creel survey results on the South Fork Flathead River within the BMWC in 1988 and 1989.

Year	1988	1989
Number of angler hours surveyed	1,010	599
Percent outfitted	8	28
Number of fish caught		
westslope cutthroat	4,149	1,723
mountain whitefish	42	87
bull trout	18	7
Catch rate (fish/hour)		
westslope cutthroat	4.1	2.6
mountain whitefish	.04	.09
bull trout	.02	.01
Percent of fish kept		
westslope cutthroat	7%	7%
mountain whitefish	33%	31%
bull trout	9%	14%
Percent of cutthroat >12 inches in length	26%	28%
NUMBER OF CUTTHROAT CAUGHT per angler trip (3 to 4 days average)	66	35

over 75 percent of the respondents indicated that they kept fish. Lucas (1985) found that allowing visitors to catch fish to eat in the wilderness but not to bring out was favored by 58 percent and opposed by 26 percent in 1982, indicating most visitors opposed a "stock the freezer" attitude.

Cutthroat Populations

Cutthroat Lengths. Little information exists on the cutthroat trout population in the South Fork drainage prior to the 1980's. MDFWP has tracked sizes of cutthroat trout through information collected in fishermen logs since 1948. Cutthroat trout lengths have fluctuated through the years with an average of 284 mm (11.2 in). Mean lengths have ranged from 244 mm (9.6 in) to 366 mm (14.4 in). These data are difficult to interpret due to the low number of anglers sampled which often results in high variability. Generally, no long-term declines or increases in cutthroat trout lengths could be detected from this information.

A single detailed angling survey was conducted on a section of the South Fork in 1960. During the 1980's, MDFWP personnel collected angling information and also estimated cutthroat trout densities for various sections of the South Fork River.

Prior to the 1984 regulation change (three cutthroat less than 305 mm (12 in)), MDFWP personnel collected angling data in 1960 and 1981 for the upper middle area of the South Fork (headwaters to Independence Park). Cutthroat lengths were quite similar for both years and averaged about 229 mm (9.0 in) with about 10 percent greater than 305 mm (Table 9). MDFWP found a substantial increase in the average length of cutthroat and the percentage that were greater than 305 mm (12 in) following the regulation change. In the upper middle section in 1986, cutthroat averaged 10.7 inches in length, as compared to 9.1 inches in 1981. The percentage of cutthroat greater than 305 mm (12 in) also increased and comprised 31 percent of angler-caught cutthroat in 1986 compared to only eight percent in 1981.

In the headwaters area, comparable data on cutthroat have been collected for five consecutive years. Catch rates and size distribution were similar in 1985, 1986 and 1987 (Table 11). Sizes of cutthroat were larger than reported in 1981. The average size of cutthroat caught in the headwaters section and the percentage of the greater than 10 and 12 inches decreased in 1988 and 1989. These decreases could be related to drought impacts or angler harvest. In 1990, size of cutthroat increased to levels noted in 1985-1987.

The three-fish, none-over-12-inches regulation imposed in 1983, appears to have resulted in more larger fish in the lower middle section of the South Fork, assuring the Mid Creek and Black Bear portions are comparable. Average size and percentage of fish larger than 10 and 12 inches in length were greater in the 1985 through 1989 period as compared to 1983.

In the lower South Fork section (Harrison), no population data were collected by MDFWP prior to 1984. Mean cutthroat length was 19 mm (0.75 in) greater in 1985 than in 1984, but the percentage of cutthroat greater than 254

Table 11. Length data for cutthroat trout captured with hook and line by MDFWP personnel in the South Fork of the Flathead River categorized by similar or same areas.

Area	Year	Section	N	Mean length (mm)	Mean length (in)	Range (mm)	Percent ≥ 254 mm (10.0 in)	Percent ≥ 305 mm (12 in)
Lower								
	1984	Harrison	150	196	(7.7)	112-338	14	02
	1985	Harrison	152	215	(8.5)	152-356	12	02
	1989	Harrison	90	198	(7.8)	123-396	10	06
Lower Middle								
	1983	Mid Creek	112	213	(8.4)	160-378	8	02
	1985	Black Bear	595	228	(9.0)	117-401	28	08
	1986	Black Bear	54	231	(9.1)	101-421	26	13
	1989	Black Bear	428	215	(8.4)	120-430	24	11
Upper Middle								
	1960	Gordon-Murphy Flats	80	228	(9.0)	90-406	34	11
	1981	Headwaters - Ltl. Salmon Cr.	151	230	(9.1)	110-350	26	8
	1984	Headwaters - Big Salmon Cr.	92	240	(9.4)	170-370	46	12
	1985	Headwaters - Big Salmon Cr.	296	258	(10.2)	150-400	59	24
	1986	Gordon-Indep. Park	586	273	(10.2)	120-427	61	31
Headwaters								
	1985		111	255	(10.0)	120-430	42	23
	1986		142	268	(10.6)	190-425	42	24
	1987		137	264	(10.4)	165-400	56	20
	1988		106	243	(9.6)	179-452	28	12
	1989		145	244	(9.6)	160-443	38	11
	1990		133	263	(10.4)	140-446	53	20

mm (10 in) and 305 mm (12 in) was about the same (Table 11). This suggests there may have been an increase in the numbers of cutthroat trout greater than 200 mm (7.9 in) and less than 254 mm (10 in) over the previous year. In 1989, average length and the percentage of fish greater than 10 inches decreased, while the percentage of fish greater than 12 inches increased. Mean cutthroat lengths and the percent of fish greater than 12 inches progressively increases moving upstream, based on 1985 angling data when all four areas were sampled.

Catch Rates. Angler catch rates can vary markedly depending on the ability of the angler and ambient fishing conditions. Therefore, we compared catch rates for MDFWP anglers with similar experience and abilities that were collected during similar times of the year (Table 12). Catch rates were lowest in the Harrison section and were highest for the upper river area in 1986. MDFWP anglers caught 3.7 cutthroat per hour in the upper middle area in 1981 prior to regulation change. Catch rates were 7.2 cutthroat per hour in 1985 and 8.7 cutthroat per hour in 1986. In the headwaters area, catch rates were similar in 1985, 1986 and 1987 (7.7, 8.8 and 7.7 fish per hour respectively). Catch rates dropped in 1988, then increased again in 1989 and 1990. Data in 1987 for the other sections are not reported in Table 11 because poor angling conditions and limited sample size rendered noncomparable results (MDFWP unpublished data).

Although angling gives a good indication of the size and age structure of a population, it does not give good information on population density.

Population Density. We found that cutthroat were nearly three times as abundant in the lower middle area (Black Bear and Mid Creek sections) than in the lower (Harrison section) or upper middle area (headwaters to Big Salmon Creek) (Table 13). Population surveys were conducted in the three sections in 1987, but late timing of the survey and unusually low flows prevented comparable estimates (MDFWP unpublished data). The surveys did show that there is probably considerable cutthroat movement during unusual low flow periods.

From our snorkel observations, it was obvious that the majority of cutthroat were found at the productive riffle:pool complexes. Young (1986) found that cutthroat trout were 3.4 times more abundant in pools than in riffles in the upper middle area of the South Fork. Shepard et al. (1982) found that 56 percent of all cutthroat observed were found in pools. Also, Pratt (1984) found that cutthroat trout tend to occur at the heads of pools. We found that the higher the riffle:pool frequency for a section of stream, the larger the population estimate per kilometer of stream (Table 14).

In the Gordon section, there were only 1.8 riffle:pools per kilometer of stream compared to 3.3 riffle:pools for the upper middle area. Therefore, there were simply less of these productive areas in a length of stream in the upper middle area (Gordon section) compared to the lower middle area (Black Bear section) and consequently densities (number per kilometer) were less. This means that in the upper middle section of the South Fork, a fisherman would have to walk or float farther between pools for good fishing or that there is more flat, shallow, less secure habitat in the upper middle area of the South Fork than in the lower middle area.

Table 12. Catch rate data for cutthroat trout captured by MDFWP anglers with similar experience in the South Fork of the Flathead River.

Year	Section	Number Caught	Hours Fished	Catch rate (#/hour)
	Lower			
1984	Harrison	243	144.0	1.7
1985	Harrison	152	73.5	2.1
	Lower Middle			
1985	Black Bear	653	103.3	6.3
1989	Black Bear	456	110.4	4.1
	Upper Middle			
1981	Big Prairie to White River	151	40.5	3.7
1985	White River	122	17.0	7.2
1985[a/]	Headwaters to Big Salmon Creek	174	24.9	7.0
1986	Gordon-Independence Park	597	68.8	8.7
	Headwaters			
1985	(Lower Young, Danaher, first	111	14.50	7.7
1986	two miles of the South Fork)	142	16.15	8.8
1987		137	17.75	7.7
1988		106	17.70	6.0
1989		145	15.00	9.7
1990		133	14.00	9.2

[a/] Catch rates by Young (1986).

Table 13. MDFWP population estimates for cutthroat trout sampled in various sections of the South Fork of the Flathead River.

Year	Section	Method	Estimate (#/km)	95% C.I.	Percent >254 mm
	Lower				
1984	Harrison	Hook-and-line Peterson	248	± 83	8
1985	Harrison	Snorkel-Peterson	215	± 29	13
	Lower Middle				
1983	Mid	Hook-and-line Peterson	680	±234	25
1985	Black Bear	Snorkel-Peterson	527	± 59	30
1989	Black Bear	Snorkel-Peterson	416	± 83	20
	Upper Middle				
1984[a/]	Headwaters to Big Salmon	Snorkel-Peterson	242	± 62	--
1986	Gordon	Snorkel-Peterson	183	± 37	54

[a/] Calculated by U or M graduate student

Table 14. Riffle:pool frequencies versus cutthroat trout estimates for the South Fork of the Flathead River.

Section	Riffle:Pool Frequency (#/km)	Cutthroat Estimate (#/km)
Gordon	1.8	183
Harrison	1.8	215
Black Bear	3.3	527
Mid Creek	3.6	680

The Harrison section also has a low riffle:pool frequency and a correspondingly low density estimate (Table 14). Additionally, this section of river flows through a canyon area with deep, slow- moving holes that hold cutthroat trout which were almost exclusively located at the head end of the pool. The lower ends of these pools were slow and contained higher amounts of sediment than the other upstream areas. Zubik and Fraley (1987a) felt that cutthroat trout found in the South Fork below the Gorge were primarily adfluvials from Hungry Horse Reservoir. This factor would also account for the reduced lengths of cutthroat in the Harrison section compared to those in upstream sections since adfluvial fish generally remain in the tributary/ river system for a maximum of three years and would not attain the size of fluvial cutthroat that remain in the river system.

MDFWP personnel found that the estimated percentage of cutthroat greater than 254 mm (10 in) in the population progressively increased upstream similar to that found by anglers (Table 12). Also, estimated size classes for a section of river were similar to those for angler-caught cutthroat indicating that anglers caught representatives from all size classes in the South Fork River population.

Tributaries. Shepard et al. (1982) estimated juvenile cutthroat and bull trout densities in five tributaries (eight reaches) of the South Fork in the wilderness complex during the summer of 1981 (Table 15). Bull trout juveniles were observed in two tributaries (three reaches). Mean densities of Age I and older fish were 3.4 cutthroat and 0.8 bull trout juveniles per 100 m^2 where the species were observed. This equates to about 40 cutthroat and ten juvenile bull trout per 100 linear yards of stream. Forty-five percent of the cutthroat observed were age III+ and older. Fraley et al. (1981) found 4.2 cutthroat and 1.7 bull trout juveniles per 100 m^2 in tributaries to the upper Middle Fork.

Discussion

Fishing Pressure. Generally, fishing pressure in the BMWC has increased about two or three fold since the 1950s. Lucas (1985) predicted that although visitor use has increased 56 percent since 1970, the rate of growth has probably slowed and may slow more in the future. Since a similar percentage of visitors fished in 1970 and 1982, fishing pressure will probably also experience slower future growth. According to statewide mail surveys, fishing presence in the 1980s averaged about 10,000 angler-days per year on the South Fork upstream from the reservoir.

Prior to 1982, fishing regulations for the South Fork were the same as those for streams statewide. These liberal limits probably did not adversely affect the cutthroat fishery when fishing pressure was low, but as pressure increased, fishermen probably began to crop off an excessive number of cutthroat, especially the older, larger individuals. Cutthroat trout are one of the most susceptible salmonids to over-harvest by anglers. Vashro (MDFWP unpublished data, 1984) and others have documented that fishermen prefer to keep the larger, older cutthroat they catch in the South Fork. This type of over-harvest not only reduces fish numbers, but over- harvests the older, larger, more productive spawners in the population.

Table 15. Mean densities (no./100 m²) of cutthroat and juvenile bull trout in South Fork tributaries surveyed during late August, 1981. Total for each species refers to age cless I, II, and III+ combined.

Stream	Reach	Area (m²)	Cutthroat Trout					Bull Trout				
			Age 0	Age I	Age II	Age III+	Total	Age 0	Age I	Age II	Age III+	Total
Little Salmon	1	2823	---	---	0.1	0.3	0.4	---	---	---	---	---
White River	1	1602	0.2	---	0.3	0.9	1.2	---	---	---	---	---
	2	1414	---	---	0.2	3.0	3.2	---	---	---	0.1	0.1
Gordon	1	2055	1.5	0.3	---	---	0.3	---		---	---	
	3	1330	1.7	1.1	4.3	3.3	8.7	---	1.3	0.7	1.3	0.6
	4	1206	---	0.2	7.7	3.7	11.6	---	0.1	0.3	0.2	0.6
Danaher	1	1639	0.1	0.4	0.4	0.6	1.4	---	---	---	---	---
Youngs	1	2744	---	---	---	0.6	0.6	---	---	---	---	---
MEAN				0.25	1.63	1.55	3.43					

Initiation of more restrictive regulations on the South Fork above Meadow Creek Gorge in 1983 (three cutthroat less than 305 mm) has reduced harvest but still allows fishermen to keep fish to eat which is an important part of the wilderness experience. Young (1986) found that over 75 percent of the anglers surveyed that fished the South Fork in the wilderness kept fish. Lucas (1985) found that most fishermen opposed a "stock the freezer attitude" in the wilderness complex. Young (1986) found that about 70 percent of the respondents felt that the current regulations would increase the number and size of cutthroat trout. He also found that only 50 percent of anglers in the South Fork would continue to fish under catch-and-release regulations.

South Fork Cutthroat Population. These more restrictive regulations on the South Fork above Meadow Creek Gorge appear to have resulted in an increase in the average size of angler-caught cutthroat and the percentage of larger fish in the population. In the upper middle area of the South Fork, department anglers found the mean length of cutthroat was 273 mm (10.7 inches) and increased 43 mm (1.7 inches) from 1981 to 1986. The percent of those sampled greater than 305 mm (12 inches) has increased from eight to 31 percent of the total sampled during this period. The Kootenai River below Lake Koocanusa is considered to be one of the most productive trout streams in Northwestern Montana. Huston (MDFWP unpublished data) estimated mean rainbow trout lengths at 249 mm (9.8 inches) and that about 10 percent of the population were greater than 305 mm. The Kootenai River has about 1,300 rainbow trout per mile while the upper middle South Fork River about 213 cutthroat per mile and the lower middle South Fork about 603 cutthroat per mile.

Young (1986) felt that his visual census of cutthroat trout indicated a reduced population but compared his one year of data to other stream populations which are much more biologically productive and, consequently, not similar to the South Fork Flathead River. Also, he estimated cutthroat trout densities in 1984 that were actually twice those estimated for two similar sections of the South Fork during 1981 (Shepard et al. 1982). The 1981 and 1984 estimates used somewhat different methods, but the estimates could indicate an increase in the density of cutthroat over the period and not a decline. The Snorkel-Peterson method used by Young (1986) to estimate cutthroat density was similar to that used by Zubik and Fraley (1988). His 1984 density estimate was similar to that found by MDFWP in 1986 for the upper middle area of the South Fork.

Based on tag returns and snorkeling data, Zubik and Fraley (1987a) and May and Weaver (1987) suggested that cutthroat trout were primarily adfluvials from HHR in the main South Fork River below Meadow Creek Gorge and fluvials or residents upstream. This may account for the smaller cutthroat in the lower South Fork compared to other upstream.

Cutthroat densities in the South Fork Flathead River are greater than those in the Middle Fork. During 1980, MDFWP anglers caught 224 cutthroat averaging 254 mm (10 inches) in 104 hours (2.2 fish per hour) on the Middle Fork in the Great Bear Wilderness. During 1981, on the upper South Fork (Salmon Forks to Gordon Creek) 151 cutthroat averaging 230 mm (9.1 inches) were caught in 40.5 angler hours (3.7 fish per hour) nearly twice the catch rate for the Middle Fork. MDFWP estimated only 84 cutthroat per km in the Middle Fork of the Flathead River near Gooseberry Park in 1988.

In addition, Department personnel estimated that age I and older cutthroat densities averaged about 37 fish per kilometer for two sections in the upper Middle Fork in 1980 (Fraley et al. 1981) and 69 fish per kilometer for two sections in the upper South Fork in 1981 (Shepard et al. 1982). Although the methods used were not comparable to density estimates made for rivers by MDFWP after 1982, it does show that cutthroat trout were about 1.9 times more abundant in the South Fork than in the Middle Fork within the BMWC based on similar estimate methods.

The only other density estimate made using a snorkel-expansion method similar to those in the South Fork was a 1985 estimate in the Whale Creek section of the North Fork Flathead River (Zubik and Fraley 1987). MDFWP estimated that cutthroat trout densities were quite similar to those for the Harrison section of the South Fork and that most of these fish were probably migratory adfluvials in both river sections. MDFWP estimated cutthroat densities using the same method for the Black Bear section in 1985 that were 2.5 times greater than those for the Harrison section on the lower South Fork or the Whale Creek section on the North Fork.

Since MDFWP has little fisheries information prior to the 1980s, it is difficult to evaluate the conditions of the fishery prior to that time. Length information collected by MDFWP anglers indicated that the average size and composition of cutthroat trout were similar in 1960 and 1981. However, natural fluctuations in populations occur and many years of data are needed to make reliable comparisons between time periods. Liberal limits and cutthroat vulnerability to angling, angler preference for larger trout and increased pressure probably resulted in a decrease in numbers and size of cutthroat in recent years prior to implementation of more restrictive regulations in 1983. The magnitude of this decrease is not known.

Trout Movements above Meadow Creek Gorge. Efforts to document use of the South Fork River and its tributaries above Meadow Creek Gorge by cutthroat trout from Hungry Horse Reservoir have been difficult. Although many cutthroat have been tagged in the South Fork above Meadow Creek Gorge, they were all marked in mid to late July and only in the main river. Trapping data for 1984 through 1986 on Hungry Horse Creek, a tributary to Hungry Horse Reservoir, showed that adult cutthroat have spawned and are completely out of the tributary system by early to mid July (May and Zubik 1985, May and Fraley 1986, and May and Weaver, 1987). Also, they found that downstream juvenile migration was nearly complete by the end of July. McLaughlin et al. (1982) found that about 92 percent of float fishermen use the South Fork during July and August. Therefore, by the time fishermen sample the South Fork Flathead River, spawning has nearly completed and almost all downstream juvenile migrants have left the system. Secondly, nearly all cutthroat spawn in tributary streams and not in main stem rivers. Also, virtually all cutthroat trout juveniles rear in these smaller tributary streams. Zubik and Fraley (1987) observed no cutthroat trout juveniles less than two years old in the main South Fork River while conducting snorkel counts of cutthroat trout.

As a result, no conclusions can be determined from this information since sampling occurs after migration and anglers are sampling the main river which

migrants use for a very short time during upstream and downstream movement. The majority of cutthroat that anglers do capture and tag in the South Fork above Meadow Creek Gorge appear to be fluvial fish based on tag return data.

Downstream movement of cutthroat through Meadow Creek Gorge has been documented. One cutthroat tagged in the headwaters area in 1986 was captured below Meadow Creek Gorge in June, 1987. Substantial downstream movement was noted for cutthroat tagged in the headwaters area in 1986.

Bull trout movement has been documented through the Meadow Creek Gorge probably because they migrate from late spring through early summer during lower flows, migration is much slower, and bull trout spend a considerable amount of time at the mouths of tributary streams before moving upstream to spawn. Consequently, they are available to anglers in the main river the entire summer during the period of heaviest fishing pressure.

MIDDLE FORK FLATHEAD RIVER DRAINAGE

Description of the Drainage

GENERAL

The Middle Fork of the Flathead River is formed by the confluence of Strawberry and Bowl creeks in the Bob Marshall Wilderness Area below the western slopes of the Continental Divide (Figure 2). From its origin, the river flows northwest for approximately 144 km (88 mi) to meet the North Fork of the Flathead River below West Glacier. The drainage area of the Middle Fork is 2,922 km^2 (Pacific Northwest River Basins Commission, 1976) and the average annual discharge is 2,956 cubic feet per second (cfs) (U.S.G.S. 1979).

The 74 km (45 mi) portion of the Middle Fork above Bear Creek is within the Bob Marshall and Great Bear Wilderness Areas and was classified as a Wild River under the Wild and Scenic Rivers Act of 1976. This upper portion of the river flows from its headwaters through a timbered valley to Schafer Meadows, where the floodplain widens to approximately 2 km (1.2 mi). From 3 km below Schafer Meadows to Bear Creek, the Middle Fork flows through a steep, rocky canyon. The Middle Fork drops an average of 6.1 m/km from its origin to where it meets U.S. Highway 2 at Bear Creek.

The river upstream from Bear Creek is bound by the Lewis and Clark Range of the Rocky Mountains to the east and the Flathead Range to the west. Major tributaries to the upper Middle Fork are Gateway, Trail, Strawberry, Bowl, and Clack creeks above Schafer Meadows and Schafer and Dolly Varden creeks in the Schafer Meadows area. From below Schafer Meadows to Bear Creek, the major tributaries are Morrison, Lake, Granite, and Long creeks.

From Bear Creek to where it meets the North Fork, the river flows for 70 km (42 mi), mainly through a steep canyon, except for the Nyack Flats area where the floodplain is up to 3 km wide. This lower portion of the Middle Fork is classified as a recreational river. The Middle Fork drops an average of 3.1 m/km along this lower portion.

The lower Middle Fork is bound by the Flathead Range to the southwest and the Livingston Range to the northeast. The northeast bank of the Middle Fork forms a large portion of the southern boundary of Glacier National Park. Major tributaries to the river below Bear Creek entering from the Flathead Range are Java, Essex, Paola, Stanton, and Deerlick creeks. These creeks are small with relatively steep gradients. Major tributaries entering from the Livingston Range on the Glacier Park side are larger with flatter gradients and include Ole, Park, Muir, Coal, Nyack, Harrison, Lincoln, and McDonald creeks.

GEOLOGY

The portion of the Middle Fork drainage downstream from Bear Creek is almost entirely underlain by Precambrian rock of the Helena, Snowslip, Sheppard, and Mt. Shields groups (Johns 1970, Mudge et al. 1977). These formations contain

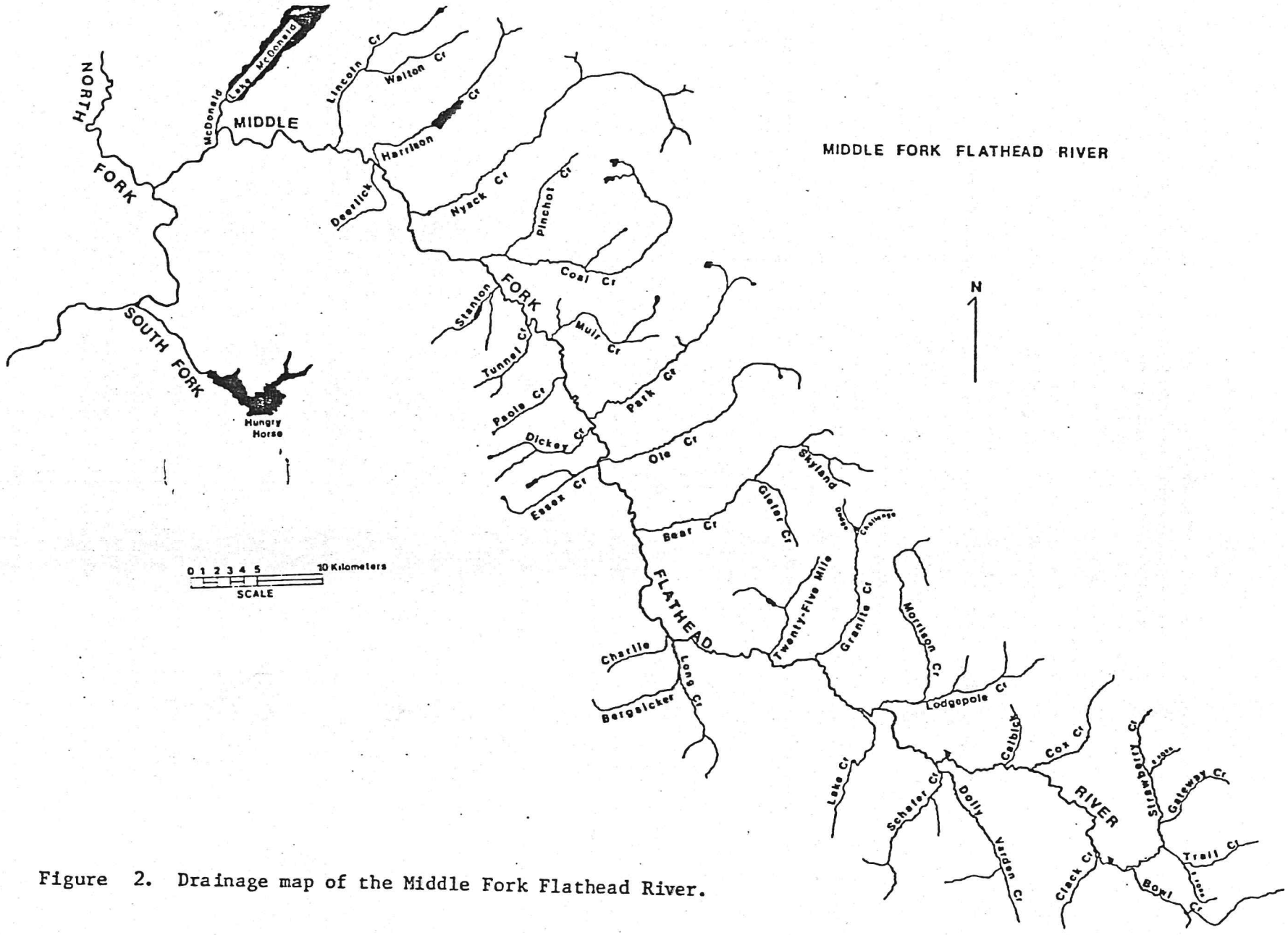

Figure 2. Drainage map of the Middle Fork Flathead River.

about 25 percent Precambrian limestone which is relatively low in carbonate content (Al Martinson, U.S. Forest Service, personal communication).

The geology of the Middle Fork drainage above Bear Creek is more complex. A major fault called the Lewis Overthrust passed through the upper portion of the drainage and caused layers of old Precambrian rock to overlay more recent Paleozoic and Cretaceous limestones, dolomites, shales, and sandstones. About 60 percent of the Middle Fork drainage above Bear Creek is underlain by Precambrian rock. Cretaceous and Paleozoic rocks comprise 25 and 15 percent of the upper drainage, respectively (Phyllis Marsh and Al Martinson, U.S. Forest Service, personal communication). These Paleozoic and Cretaceous formations are relatively high in carbonate content.

Lake and Schafer creeks drain the Precambrian McNamara formation, which is very low in carbonate content. The Dolly Varden and Clack creek drainages are dominated by carbonate rich Paleozoic limestones. The headwaters area of the Middle Fork (Gateway, Strawberry, Trail, and Bowl creeks) is underlain by the Kootenai Formation of the Cretaceous Period, which is also relatively high in carbonate content. The water chemistry of the Middle Fork drainage is directly related to this varied geologic pattern.

WATER CHEMISTRY AND FLOWS

Water chemistry information concerning the Middle Fork of the Flathead River below Bear Creek has been reported by Nunnalee (1976), the Flathead Drainage 208 Project (1976), and Stanford et al. (1979 and 1980). The river within the BMWC (above Bear Creek) has been less studied. The Montana Department of Health sampled the river near Schafer Meadows in 1976. The Montana Department of Fish, Wildlife and Parks measured alkalinity, conductivity and flows in 1980 (Table 16).

Water chemistry and flow data concerning tributaries of the Middle Fork Flathead River are limited. MDFWP measured various parameters for tributaries within the BMWC in 1980 and 1981 (see Appendix).

Maximum water temperatures in the Middle Fork drainage are reached in August and generally do not exceed 20°C (see Appendix report). Mean daily maximum temperatures in August ranged from 14.9°C in Ole Creek to 17.8°C in the Middle Fork Flathead River near Schafer Meadows.

HABITAT CHARACTERISTICS OF TRIBUTARIES TO THE MIDDLE FORK

Stream habitat was evaluated using a modification of the system developed by the Resource Analysis Branch of the British Columbia Ministry of the Environment (MDFWP 1983). Each tributary was surveyed by helicopter and divided into one or more reaches. Reaches were identified as portions of the stream having distinct associations of physical habitat characteristics.

Table 16. Alkalinity, conductivity, and flows measured at points on the Middle Fork of the Flathead River, October, 1980.

Site	Date	Alkalinity (mg/l $CaCo_3$)	Conductivity (pmhos/cm)	Flow(cfs)
Middle Fork at Gooseberry Park	10/7	150	220	44.1
Middle Fork at Schafer Meadows	10/10	152	220	56.0
Middle Fork at Granite Creek	10/16	117	185	--
Middle Fork[a/] at Bear Creek	9/18	114	210	198

[a/] Alkalinity and conductivity are from measurements made by the Montana Bureau of Mines and Geology, September 13, 1980 (U.S. Forest Service, unpublished data).

Surveys were completed on 51 reaches of 21 major tributaries within the BMWC (Table 17). The Appendix Report includes a complete set of tributary maps delineating important habitat characteristics and barriers.

Fish Populations

RESULTS

It is important to describe the methods used to census fish populations, and determine fish age and growth so that valid comparisons between studies can be made. Refer to the Appendix Report for a detailed description of methods used to obtain the data in this section.

DISTRIBUTION AND ABUNDANCE

Based on information collected during the Flathead River basin studies, it appears that adfluvial cutthroat are most common in the Middle Fork drainage below Bear Creek (just outside the BMWC). The majority of cutthroat in the river upstream of Bear Creek are thought to be fluvial fish. In 1989, MDFWP tested 26 fish from Cox Creek and 17 fish from the Middle Fork Flathead River near Schafer Meadows. All of these fish were found to be pure westslope cutthroat.

Bull trout in the Middle Fork Flathead system are adfluvial, growing to maturity in Flathead Lake and migrating into the river and tributary systems to spawn. Most juveniles rear in tributary streams from one to three years before returning to the lake. The bull trout has been designated a species of special concern in Montana because of the restricted distribution of the large adfluvial form and because of threats to spawning and rearing habitat.

River

Underwater fish counts were made in 120 pool, 41 run, 22 riffle, and 10 pocket water habitat units in the Middle Fork above Bear Creek within the BMWC during the summer of 1980. A total of 993 westslope cutthroat, 18 juvenile bull trout, 132 mature bull trout, and 5,762 mountain whitefish were counted by observers during fish density estimates.

Density estimates were made in mid summer for pool and run habitat units in a 23 km section of the Middle Fork above Schafer Meadows and a 48 km section below Schafer Meadows (Table 18).

Total densities of cutthroat were 1.55 fish per 100 m^2 (about 92 sq yd) surface area in pools and runs in the river upstream from Schafer Meadows and 0.97 fish per 100 m^2 downstream. Only two juvenile bull trout were seen during these mid-summer estimates. River densities of mature bull trout on their spawning migration from Flathead Lake were 0.06 fish per 100 m^2 in the upper section and 0.12 fish per 100 m^2 in the lower section. Mountain whitefish densities were relatively high, averaging 2.84 fish per 100 m^2 in the upper section and 7.76 fish per 100 m^2 in the lower section.

Table 17. Reach information for Middle Fork tributaries surveyed in 1980.

Drainage	Reach number	Drainage area (km²)	Length (km)	Gradient (%)	Late Summer flow (cfs)
Long Creek		19.37	8.61	2.5	
	1		2.72	1.8	
	2		1.32	1.8	
	3		4.57	3.2	
Granite Creek		74.6	13.42	1.4	13.7
	1		7.89	1.7	
	2[a/]		5.53	1.0	
Lake Creek		19.37	7.43	1.6	21.4
	1		2.54	2.5	
	2		4.89	0.7	
Miner Creek		19.53	4.36	2.8	
	1		2.50	1.7	
	2		1.86	3.7	
Morrison Creek		133.10	22.39	2.0	28.5
	1		7.48	1.1	
	2		3.78	2.3	
	3		8.80	1.7	
	4[a/]		2.23	5.2	
Lodgepole Creek		49.2	10.66	1.1	
	1		6.53	1.1	
	2		4.13	1.0	
Whistler					
	1		3.12	1.6	
Schafer Creek		126.4	14.17	2.1	15.3
	1	4.60	0.4		
	2		1.13	2.1	
	3		4.78	1.0	
	4		3.66	6.0	
W. Fork Schafer					
	1		3.25	3.0	
Dolly Varden Creek		68.4	14.79	1.1	14.7
	1		13.05	1.00	
	2		1.74		
Argosy		15.4	5.19	3.5	
	1		1.46	5.8	
	2		3.73	2.7	

Table 17. Continued

Drainage	Reach number	Drainage area (km^2)	Length (km)	Gradient (%)	Late Summer flow (cfs)
Calbick Creek		21.70	4.3	2.3	2.5
	1		4.3	2.3	
Cox Creek		51.57	11.56	1.5	1.4
	1		3.27	0.4	
	2		6.15	1.6	
	3		2.14		
Clack Creek		36.57	10.56	3.8	9.9
	1		2.82	1.0	
	2		2.67	1.0	
	3		4.07	7.0	
Bowl Creek		46.80	17.19	2.5	18.3
	1		2.59	2.1	
	2		4.20	2.5	
	3		1.6	0.5	
	4		6.4	3.3	
	5		2.4	3.6	
Basin		25.25	10.5	1.3	4.1
	1		2.1	1.3	
	2		6.6	1.1	
	3		1.8	3.1	
Strawberry Creek		71.04	19.75	1.2	15.2
	1	4.88	0.5		
	2		7.53	1.1	
	3		5.07	1.9	
	4		2.27	1.0	
E. Fork Strawberry			5.00	3.6	
	1		3.04	5.2	
	2		1.96		
Trail		49.91	11.74	2.0	9.6
	1		7.74	1.6	
	2		4.0	2.7	
Gateway		19.63	7.47	3.4	4.0
	1		2.49	2.9	
	2		2.16	4.0	
	3		1.77	4.8	
	4		1.05	1.2	
S. Fork					
	1	4.79	2.5		

Table 18. Fish densities (No./100 m²) by age class in pool and run habitat units of the Middle Fork of the Flathead River during mid summer, 1980. Numbers of each feature snorkeled and numbers of fish observed are in parentheses.

Feature	Cutthroat trout			Bull trout				Mountain whitefish	
	Age I	Age II	Age III+	Age I	Age II	Age III+	Mature	<152 mm	>152 mm
Middle Fork above Schafer Meadows (7/24 - 7/29)									
Pool (42)	.04 (13)	1.19 (342)	.41 (119)	---	---	.007 (2)	.06 (18)	.33 (96)	2.53 (727)
Run (7)	.09 (4)	0.51 (22)	.33 (14)	---	---	---	.02 (1)	.49 (21)	2.21 (95)
Combined (49)	.05 (17)	1.10 (365)	.40 (133)	---	---	.006 (2)	.06 (19)	.35 (117)	2.49 (822)
Middle Fork below Schafer Meadows (8/5 - 8/12)									
Pool (56)	---	0.01 (3)	.98 (330)	---	---	---	.11 (37)	.26 (86)	7.32 (2475)
Run (3)	---	---	.59 (10)	---	---	---	.29 (5)	--- (195)	11.46
Combined (59)	---	0.01 (3)	.96 (340)	---	---	---	.12 (42)	.24 (86)	7.52 (2670)

Density estimates by species (Table 19) were made in late summer in the same two areas of the Middle Fork. These estimates were concentrated on 16 km (10 mi) of the river above Schafer Meadows (Gooseberry Park downstream to Cox Creek) and a 16 km section downstream from Schafer Meadows (from 3 m below Schafer Meadows downstream to Granite Creek). Fish densities were estimated in every third pool, run, and pocket water habitat unit, and every fourth riffle habitat unit. Pools were stream features with a definite shallowing at the head and tail of the feature. Runs were deeper than riffles but did not fit the category of pools or pocket water. Pocket water was an area of the stream where the flow is broken by boulders. Riffles were shallow areas of flowing, broken water.

Late summer density of cutthroat in pool and run habitats was less than half of that found in mid-summer estimates. Smaller densities in late summer may be due to oversummer mortality, movement of trout into tributary streams or out-migration to the lower Flathead River or Flathead Lake. More juvenile bull trout were observed in late summer than in early summer. Densities of mature bull trout spawners was twice as high in the upper section and similar in the lower section in the mid-summer and late summer estimates.

Densities of cutthroat and juvenile bull trout in pocket water habitat units in both sections was similar to that found in run habitats and slightly lower than pool densities. No cutthroat trout and very few juvenile bull trout were seen in riffle habitats. Riffles were dominated by mountain whitefish in both river sections averaging just over one fish per 100 m^2 surface area. The average density of mountain whitefish in all features combined was more than ten times than the average total trout density.

An estimate of total surface area of each feature was calculated. The estimate was based on the total number of each habitat unit in two 16-km (10 mi) sections and average feature size measured on randomly selected features in each reach. A population estimate for each species in the 16 km sections was based on the average density of species in a randomly selected sample of each feature or habitat unit (Table 20). The number of mature adfluvial bull trout was estimated by actual counts of all likely looking habitat in each 10 mile section.

Mountain whitefish dominated the river fish population estimate calculated in this manner, outnumbering trout by more than ten to one. Cutthroat trout in the two sections averaged 575 fish per 16 km (10 mi). This estimate represents late summer numbers of the resident fluvial (river-dwelling) population of cutthroat after summer mortality or migration had occurred. Early summer population numbers of cutthroat were probably much higher. Accurate estimates of juvenile bull trout numbers, especially age I, were difficult to make in the river due to their secretiveness and association with the rocky substrate. They were common under rocks along the river margin, but very few were seen in snorkeling estimates. Mature bull trout were generally easy to observe because of low flows and good water clarity. They were observed mainly in pools and runs. Numbers were generally largest in areas just below the mouths of major bull trout spawning tributaries.

In 1988, MDFWP conducted snorkel-Peterson estimates of estslope cutthroat in the Schafer and Gooseberry section of the river. Workers estimated 216 (±62)

Table 19. Fish densities by age class for pool, riffle, run, and pocket water habitats in 16-km sections of the Middle Fork of the Flathead River above and below Schafer Meadows during late summer, 1980. Number of features snorkeled and numbers of fish observed in each age class are in parentheses.

	Fish per 100 m² surface area								
	Cutthroat trout			Bull trout				Mountain whitefish	
Feature	Age I	Age II	Age III+	Age I	Age II	Age III+	Mature	<152 mm	>152 mm
Middle Fork above Schafer Meadows (8/23 - 8/27)									
Pool (12)	.01 (1)	---	.38 (44)	---	---	.02 (2)	.19 (22)	.43 (50)	2.30 (269)
Run (15)	---	.03 (2)	.26 (19)	.01 (1)	.04 (3)	.03 (2)	.15 (11)	.15 (11)	2.50 (185)
Riffle (11)	---	---	---	.03 (1)	---	.06 (2)	000	.15 (5)	.98 (33)
Pocket water (6)	---	.07 (2)	.22 (6)	.13 (3)	---	.04 (1)	---	.13 (3)	2.43 (66)
Combined (44)	.004 (1)	.016 (4)	.27 (69)	.02 (5)	.012 (3)	.027 (7)	.12 (33)	.27 (69)	2.17 (553)
Middle Fork below Schafer Meadows (9/5 - 9/8)									
Pool (10)	.01 (1)	---	.40 (30)	---	---	---	.24 (18)	.01 (1)	10.91 (820)
Run (16)	.01 (2)	---	.09 (24)	---	---	.004 (1)	.07 (20)	.04 (11)	2.1 (583)
Riffle (11)	---	---	---	---	---	---	---	.20 (14)	.86 (59)
Pocket water (4)	.07 (1)	---	.34 (5)	---	---	---	---	.27 (4)	3.78 (56)
Combined (41)	.01 (4)	---	.13 (59)	---	---	.002 (1)	.10 (38)	.07 (30)	3.48 (1518)

Table 20. Estimates of number of cutthroat trout, bull trout, and mountain whitefish in 16-km (10 mi) sections of the Middle Fork of the Flathead River above and below Schafer Meadows. Estimates are based on snorkeling in late summer. These numbers are useful for relative comparison and are not considered total estimates of the population.

Area	Number of Fish per 16-km								
	Cutthroat trout			Bull trout				Mountain whitefish	
	Age I	Age II	Age III+	Age I	Age II	Age III+	Mature[a/]	<150 mm	>150 mm
Above Schafer Meadows	10	41	670	61	29	6	42	720	5,850
Below Schafer Meadows	28	1	401	<1	55	<1	58	220	10,620

[a/] Estimated numbers per km is based on actual counts.

cutthroat in the 1.6-mile Gooseberry section and 110 (±41) cutthroat in the 2.5-mile Schafer section. Only 6.5% of the cutthroat in the Gooseberry section were greater than 10 inches. All trout in the Schafer section were less than 10 inches. Drought conditions in the summer of 1988 may hve contributed to these low estimates.

MDFWP caught cutthroat in the Gooseberry section at a rate of 3.7 fish per hour. The mean length (n=78) was 191 mm, or 7.5 inches.

Tributaries

Westslope cutthroat trout were found in all Middle Fork tributaries surveyed in 1979 and 1980 (Table 21). Residence of adfluvial cutthroat in most tributaries of the Middle Fork within the BMWC remains uncertain because of the relatively small amount of stream trapping and tag return information available. Juvenile bull trout were observed in all but five of the tributaries surveyed.

Densities of westslope cutthroat trout in the reaches surveyed (Table 22) averaged 4.2 fish per 100 m^2 of surface area (about 25 fish per 100 linear yards of stream). Stream reaches supporting greater than 10 cutthroat/100 m^2 were identified as critical rearing areas. These included nine reaches of Gateway, East Fork Strawberry, Basin, Cox, Argosy, Challenge, Twenty-five Mile. Investigations showed that the number of cutthroat in a reach of tributary was related to the amount of fish cover in the form of logs, debris, etc. present in that reach (Fraley and Graham 1982).

Densities of juvenile bull trout were lower than those of cutthroat, partly because of the difficulty in observing the bottom-oriented bull trout (Table 20). Densities of juvenile bull trout in reaches where they were present averaged 1.7 fish/100 m^2 (about ten fish per 100 linear yards of stream). Critical areas for bull trout rearing (as identified by supporting densities of at least 1.5 bull trout/100 m^2) included nine reaches of Whistler, Morrison, Charlie, Strawberry, Granite, Long and Tail creeks.

A total of 333 pools, 425 runs, 441 riffles, and 108 pocket water areas were snorkeled in 1979 and 1980 (including North Fork tributaries). Densities of age II and III+ cutthroat were largest in pools, followed by runs, pocket water areas, and riffles in order of decreasing abundance (see Appendix Report). Bull trout densities varied little between features, except for age II fish which had substantially larger densities in pools than in other features.

Refer to the Appendix Report for maps showing all the fisheries characteristics of each Middle Fork tributary.

AGE AND GROWTH

Cutthroat Trout

Eighty-seven percent of the cutthroat trout caught in tributary streams were 0-3 years old at time of aging, while 86 percent of the fish caught in the

Table 21. Fish distribution in upper (above Bear Creek) Middle Fork tributaries, + = species present, - = species absent, * = migratory cutthroat (confirmed by trapping and tagging), ? = unknown, needs further study.

	Cutthroat trout		
	Migratory	Resident	Bull trout
Charlie	?	+	+
Long	?	+	+
Bergsicker	?	+	+
Twenty-five Mile	?	+	+
Granite	*	+	+
Challenge	*	+	+
Dodge[a/]	*	+	+
Lake	?	+	+[b/]
Miner	?	+	-
Morrison	*	+	+
Lodgepole	?	+	+
Whistler	?	+	+
Schafer	?	+	+
W. Fork schafer	?	+	-
Dolly Varden	?	+	+
Argosy	?	+	+
Calbic	?	+	=
Cox	?	+	-
Clack	?	+	+
Bowl	?	+	+
Basin	?	+	+
Strawberry	?	+	+
E. fork Strawberry	?	+	+
Trail	?	+	+
S. fork Trail	?	+	-
Gateway	?	+	+

[a/] Outside the BMWC boundary
[b/] Bull trout were present below the falls.

Table 22. Mean densities (No./100 m²) of cutthroat and juvenile bull trout in Middle fork tributaries surveyed during the summer of 1979 and 1980. Total for each species refers to age classes I, II, and III+ combined.

		Fish per 100 m² surface area									
		Cutthroat trout					Bull trout				
Stream	Reach No.	Age 0	Age I	Age II	Age III+	Total	Age 0	Age I	Age II	Age III+	Total
Charlie Cr.	001	0.5	1.0	2.0	1.0	4.0	1.5	5.6	0.7	---	6.3
	002	---	---	---	0.3	0.3	---	4.5	4.2	---	8.7
Long Cr.	001	---	---	---	---	---	---	---	0.2	---	0.2
	002	0.2	---	0.2	0.5	0.7	---	0.2	0.7	0.3	1.2
	003	---	0.2	0.5	0.1	0.8	---	0.6	0.4	0.9	1.9
Bergsicker	001	---	---	---	0.6	0.6	---	---	0.4	---	0.4
Twenty-five Mile Cr.	003	---	5.7	5.0	3.0	13.7	---	---	---	---	---
Granite Cr.	001	---	---	---	0.5	0.5	---	---	0.7	1.4	2.1
	002	---	0.2	---	1.3	1.5	0.1	---	0.2	---	0.2
Challenge	001	1.3	3.8	6.6	3.5	13.9	---	---	---	0.25	0.25
Lake Cr.	001	---	---	0.3	2.1	2.4	---	---	---	---	---
	002	---	---	---	0.5	0.5	---	---	---	---	---
Miner Cr.	001	---	---	---	1.3	1.3	---	---	---	---	---
	002	---	---	---	2.8	2.8	---	---	---	---	---
Morrison Cr.	001	---	---	---	0.2	0.2	---	0.2	0.3	0.3	0.8
	002	---	---	---	0.7	0.7	---	0.5	1.1	2.4	4.0
	003	---	---	0.6	3.0	3.6	---	---	2.7	5.1	7.8
	004	---	---	---	---	---	0.4	0.5	0.5	0.3	1.3
Lodgepole Cr.	001	---	---	0.1	0.4	0.5	---	0.3	---	---	0.4
	002	0.2	0.8	2.3	1.2	4.3	---	0.2	---	0.2	0.4
Whistler Cr.	001	---	---	0.2	1.2	1.4	---	0.5	5.5	1.2	7.2

Table 22. Continued

Stream	Reach No.	Fish per 100 m² surface area: Cutthroat trout Age 0	Age I	Age II	Age III+	Total	Bull trout Age 0	Age I	Age II	Age III+	Total
Schafer Cr.	001	---	0.1	---	---	0.1	0.1	---	---	---	0.1
	002	---	0.1	0.5	1.1	1.7	---	---	---	---	---
	003	---	---	0.8	3.1	3.9	---	---	---	---	---
	004	---	1.3	1.7	0.9	3.9	---	---	---	---	---
W.F. Schafer	001	---	0.7	2.2	2.6	5.5	---	---	---	---	---
Dolly Varden	001	---	---	0.1	0.1	0.2	0.1	---	---	---	0.1
Argosy Cr.	001	---	---	0.2	1.0	1.2	---	---	---	0.4	0.4
	002	---	2.2	7.9	1.3	11.4	---	0.9	0.2	---	1.1
Calbic Cr.	--1	---	2.4	4.1	0.6	7.1	---	0.6	---	---	0.6
Cox Cr.	001	---	---	0.1	0.3	0.4	---	---	---	---	---
	002	1.1	1.1	2.7	6.5	10.3	---	---	---	---	---
Clack Cr.	003	---	---	---	0.6	0.6	---	---	---	---	---
Bowl Cr.	001	---	---	0.2	---	0.2	---	---	---	---	---
	002	---	---	---	0.3	0.3	---	---	---	---	---
	003	0.1	1.0	1.2	2.4	4.6	---	0.2	0.4	0.2	0.8
	004	---	0.3	---	0.6		0.9	---	---	0.1	0.3 0.4
	005	---	---	0.2	---	0.2	---	---	---	0.2	0.2
Basin Cr.	001	0.4	3.0	4.2	4.5	11.7	---	0.1	---	---	0.1
	002	1.2	1.3	3.4	2.0	6.7	---	---	0.5	0.1	0.6
	003	---	0.2	1.4	11.9	13.5	---	---	---	0.7	0.7

Table 22. Continued

Stream	Reach No.	Fish per 100 m² surface area: Cutthroat trout Age 0	Age I	Age II	Age III+	Total	Bull trout Age 0	Age I	Age II	Age III+	Total
Strawberry	001	---	---	---	0.1	0.1	---	---	---	0.1	0.1
	002	---	0.7	2.6	2.0	5.3	---	0.2	0.2	0.3	0.7
	003	---	---	---	0.1	0.1	---	---	0.2	---	0.2
	004	---	0.2	0.4	---	0.6	---	0.2	3.1	---	3.3
E.F. Strbry	001	---	---	2.1	9.6	11.7	---	---	0.6	0.8	1.4
	002	---	0.3	---	0.8	1.1	---	---	---	0.3	0.3
Gateway Cr.	001	---	---	0.5	0.3	0.8	---	0.4	0.5	0.2	1.1
	002	---	---	0.4	1.3	1.7	---	---	---	---	---
	003	0.6	3.3	4.0	3.2	10.5	---	---	---	---	---
	004	2.0	1.8	18.7	6.7	27.2	---	---	---	---	---

river were 3-5 years old. We determined that 75 percent of the fish collected in the Middle Fork Flathead River had reared two or three years in the tributaries before entering the river (see Appendix Report). About 22 percenthad reared one year in tributaries. Lengths of fish each age class were larger in the river than in the tributaries (Table 23).

Cutthroat captured by Department anglers in the Middle Fork Flathead River in 1980 averaged 9.3 inches in length (Table 24). Over one-third of the cutthroat were greater than ten inches. Cutthroat captured by Department anglers in tributaries of the Middle Fork averaged 5.7 inches.

Backcalculated lengths of bull trout based on juveniles and adult spawners collected in the Middle Fork drainage differed substantially from lengths calculated from juveniles only (see Appendix Report). It appears that backcalculations for annuli 1, 2, and 3 (age marks relating to year 1, 2 and 3 in the life of the fish) are not accurate when adult spawners are included in the calculations. A total of 40 otoliths (inner ear bones) from juvenile bull trout were aged. Ages assigned otoliths and scales from the same fish were in nearly 100 percent agreement.

Average length of adult bull trout spawners collected by hook and line in the Middle Fork drainage in 1980 was similar to average lengths recorded for adult bull trout in some previous studies in the Flathead River system (Table 25).

Refer to the Appendix Report for more detailed information on age and growth of fish in the Middle Fork drainage.

FOOD HABITS OF TROUT

Ephemeroptera (mayflies), Diptera (true flies) and Trichoptera (caddis flies) were the major orders of insects in the diet of cutthroat less than or equal to 110 mm (4.3 in) in length in tributaries of the Middle Fork Flathead River (Appendix B). In the diet of cutthroat greater than 110 mm in length, major orders were Hymenoptera (terrestrial adults), Diptera adults, and Trichoptera.

Diets of cutthroat from the Middle Fork Flathead River included winged adults of the orders Trichoptera, Diptera, and Ephemeroptera (see Appendix Report). Large cutthroat trout in the Middle Fork Flathead River and tributaries feed largely on the water surface for winged insects.

Mayflies were by far the most important insect order in stomachs of both small and large bull trout in tributaries of the Middle Fork Flathead River. Other important orders in bull trout diets were Diptera and Trichoptera.

Baetidae was the major family in bull trout stomachs collected in the Middle Fork drainage, followed by Ephemerellidae and Siphlonuridae (see Appendix Report). Siphlonuridae was not a major mayfly family in Middle Fork benthic insect samples, but its presence in bull trout stomachs indicated selection for this family. The "free swimming" habits of siphlonurids may make them easier

Table 23. Calculated lengths and increments of length (from scale samples) for cutthroat trout collected in the Middle Fork of the Flathead River and tributaries in 1980.

Age	Number of fish	Length at Age (annulus) (mm) 1	2	3	4	5
Middle Fork Flathead River						
1	0	--				
2	16	51	95			
3	82	49	99	154		
4	69	50	97	156	217	
5	17	51	107	161	217	269
Grand mean calculated length		50 (2.0 in)	99 (3.9 in)	156 (6.1 in)	217 (8.5 in)	269 (10.6)
Number of fish		(184)	(184)	(168)	(86)	(17)
Length increment (mm)		50	49	57	61	52

Age	Number of fish	Length at Age (annulus) (mm) 1	2	3	4	5
Middle Fork tributaries						
1	45	49				
2	135	51	95			
3	164	51	95	138		
4	24	48	90	141	191	
5	4	59	101	139	204	251
Grand mean calculated length (2.0 in)		51 (3.7 in)	95 (5.5 in)	139 (7.6 in)	193 (9.9 in)	251
Number of fish	(327)	(191)	(28)	(4)		
Length increment (mm)		51	44	44	52	47

Table 24. Size distribution of westslope cutthroat trout caught by department anglers in the Middle Fork of the Flathead River and in tributaries to the Middle fork Flathead River during summer, 1980.

Number of Fish	x length	% > 6" (150 mm)	% > 8" (200 mm)	% > 10" (250 mm)	% > 12" (300 mm)
Middle Fork Flathead River					
184	9.3" (237.4 mm)	95.1	78.8	38.0	12.5
Middle Fork Tributaries					
381	5.7" (145.5 mm)	47.8	13.6	3.4	1.0

Table 25. Comparison of lengths of adult bull trout collected in the Middle Fork drainage with previous studies in the Flathead River system.

Study	Average Length (mm)	Number of Fish
Middle Fork, BMWC, 1980	618	35
North fork creel census, 1979	638	36
Flathead River, all forks, creel census, 1975	628	46
Middle Fork River trap at Bear Creek, 1957	622	87

prey for the juvenile bull trout. Although Heptageniidae was the major mayfly family in the Middle Fork benthic samples, it was not the predominant family in the stomachs of juvenile bull trout collected from the Middle Fork drainage.

SURVEY OF BULL TROUT SPAWNING SITES

Numbers of bull trout spawning sites (redds) in tributaries of the Middle Fork Flathead drainage have ranged from 237-523 during years when all streams were surveyed (Table 26). During these years, bull trout spawning sites in the Middle Fork drainage averaged 46 percent of the total basin-wide count (including the North Fork). The majority of bull trout from Flathead Lake which spawn in the Middle Fork drainage enter tributaries within the BMWC.

Bull trout redds have been counted in selected streams within the BMWC annually since 1979. These "monitoring counts" have fluctuated but generally indicate a stable spawning population.

Microhabitat measurements (size, water depth) of bull trout redds varied between tributaries (see Appendix Report). Redds averaged 2.2 m (2 yd) in length and 1.0 m (0.9 yd) in width, and were built in water depths averaging 0.26 m (0.3 yd).

SURVEY OF THE FISHERY

Creel Cards

Westslope cutthroat trout were the most numerous species in the recreational catch on the Middle Fork Flathead River from 1979-1981 based on voluntary creel card returns from anglers (Table 27). Anglers released approximately half of the cutthroat and most of the mountain whitefish that they caught. The release rate for bull trout was variable between years, ranging from 90 percent in 1979 to 33 percent in 1981.

In 1988 and 1989, MDFWP conducted creel card surveys in the entire BMWC. Returns for the Middle Fork drainage were low (Table 28). Only 11 anglers returned cards in 1988, reporting 20 individual trips to specific waters.

Hook and Line Sampling

In 1980, Department anglers caught cutthroat in the Middle Fork Flathead River at a rate of 2.15 fish per hour (Table 29). Bull trout catch rates averaged 0.33 fish per hour. These rates (especially for bull trout) were higher than recorded in 1962, but anglers in 1980 had the advantage of fishing areas where snorkel surveys had located mature bull trout.

Catch rates during 1980 in Middle Fork tributaries within the BMWC ranged from 0.5 to 12.5 fish per hour (Table 30). Mean lengths of cutthroat ranged from 134 mm to 293 mm.

Table 26. Numbers of bull trout redds in tributaries of the Middle Fork Flathead River during years when nearly complete surveys were conducted.

Tributary	Year				
	1986	1982	1981	1980	Average
Strawberry	41	39	21	17	30
Trail	53	30	26	31	35
Bowl	36	19	10	29	24
Clack	16	7	7	10	10
Schafer	30	17	12	10	17
Dolly Varden	42	36	31	21	33
Morrison[a/]	52	86	32[b/]	75	61
Lodgepole	42	23	18	14	24
Granite[a/]	37	34	14[b/]	34	30
Bear[c/]	21	23	12	9	16
Long*	*	*	8	--	
Charlie	*	*	*	7	--
Ole	36	51	23	19	32
Nyack[c/]	27	23	14	14	20
Lake	*	*	*	1	--
Dirtyface	*	*	*	0	--
Elk	*	*	*	1	--
Coal[c/]	3	*	13	*	25
Park[c/]	87	*	13	*	25
Total Middle Fork	523	388	237	300	

[a/] Portions of the stream are outside the BMWC.
[b/] Counts low due to ice cover.
[c/] Entire stream is outside BMWC.

Table 27. Catch information from voluntary creel cards returned in 1979, 1980 and 1981. Number of fish caught is in parentheses

Year	Number of anglers	Total angler hours	Catch per hour		
			Cutthroat trout	Bull trout	Mountain whitefish
1979	44	228	1.61 (367)	.08 (19)	.91 (197)
1980	38	243	1.68 (408)	.05 (11)	.97 (236)
1981	26	113	1.21 (137)	.05 (6)	.36 (41)

Table 28. Results from creel card surveys of anglers in the Middle Fork drainage during 1988 and 1989.

	1988	1989
Number of angler trips surveyed	20	17
Number of angler hours	110	81.25
Percent outfitted	20	0
Percent fished river	75	59
Percent fished creek	25	35
Percent fished lake	0	6
Tackle used:		
Flies	40	67
Lures	15	0
Bait	0	0
Combination	40	0
No information	5	33
Westslope cutthroat caught	88	13
number per hour	0.8	.16
percent kept	35.0	15.0
percent > 12"	9.0	18.0
Bull trout	7	0
number per hour	0.07	--
percent kept	14.0	--
Percent > 12"	14.0	--
Mountain whitefish	23	0
number per hour	0.2	--
percent kept	48.0	--
percent > 12"	2.0	--

Table 29. Catch rates (number of fish per hour) from hook and line sampling by Fish, Wildlife and Parks personnel on Middle Fork of the Flathead River within the BMWC during the summers of 1962 and 1980. the number of fish caught of each species is in parenthesis.

Year	Total fisherman hours	Number of Fish Caught per Hour		
		Cutthroat trout	Bull trout	Mountain whitefish
1962	164	.71 (117)	.06 (1)	.25 (39)
1980	104	2.15 (224)	.33 (35)	.62 (20)
1988	Gooseberry			
1988	Schafer			

Table 30. Catch information from hook and line sampling during the summer of 1980 by Department personnel on tributaries to the Middle Fork Flathead River within the BMWC.

Stream name	Number caught	Angler hours	Fish/ hour	Number measured	Minimum length (mm)	Maximum length (mm)	Average length (mm)	Average length (inches)
Granite	15	3.5	4.3	15	220	325	265	10.4
Lake	4	---	---	4	230	280	254	10.0
Morrison	6	5.5	1.1	4	255	310	293	11.5
Lodgepole	4	2.0	2.0	3	120	162	143	5.6
Schafer	30	6.0	5.0	30	105	228	153	6.0
Dolly Varden	6	13.0	0.5	3	187	248	217	8.5
Cox	15	6.0	2.5	12	135	216	176	6.9
Bowl	24	4.0	6.0	24	101	250	146	5.7
Basin	75	6.0	12.5	75	75	202	134	5.3
Strawberry	8	4.0	2.0	4	135	310	192	7.6
Trail	10	3.0	3.3	9	120	240	180	7.1
Gateway	1	1.5	0.7	1	252	252	252	9.9

MOUNTAIN LAKES

Information on mountain lakes in the Middle Fork drainage within the BMWC is limited (Table 31). Cutthroat populations (genetically untested) exist in 12 lakes. Populations are maintained by planting in six of the lakes and by natural reproduction in six of the lakes. The level of fishing pressure and harvest in these lakes is not well documented. Fishing use is relatively high on Stanton, Marion, Scott, Flotilla and Castle, and relatively light on Dickey, Tranquil (east and west), Cup and Almeda.

Table 31. Fisheries information for lakes in the Middle Fork drainage within the BMWC (Wct - westslope cutthroat, Rb - rainbow trout, FSu = Finescale sucker, Mwf = Mountain Whitefish, Yct = Yellowstone cutthroat). Year of the most recent plant is in parentheses.

Lake	Species	Planted/Natural	Common Size Range
	Middle Fork Drainage		
Stanton	Wct, Mwf, FSu	Natural	8 - 13"
Marion	Wct, (Rb/Wct)?	Natural	10 - 12"
Almeda	Wct	Planted (1988)	12 - 16"
East Tranquil	Wct	Natural	10 - 18"
West Tranquil	Wct	Natural	13 - 20"
Elk	Wct	Planted (1988)	13 - 17"
Castle	Wct	Planted (1989)	11 - 18"
Scott	Wct	Natural	13 - 15"
Flotilla	Wct (Yct/Wct?)	Natural	9 - 16"
Cup	Wct	Planted (1988)	11 - 16"
Dickey	Wct	Planted (1990)	10 - 13"
Bergsicker	Wct	Planted (1990)	11 - 13"

BLACKFOOT RIVER DRAINAGE

Introduction

BACKGROUND

The Blackfoot River flows 122 miles in a westerly direction from its source near the continental divide to its confluence with the Clark Fork River at Bonner, Montana (Figure 3). Principle tributary streams in downstream order are: Alice, Landers Fork, Nevada, North Fork, Chamberlain, Monture, Clearwater, Belmont, Gold, and Union creeks. The Landers Fork, North Fork, Clearwater and Monture creeks are the largest of the Blackfoot's tributaries; three of these originate in the BMWC (Clearwater does not). The Blackfoot River drainage in nonwilderness areas has and continues to be used extensively for timber production, mining, and livestock production. Segments of the Blackfoot River tributaries that occur in the BMWC dissect high elevation mountainous terrain and generally reach the broad Blackfoot River Valley shortly after leaving the wilderness and national forest boundaries. The Blackfoot River is essentially a "free-flowing" stream except for a small diversion near the mouth that serves the wood products mill at Bonner.

Fishing and other forms of water-based outdoor recreation are important in the Blackfoot drainage. The formation of the Blackfoot River Conservation and Recreation Management Plan to assure orderly public access through private lands in 1977 has greatly increased the availability of the Blackfoot River to recreationists. A recreational user survey conducted in 1977 during the first year of the plan found that, below the Clearwater River, anglers comprised 80 percent of the recreational users of the Blackfoot River. Campers and non-fishing floaters accounted for most of the remaining 20 percent of recreational users. The river corridor development resulted in the reclassification of the Blackfoot River to a Class 1 stream in the state of Montana river classification system.

A total fishing pressure estimate based on statewide mail survey in the 1984-85 fishing season was 40,824 angler-days (334 per mile). Most of the fishing pressure occurred below the Clearwater River with a pressure estimate of 832 man-days per mile. The Blackfoot contains wild populations of rainbow, westslope cutthroat, yellowstone cutthroat, brook, brown, bull trout, and mountain whitefish. Western Montana's best trophy fluvial bull trout population resides in the Blackfoot River. Densities of the large bull trout were estimated at one to two fish per mile in the lower Blackfoot by the MDFWP. Tributary streams originating in wilderness area are known to be key spawning streams for the fluvial bull trout.

In 1988, MDFWP conducted a creel card angler survey in the Blackfoot drainage within the BMWC. Anglers surveyed fished 73 hours and caught 46 cutthroat (0.6 fish per hour), one bull trout and two mountain whitefish. Most anglers fished lakes.

Stream discharge on the Blackfoot River near the mouth averages 1,633 cubic feet per sec (cfs) and has ranged from 19,200 cfs (June 10, 1964) to 200 cfs (January 4, 1950) USGS (1986). Instream flows for recreational purposes were

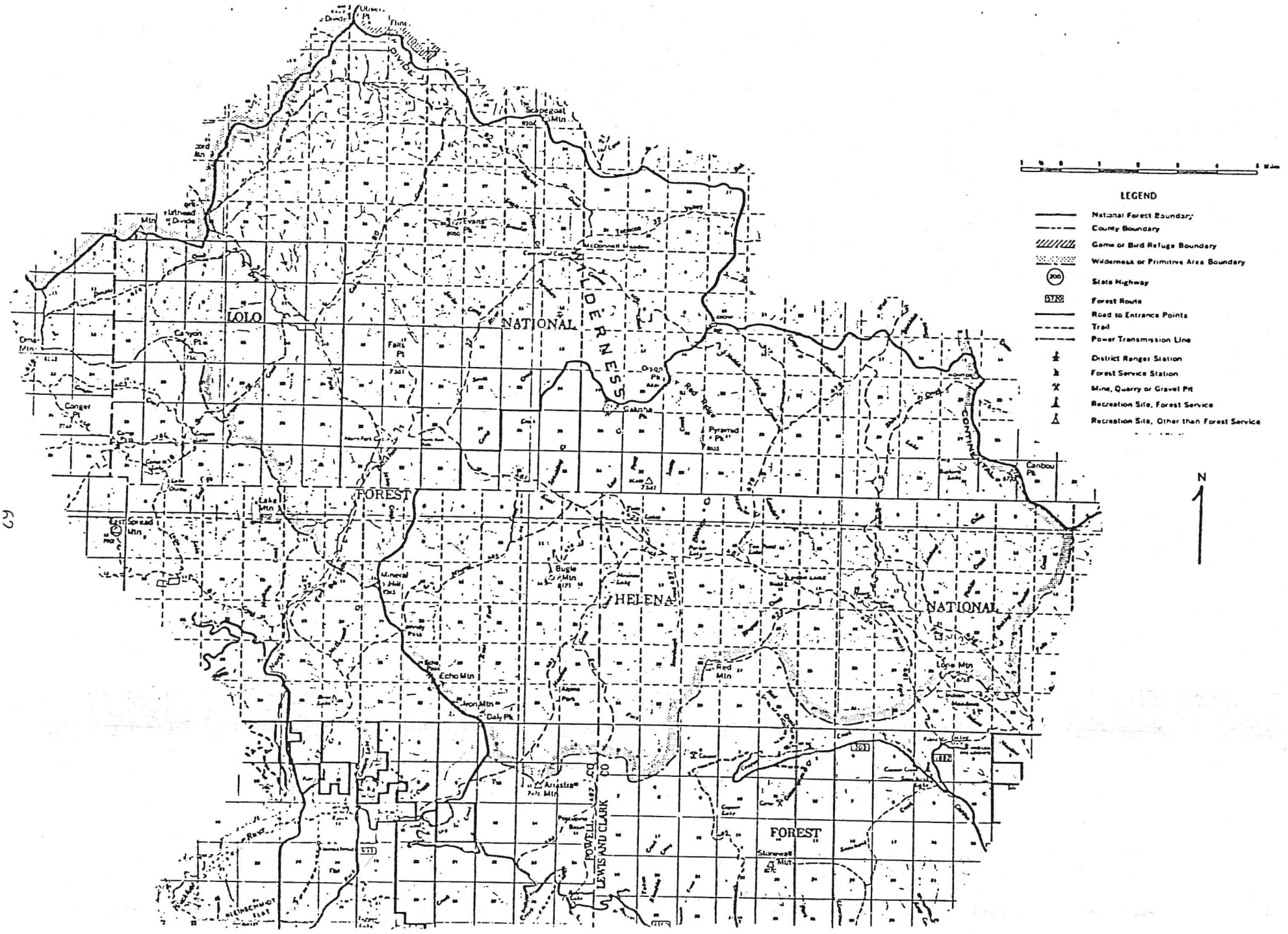

Figure . The Blackfoot River drainage within the BMWC.

appropriated for the Blackfoot River in 1970 by the Montana Fish and Game Commission and legislative action.

The Blackfoot River drainage portion of the Bob Marshall wilderness complex provides some of the best spawning opportunities for the large fluvial bull that inhabit the Blackfoot and North Fork of the Blackfoot River. The landforms that make up these drainages have been notoriously unstable with frequent mass ground movements even in the wilderness area. The hydrology of the drainages appear to be similar for all the major streams. These streams have reaches that go dry in the low flow months because of loss of stream flow to subsurface aquifers. The stream flows generally reappear as separate spring creeks and within the stream channel downstream several kilometers. This hydrologic feature probably contributes to the successful spawning of the bull trout and helps reduce the impacts of the unstable land movements. Studies in the Flathead drainage have identified this hydrologic pattern as being important to successful spawning in the Flathead and Swan drainages.

FISHERIES BY DRAINAGE

All of the drainages that follow in this section have one characteristic in common: an inadequate habitat and biological database. The lakes in the Blackfoot drainage have received some attention but the streams, including the major drainages, have essentially no significant data collections. The Blackfoot drainage currently holds the best populations of trophy fluvial bull trout in the state. However, these unique fish are found in very low densities and spawning runs in tributaries are extremely small, sometimes numbering a single spawning pair.

LANDERS FORK OF THE BLACKFOOT RIVER

The Landers Fork is suspected to contain bull trout, westslope cutthroat, brook trout, sculpin, and mountain whitefish. No data exists for trout populations within the wilderness boundaries. A fall stream flow measured by MDFWP personnel at the highway 200 crossing was 44 cfs. The Landers Fork goes underground in a section below the wilderness boundary like several other streams and sections of streams in the upper Blackfoot River drainage.

Tributaries

Tributary streams of the Landers Fork include Fickler, Baking Powder, Lookout, Lake, Maryann, Middle Fork and Crow creeks. No fisheries information is available for most of these streams. Bighorn Creek was planted with 3,600 undesignated cutthroat 2.5 cm long in 1950. These fish originated from the hatchery in Ovando. Baking Powder Creek was planted with 3,100 rainbow trout 2.5 cm long in 1952. Ringeye Creek was planted with 4,000 undesignated cutthroat 2.5 cm long in 1943 from the hatchery in Ovando.

Lakes

Bighorn Lake. Bighorn Lake, located 24 km by trail up the Landers Fork and Bighorn Creek, has a good wild population of lakeshore-spawning cutthroat trout. The wild population probably originates from the 1952 plant of 6,800 cutthroat trout from the Ovando hatchery. Records in the regional office of the MDFWP based on phenotype only indicate that the fish are yellowstone cutthroat. However, no records exist to indicate a plant of yellowstone cutthroat was ever made in the lake. Recent findings concerning the diverse phenotypes in westslope cutthroat certainly preclude a conclusion that the lake is inhabited by yellowstone cutthroat. The lake is 5.4 hectares in area and has a maximum depth of 16 m. This lake population of cutthroat is currently in a near natural condition and does not appear to be impacted by fisherman harvest in regards to population age and size distribution. The long distance to the lake coupled with a lack of other significant destinations make the trip to Bighorn Lake a single goal trip and helps reduce pressure. Angler trips into the lake in 1985 indicate that both size and numbers of cutthroat are being maintained with the current pressure. All efforts to improve access into this area or closely adjoining areas should be avoided because of the highly vulnerable nature of this cutthroat fishery.

The Canyon Creek fire of 1988 burned the timbered perimeter around the lakeshore.

Little Crystal Lakes (unnamed lakes northeast of Heart Lake). Two of the four lakes have the capability to produce a fishery. The middle largest lake (Little Crystal T16N, R8W, S17CB) had a remnant population of rainbow trout through the 1970's which has disappeared in the 1980's according to the local game warden. The other lake (upper Little Crystal T16N, R8W, S17CA) was planted with 200 westslope cutthroat in 1977 (unsuccessful in establishing a fish population). The lakes are both 6 m maximum in depth and less than 1 hectare in area.

The lakes are located next to Heart Lake, which has been heavily used over the past several years, but because of no trail access Little Crystal Lakes have received no noticeable use. No trail should ever be constructed to these lakes. A fisheries could be reestablished in both of these lakes.

Heart Lake. Heart Lake is located 9 km from the trailhead at Indian Meadows which is a major access trail for the Lincoln- Scapegoat Wilderness. The lake has a surface area 13.4 ha and a maximum depth of 15.2 m. A small outlet, with about 0.056 cubic meters per second (CMS) flow in the spring, drains into the Landers Fork via an unnamed tributary. Heart Lake was first planted in the early 1930's with grayling and, again, in the 1960's, a total of 874,000 2.5 cm fish were introduced. Undesignated cutthroat were planted during the period 1942 to 1952 at a rate of 3,000 to 16,000 (fry to 5 cm) for a total of 48,000 introduced. Rainbow were planted once in 1937 (10,000 rainbow fry). Overnight gillnet sets in 1959 caught cutthroat and grayling at a rate of 1 and 2.5 per set respectively. An overnight gillnet set in 1968 produced 29 grayling and no cutthroat. The grayling averaged 25.4 cm (10 in) TL and ranged between 22.6 and 37.3 cm TL. An overnight gillnet set in 1975 produced 39 grayling with an average length of 37.3 cm TL and a range of 35.0 to 40.6 cm TL. Grayling ages

were determined from scales and ranged from five to seven years in the 1975 sample. Angler and warden reports from Heart Lake in 1986 indicate that the grayling population disappeared and the lake is now barren. In 1974, the lake had an estimated use of 202 angler-days based upon statewide mail survey which may be conservative.

This lake with a 30 percent littoral zone has produced good grayling fishing in the past and could be considered for reintroduction of the grayling and periodic replanting. The plant in 1965 appeared to survive for at least ten years which would probably be a good planting cycle. In 1988, MDFWP planted 5,000 westslope cutthroat trout in the lake.

Webb Lake. Webb Lake, a moderately productive moraine lake, is located about 11 km from the Indian Meadows trailhead. A USFS guard station cabin is built on one end of the lake and is used by administrative crews while in the area. Webb Lake is 2.7 ha in surface area and has maximum depth of 1.3 m. The outlet drains into an unnamed tributary to Ringeye Creek which flows into the Landers Fork. Webb Lake always has a high amount of turbidity that probably contributes cover for the fish residing there. Cutthroat trout captured in gillnets appear to be yellowstone cutthroat. Webb Lake was planted from 1940 to 1952 with an undesignated strain of cutthroat from hatcheries in Anaconda and Ovando. The annual plants of 5 cm fish varied from 1,000 to 15,000 for a total of 50,000 fish through the period. Two overnight gillnet sets in 1959 captured an average of 15 fish per set with an average TL of 29.5 cm and a range of 19.0 to 48.8 cm TL. The length frequencies of the catch indicated a healthy fish population. In 1968, a gillnet set caught 27 cutthroat with average TL of 29.5 cm and a range of 15.7 to 47.7 cm TL. The gillnet data confirmed that Webb Lake supported self-sustaining fishery of unknown genetic make-up. Webb Lake in 1974 supported an estimated 300 angler-days.

EAST FORK OF THE NORTH FORK OF THE BLACKFOOT RIVER

Fish species present probably include westslope cutthroat and bull trout. Rainbow trout and yellowstone cutthroat may be present but are not confirmed. This drainage is in need of extensive survey work for any definitive management plan to be developed.

Historical fish planting records revealed that this stream was planted several times between 1940 and 1952 with 4,000 to 12,000 2.5 cm undesignated cutthroat. The earlier plants originated from the hatchery in Ovando and the later plants came from the Anaconda hatchery.

Tributaries

Tributary streams of the East Fork of the North Fork Blackfoot include Sourdough, Meadow, East Fork Meadow, Mineral, Camp, Spaulding, Lost Pony, and Scotty creeks. Very little information is available for these streams.

Historical fish planting records indicate that Meadow Creek was planted several times between 1932 and 1952. The plants of undesignated cutthroat trout

2.5 cm long numbered between 6,000 to 42,000 annually. The planted fish originated from the Anaconda and Ovando hatcheries. In 1945, 12,000 rainbow trout 5 cm long were also planted in this creek.

Fish species expected to be present include: undesignated cutthroat, rainbow, rainbow x cutthroat hybrids, and bull trout. In the 1984 statewide pressure estimates, this stream had an estimated annual pressure of 594 angler-days.

Scotty Creek was planted in 1943 and again in 1948 with undesignated cutthroat 5 cm long from the hatchery in Ovando. The plants numbered about 2,000 fish each.

Lakes

Several of the lakes in the drainage (e.g., Twin Lakes) were burned by the 1988 Canyon Creek fire and fish populations were reportedly affected.

Meadow Creek Lake. This lake has a surface area of 5.1 ha with a maximum depth of 1.0 m. The lake was formed by a valley recessional moraine. No scientific data collections have been made on the lake. The cutthroat trout found in this lake are suspected to be yellowstone cutthroat. This lake receives an estimated annual fishing pressure of about 100 angler-days. The naturally reproducing population could sustain more angling pressure but shoreline impacts would probably accompany the increased pressure. Historical fish planting records revealed several fish plants between the years 1932 to 1952. A total of 500,000 undesignated cutthroat and 29,280 rainbow trout were planted in 1937. The cutthroat originated from both the Anaconda and Ovando hatcheries and the rainbow from the Ovando station.

Upper Twin Lake. This lake has a surface area of 2.6 ha and a maximum depth of 3.0 m. The lake drains into an unnamed tributary to the East Fork of the North Fork Blackfoot River. The lake has never been stocked. This lake is accessible by trail 13 miles up Meadow Creek trail. In 1968, a single overnight gillnet set caught 17 undesignated cutthroat ranging in size from 17.8 to 55.9 cm long. In 1985, a fisherman reported numerous fish between 5.0 and 30.5 cm long. The species would probably be similar to the lower Twin Lake population which is suspected to be yellowstone cutthroat. MDFWP planted 4,000 westslope cutthroat trout in Upper Twin Lake in 1989.

Lower Twin Lake. This lake has a surface area of 6.3 ha and a maximum depth of 3.0 m. The lake drains in an unnamed tributary of the East Fork of the North Fork Blackfoot River. Abundant undesignated cutthroat populate this lake with natural reproduction. The cutthroat that inhabit this lake are suspected to be yellowstone cutthroat that were probably introduced with the fish plants of 1950 and 1952. Historical planting records show that 3,600 and 10,000 2.5 cm long cutthroat were planted respectively in 1950 and 1952. The fish came from the Anaconda hatchery.

Parker Lake. This lake has a surface area of 8.9 ha and is formed by a recessional moraine. The maximum depth of the lake is 1.3 m. Visual and angler

surveys of the lake described the population of cutthroat trout as abundant. The naturally reproducing population of cutthroat in Parker Lake are suspected to be yellowstone cutthroat. Fish planting records indicate that from 3,000 to 6,000 undesignated cutthroat were planted per year between the years 1942 and 1952. The planted fish originated from the hatchery at Ovando. The estimated annual fishing pressure is 100 angler-days. Parker Lake is accessed by trail 16 km from the trailhead at Indian Meadows.

NORTH FORK OF THE BLACKFOOT RIVER

This stream is the largest of the tributaries to the Blackfoot River. A major falls forms a natural barrier to upstream fish movement 9.6 km above the wilderness boundary. The North Fork supports a significant fall run of large fluvial bull trout from the Blackfoot and is suspected to have a resident population in addition to the migratory fish. The wilderness portion of the North Fork also supports a population of cutthroat trout of unknown species and may have some rainbow and/or yellowstone cutthroat. MDFWP counted 11 and 12 bull trout redds, respectively, in 1988 and 1989. A key area is from the srossing below the North Fork ground station to the first falls.

Historical fish planting records show the river was planted throughout the period 1932 to 1954. The plants were made with both rainbow and undesignated cutthroat and numbered from 2,000 to 22,000 annually. The fish originated from the hatcheries in Anaconda and Ovando.

Tributaries. Tributaries of the North Fork Blackfoot River include Jakey, Cabin, Canyon, Dwight, South, Sorgo, Theodora, Cooney, Broadus, Eagle and Dabrota creeks, and the Dry Fork of the North Fork. Very little fisheries information exists for these streams. The Dry Fork was planted from 1928 to 1952 with 6,000 to 10,000 undesignated cutthroat 2.5 cm long. Cabin Creek was planted in 1952 with 6,000 undesignated cutthroat from the Anaconda hatchery. Cooney Creek was planted with 20,000 rainbow trout in 1941 and 4,000 undesignated cutthroat in 1950 from the Ovando hatchery. Dabrota Creek was planted in 1950 with 3,600 undesignated cutthroat 2.5 cm long from the Ovando hatchery.

No productive lakes exist in the drainage within the BMWC.

EAST FRONT DRAINAGES

Description of the Drainages

NORTH FORK SUN RIVER

The North Fork of the Sun River originates along the continental divide and flows south to its junction with the South Fork of the Sun River at the head of Gibson Reservoir (Figure 4). The upper portion of the North Fork drainage and the entire west side of the drainage is timbered, while grass-covered hills follow the east side of the lower portion of the drainage. The summer flow of the North Fork ranges from 100 to 150 cubic feet per second (cfs).

Major tributaries of the North Fork Sun River include Headquarters, Rock, Biggs and Moose creeks. Summer flows in tributaries to the North Fork range from 5 to 50 cfs. Three of the ten mountain lakes in the North Fork drainage support fish populations.

SOUTH FORK SUN RIVER

The South Fork of the Sun River flows north from its origin on the continental divide to the junction with the North Fork at Gibson Reservoir. The drainage is timbered except for a meadow section at Pretty Prairie. Summer flows in the South Fork range from 100 to 150 cfs. The West Fork is the largest tributary in the drainage. One of the five mountain lakes in the drainage within the BMWC supports fish.

Dearborn River

The Dearborn River originates along the continental divide near Scapegoat Mountain and flows east-southeast to the downstream BMWC boundary. In the upper portion of the drainage, the stream meanders through a timbered floodplain. In the lower reaches, the Dearborn flows through a steep-walled canyon. There are no mountain lakes in the drainage which support fish.

STREAMS IN THE GREAT BEAR ADDITION

There are eight major streams in the proposed Great Bear addition. Tributaries in the Marias drainage include the North, Middle and South forks of Birch Creek, and the North and South forks of Dupuyer Creek. Streams in the Teton drainage include the North and East forks of the Teton River, and Bruce Creek. Floodplain signs of the 1964 and 1975 floods are evident in all these drainages. There are no mountain lakes in the drainages.

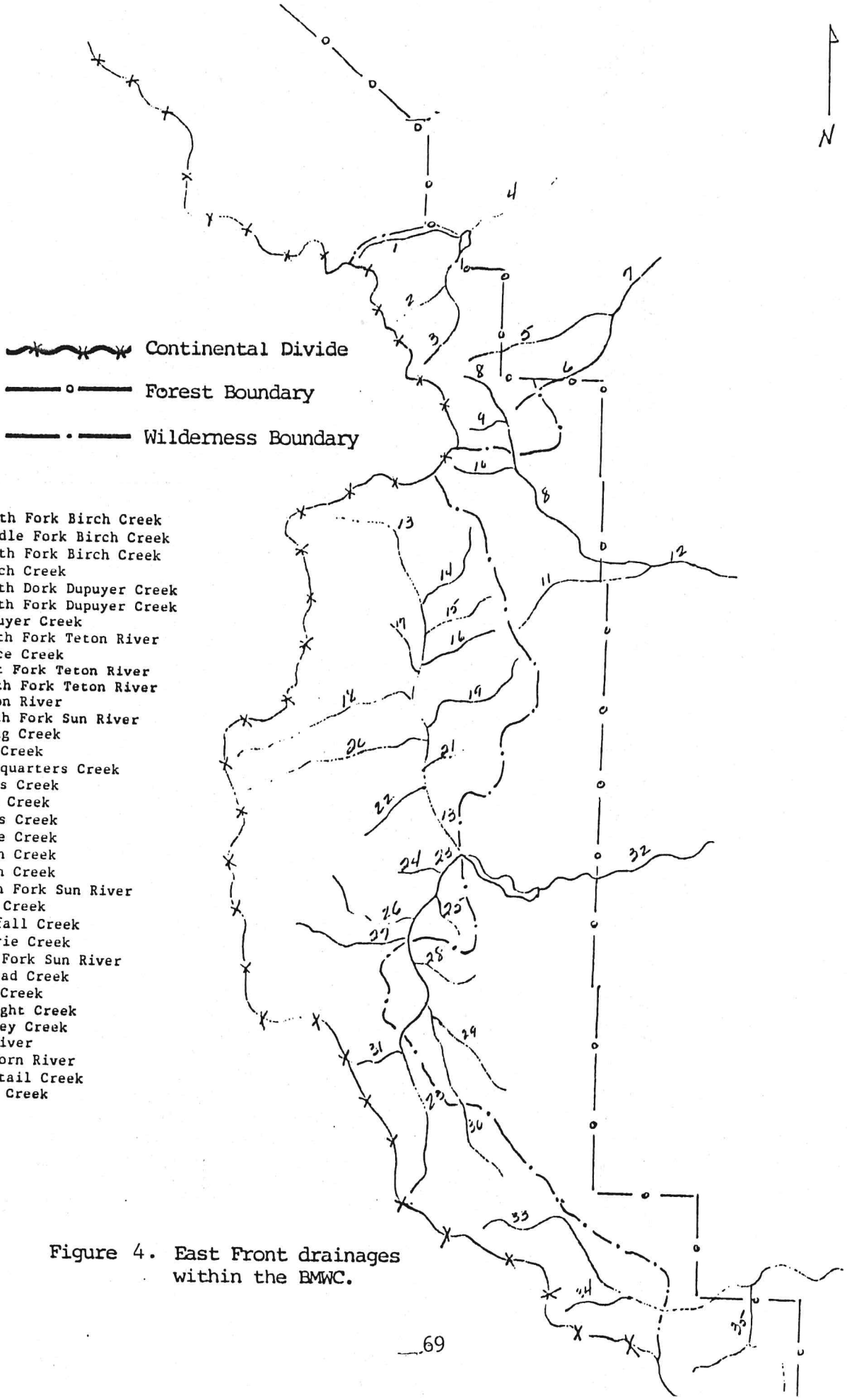

Figure 4. East Front drainages within the BMWC.

Fish Populations

NORTH AND SOUTH FORKS OF THE SUN RIVER

Fisheries information is limited on the forks of the Sun River within the BMWC. Most of the information was gathered to assess the effects of the two fish angling limit (1975-1983) on the trout population in the forks. After 1983, the general stream limit for the BMWC applied (three fish, none over 12 inches).

Average lengths of rainbow trout in the North Fork Sun River from 1975 to 1989 ranged from 9.8 to 12.2 inches (249 to 310 mm). Lengths of rainbow trout in the South Fork Sun River ranged from 10.9 to 12.7 inches, or 277 to 323 mm (Table 32). Other species present on the forks include cutthroat trout, hybrids of cutthroat and rainbow trout, and eastern brook trout.

Rainbow trout generally reach 10 inches (254 mm) in the forks of the Sun River during their third year of life (Tables 33 and 34). By their fourth year, rainbow exceed 12 inches in both forks.

A preliminary snorkel estimate (see Appendix Report for methods) conducted on the South Fork Sun River on August 3, 1987, indicated a rainbow trout population of 191 fish in a 1.05 mile (1.68 km) section from Burnt Creek to Deer Creek. However, because of the physical characteristics of the stream section, the estimate was thought to be a minimum value.

MDFWP conducted a snorkel estimate on the south Fork Sun River from Windfall Creek to Bay Creek (1.061 mi) on August 11, 1989. Snorkelers estimated 908 fish in the section, or 856 fish per mile, rainbow and cutthroat trout combined.

Grayling were introduced in Rock Creek in the North Fork Sun River drainage in 1984. Survival and status of the plant are unknown. Some grayling have moved downstream to the North Fork.

Very little information exists on mountain lakes in the drainage within the BMWC (Table 35). Mean lengths of yellowstone cutthroat trout ranged from 10.1 to 14.2 inches in the four lakes with fish populations.

In 1988 and 1989, MDFWP conducted a creel card angler survey in the drainage (Table 36). Anglers surveyed fished 274 hours in 1988 and caught 336 rainbow, 91 cutthroat, and 69 brook trout. Species composition was similar in 1989. However, the catch rate for rainbow trout was more than twice as high in 1989.

DEARBORN RIVER

Almost no fisheries information is available for the Dearborn River within the BMWC. Reports indicate a viable fishery for rainbow and cutthroat trout. Whitetail Creek, a major tributary, contains cutthroat trout.

Table 32. Length frequency of rainbow trout (and Rb, Ct, RbxCt in 1989) in the North and South forks of the Sun River from hook-and-line surveys (Expressed as percent of the total trout sampled).

Length group greater than or equal to	1975	1976	1977	1978	1979	1983	1985	1989
North Fork								
10 inches (254 mm)	70.6	74.0	81.0	92.1	67.1	77.0	82.0	45.0
11 inches (279 mm)	54.4	59.4	66.0	81.7	52.1	63.0	67.0	30.0
12 inches (305 mm)	29.4	41.7	51.0	68.3	37.0	39.0	42.0	18.0
13 inches (330 mm)	17.6	22.9	34.0	35.7	20.5	15.0	22.0	4.0
Number of fish in sample	68	96	41	126	73	73	75	67
Average length (all fish)	10.9	11.3	11.5	12.2	10.7	11.3	11.6	9.8
South Fork								
10 inches (254 mm)	71.2	80.0	91.0	80.8	86.0	88.0	87.0	79.0
11 inches (279 mm)	56.0	63.3	84.0	64.2	64.7	79.0	75.0	50.0
12 inches (305 mm)	40.8	50.5	79.0	49.5	44.1	46.0	48.0	28.0
13 inches (330 mm)	30.6	24.8	51.0	37.9	29.4	18.0	39.0	10.0
Number of fish in sample	59	102	70	95	68	82	61	104
Average length (all fish)	11.4	11.8	12.7	11.8	11.6	11.8	12.2	10.9

Table 33. Length range and age class distribution of trout in the North and South forks of the Sun River, July 31 - August 1, 1979.

Stream	Species*	Number of Fish	Length Range (Average)	Age Class	Number of Fish	Length Range
North Fork	Ct	12	7.5 - 12.0 (9.7)			
	Eb	2	6.0 - 7.0 (6.5)			
	RbxCt	4	8.9 - 16.2 (12.3)			
	Rb	73	5.3 - 14.5 (19.7)	I	10	5.3 - 8.6
				II	20	8.1 - 11.0
				III & older	42	9.3 - 14.5
South Fork	Ct	3	7.1 - 9.6 (8.7)			
	Eb	5	7.1 - 9.0 (7.8)			
	RbxCt	2	9.9 - 11.2 (10.6)			
	Rb	68	5.7 - 17.5 (11.6)	I	5	5.7 - 8.4
				II	17	7.8 - 12.2
				III & older	46	10.0 - 17.5

* Species abbreviations: Ct - cutthroat trout; Eb - brook trout; RbxCt - rainbow cutthroat hybrid; Rb - rainbow trout.

Table 34. Calculated growth (in inches) of rainbow trout from the forks of the Sun River, August, 1975.

	Age Group	Number of Fish	Average total length at each year of life				
			I	II	III	IV	V
North Fork Sun River	I	64					
	II	11	3.7	7.0			
	III	30	3.8	7.2	9.7		
	IV	15	3.2	5.9	9.5	12.0	
	V	2	2.9	6.4	9.3	12.1	13.6
	Averages	64	3.6	6.8	9.6	12.0	13.6
South Fork Sun River	I	54					
	II	20	7.6				
	III	12	3.9	7.1	9.8		
	IV	12	3.9	6.9	10.3	12.9	
	Averages	38	4.0	7.1	10.1	12.9	

Table 35. Information on lakes in the Sun River drainage within the BMWC (all lakes contain yellowstone cutthroat).

Lake	Date of Survey	Number of Fish	Mean Length in inches (range	Mean weight (pounds)
Bear (natural reproduction)	7/19-20/65	6	13.5 (12.8 - 13.9)	0.76 (0.63 - 0.84)
	8/11/76	4	14.2 (11.8 - 15.7)	---
Levale (natural reproduction)	7/21-23/65	36	10.1 (7.8 - 12.2)	0.36 (0.15 - 0.60)
Sock (planted every other year)	7/26/82	7	11.6 (10.0 - 14.7)	---
Unnamed (natural reproduction)	7/24/82	5	13.2 (9.7 - 18.5)	--

Table 36. Results of a creel card angler survey on the Sun River drainage. Almost all anglers fished the north and south forks of the Sun River.

	1988	1989
Number of angler trips surveyed	40	26
Number of angler hours	274	124
Percent outfitted	23	10
Percent fished river	92	92
Percent fished creek	0	0
Percent fished lake	8	8
Tackle used (percent):		
Flies	38	40
Lures	0	5
Bait	5	0
Combination	50	25
No information	7	30
Westslope cutthroat caught:	91	74
number per hour	0.3	0.6
percent kept	21	11
percent > 12"	39	31
Brook trought caught:	69	39
number per hour	0.25	0.31
percent kept	3	3
Percent > 12"	0	3
Rainbow trout caught	336	350
number per hour	1.2	2.81
percent kept	18	6
percent > 12"	15	32

STREAMS IN THE GREAT BEAR ADDITION

Limited information is available on these streams. Cutthroat were introduced in the South Fork of Birch Creek below Crazy Creek (near Pinto and Circus creeks) in 1974. In 1979, cutthroat ranging from 5 to 12 inches were captured in the section.

Cutthroat trout ranging from 7.7 to 10.0 inches in length were sampled in the North Fork of Birch Creek in 1971. In the North Fork of Dupuyer Creek, cutthroat (7.6 to 10.5 inches) and eastern brook trout (6.5 to 10.6 inches) were sampled in 1976. In the South Fork Dupuyer Creek, cutthroat from 2.3 to 9.8 inches were sampled in 1976.

LITERATURE CITED

Carlander, K.D. 1969. Handbook of fresh water fishery biology, Vol. 1. Iowa State University Press. 752pp.

Flathead Drainage 208 Project. 1976. The North Fork of the Flathead River: a baseline characterization. 89pp.

Fraley, J., D. Read and P. Graham. 1981. Flathead River fisheries study. Montana Department of Fish, Wildlife and Parks. 132pp plus appendix.

Fraley, J., and P. Graham. 1982. Physical habitat, geologic bedrock types and trout densities in tributaries of the Flathead River drainage, Montana. in W.B. Armantrout (ed.). Acquisition and utilization of aquatic habitat inventory information. Proceedings of a symposium held October 28-30, 1981, Portland, OR.

Fraley, J. and B. Shepard. 1989. Life history, ecology and population status of bull trout (Salvelinus confluentis) in the Flathead Lake and River syste, Montana. Northwest Science 63(4)133-143.

Graham, P., D. Read, S. Leathe, J. Miller, K. Pratt. 1980. Flathead River basin fishery study. MDFWP, Kalispell, MT. 118pp. plus addendix.

Hesse, L. 1977. FIRE I, a computer program for the computation of fishery statistics. Nebraska Tech. Ser. No. 1. Nebraska Game and Parks Commission. Project No. F-10-R. 60pp.

Johns, W.M. 1970. Geology and mineral deposits of Lincoln and Flathead counties, Montana. Mont. Bureau of Mines and Geology, Bulletin 36. 68pp.

Johnson, T.H., and T.C. Bjornn. 1978. Evaluation of angling regulations in management of cutthroat trout. Idaho Cooperative Fishery Research Unit, College of Forestry, Wildlife and Range Sec. Univ. of Idaho, Moscow. 153pp.

Lucas, R. 1985. Visitor characteristics, attitudes and use patterns in the Bob Marshall Wilderness complex, 1970-82. USFS, 32pp.

May, Bruce and R.J. Zubik. 1985. Quantification of Hungry Horse Reservoir water levels needed to maintain or enhance reservoir fisheries. BPA project no. 83-465, MDFWP, Kalispell, MT 101pp.

May, Bruce and J. Fraley. 1986. Quantification of Hungry Horse Reservoir water levels needed to maintain or enhance reservoir fisheries. BPA contract no. DE-AI79-84BP12659, MDFWP, Kalispell, MT 91pp.

May, Bruce and T. Weaver. 1987. Quantification of Hungry Horse Reservoir water levels needed to maintain or enhance reservoir fisheries, annual report 1986. BPA contract no. DE-A179-84BP12659, project no. 83-465. 68pp.

McLaughlin, W. E. Kruppe, W. Paradice, W. Salvi and M. Weesher. 1982. Flathead River study final report draft.

Mudge, R.M., R.L. Earhard and D.D. Rice. 1977. U.S. Geological Survey open end file rept. 77-25. 28pp.

Montana Department of Fish, Wildlife and Parks, et al. 1982. Fish and Habitat inventory of streams in the Middle Fork Flathead Drainage. 229pp.

Montana Department of Fish, Wildlife and Parks. 1976. Central Montana Fisheries Study. Project FS-R-25, Job Ia. FWP Region Four, Great Falls, MT.

_____. 1980. Central Montana Fisheries Study. Project FS-R-29, Job Ia. FWP Region Four, Great Falls, MT.

Pacific Northwest River Basin Commission. 1976. River mile index. Clark Fork - Pend Oreille River. Washington, Idaho, Montana and British Columbia. 53pp.

Pratt, K.L. 1984. Habitat selection and species interactions of juvenile westslope cutthroat trout (Salmo clarki lewisi) and bull trout (Salvelinus confluentus) in the upper Flathead River Basin. Thesis. University of Idaho, Moscow, Idaho.

Shepard, Bradley B., J.J. Fraley, T.M. Weaver and P. Graham. 1982. Flathead River fisheries study--1982. Funded by EPA, through FRBEIS. Research conducted by MDFWP, Kalispell, MT 86pp.

Shepard, Bradley B., K.L. Pratt and P. Graham. 1984. Life histories of westslope cutthroat and bull trout in the upper Flathead River basin, Montana. EPA contract no. R008224-01- 05. MDFWP, Kalispell, MT 85pp.

Stanford, J.A., F.R. Hauer, and T.J. Stuart. 1979. Annual report of work completed during 1978-79 on limnology of Flathead Lake-River ecosystem. Flathead Research Group, Univ. of Montana Biological Station, Bigfork, Montana. 155pp.

Stanford, J.A., F.R. Hauer, T.J. Stuart, B.K. Ellis, and W.B. Perry. 1980. Limnology of the Flathead River-Lake ecosystem, Montana: Annual Report. Flathead Research Group. Univ. of Montana Biological Station, Bigfork, Montana. 443pp.

U.S. Geological Survey. 1979. Water resources data for Montana U.S.G.S. water data report. MT-79-1. 842pp.

Young. 1986. Ecology and status of a wilderness fishery: westslope cutthroat trout in the South Fork Flathead River.

Zubik, R.J. and J. Fraley. 1987a. Determination of fishery losses in the Flathead system resulting from the construction of Hungry Horse Dam. Prepared for U.S. Department of Energy, BPA, Div. of Fish and Wildlife. BPA contract no. DE-AI79- 85BP23638, project no. 85-23. MDFWP, Kalispell, MT 33pp.

Zubik, R.J. and J. Fraley. 1988. Comparison of snorkel and mark-recapture estimates for trout populations in large streams. North American Journal of Fisheries Management 8:58-62.