MONITORING FISHERIES HABITAT AND FISH POPULATIONS IN THE FLATHEAD BASIN

Results of Monitoring Activities under the Flathead Basin Commission's Master Plan

Montana Department of Fish, Wildlife and Parks
P.O. Box 67
Kalispell, MT 59903

September 1990

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P.O. Box 67
Kalispell, MT 59903

September 17, 1990

Gary Brown, Chairman
FBC Monitoring Committee
Montana Dept. of State Lands
Forestry Division
2705 Spurgin Rd.
Missoula, MT 59801

Dear Gary:

Attached is the fisheries section for the Flathead Basin Commission's report on the Master Plan for water quality monitoring. We formatted the fisheries section as much as possible to be readable by persons without a background in fisheries science. First, we concentrated on the more important sites and did not report all data for all sites. Second, we relied mostly on figures, placing detailed tables in an appendix. Third, we did not describe methods in detail, nor did we cite literature throughout the text. Instead, we included a bibliography where support information can be found.

I look forward to working with the technical committee members and members of the monitoring committee to complete the overall monitoring report. When we examine all the information together for the monitoring sites, we may be able to draw more conclusions on the fisheries information.

We are formatting a diskette containing the report in WordPerfect 5.1, and will transmit this to the editor next week. We contacted the editor and she informed us that format is compatible with her plans. If you have any questions, please contact me.

Best Regards,

John

John Fraley
Fisheries Program Officer

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INTRODUCTION

The fishery in the Flathead Basin is extensive and unique. More than 20 native and introduced fish species reside in streams and lakes of the Flathead Drainage. Bull trout and cutthroat trout are considered species of special concern, a designation which recognizes their sensitivity to habitat degradation, angler harvest, and threat of hybridization with non-native fish species.

Some fish species, including bull trout and westslope cutthroat trout migrate between Flathead Lake and the river/tributary system. Adult fish reside in the lake, migrate through the river corridors, and spawn in upstream tributaries of the North and Middle forks. Fish in Hungry Horse Reservoir display the same migratory pattern in the upper South Fork of the Flathead River.

Because bull trout and westslope cutthroat are sensitive to changes in habitat and angling pressure, they represent excellent indicator species for long-term monitoring. Also, they use a combination of lake, river, and tributary habitats so they are sensitive to changes in any part of the aquatic system. The Montana Department of Fish, Wildlife and Parks (the Department) has monitored fish populations and key components of stream habitat at sites around the basin as part of the Flathead Basin Commission's (FBC's) Master Monitoring Plan. The Department recommended many of these sites and activities after identifying the important waters around the basin for spawning and rearing of bull trout and westslope cutthroat trout during the Flathead River Basin Environmental Impact Study.

This report summarizes the results of fisheries habitat and fish population monitoring in selected sites outlined in the Master Plan. The discussion focuses on the most important

sites; it does not present all information for all sites. Appendix A lists reports and publications where more detailed data and analyses can be found. The recommendation section includes an analysis of which sites and activities are yielding the most useful data and should be continued in the long-term monitoring program. Also, recommendations are made for changing the priority of some sites and deleting some sites from the monitoring plan.

METHODS

The Department monitored key components of stream habitat and fish populations at 40 sites in the Flathead Basin (Appendix B). Fisheries habitat measurements include substrate composition and substrate score. Substrate composition, particularly the percentage of fine materials less than 6.35 mm (0.25 in) is measured by removing cores of stream bottom from a sampling site. These cores are returned to the laboratory, dried, sieved, and each size component is weighed. The percentage of fine materials indicates fish egg and fry incubation habitat quality. Substrate score is a transect method of determining the relative imbeddedness of rocky substrate. This is a measure of the amount of rearing habitat in rock crevices for young fish.

Biologists monitor fish populations by surveying spawning areas and counting spawning sites or "redds," by electrofishing in streams, and by gillnetting, and hydroacoustic sampling in lakes. Most electrofishing estimates are derived by removing fish from a 150 meter (480 feet) section of stream channel on two successive passes and calculating the total number based on the ratio of the passes. The hydroacoustic method now used by the

Department employs a dual beam signal that enables biologists to discern the approximate size of fish targets recorded on a chart along transects of Flathead Lake.

Detailed description of methods can be found in the reports listed in Appendix A.

RESULTS AND DISCUSSION

FISHERIES HABITAT QUALITY

Concentration of fine materials in stream bottoms is a key indicator of fisheries habitat quality. Materials less than 6.35 mm (0.25 in) in the streambed gravels can reduce the survival of fish eggs and emergence success of fry (see Figures 1 and 2). Materials 6.35 mm and smaller can be generated by land-use activities such as forest road construction.

Biologists have monitored the percentage of fine materials in the substrate of important streams used by spawning bull trout and cutthroat trout at sites specified in the Master Plan. Coal Creek contains relatively high sediment levels while Trail Creek gravels contain a relatively low percentage of sediments (Figure 3).

In the Upper Coal Creek drainage, fine materials decreased significantly ($p < .10$) between 1985 and 1986 in the South and North forks (Appendix C). No significant change was noted since 1986 on the South Fork. On the North Fork, sediments increased significantly ($p < .05$) between 1987 and 1988. Active sediment sources were identified on both the North and South forks of Coal Creek during stream feature identification surveys in 1988. We observed major management-related sediment contributing areas in the upper South Fork drainage area above a series of relatively stable beaver dams. A large amount of deposited material is currently stored behind these dams. No major land disturbing

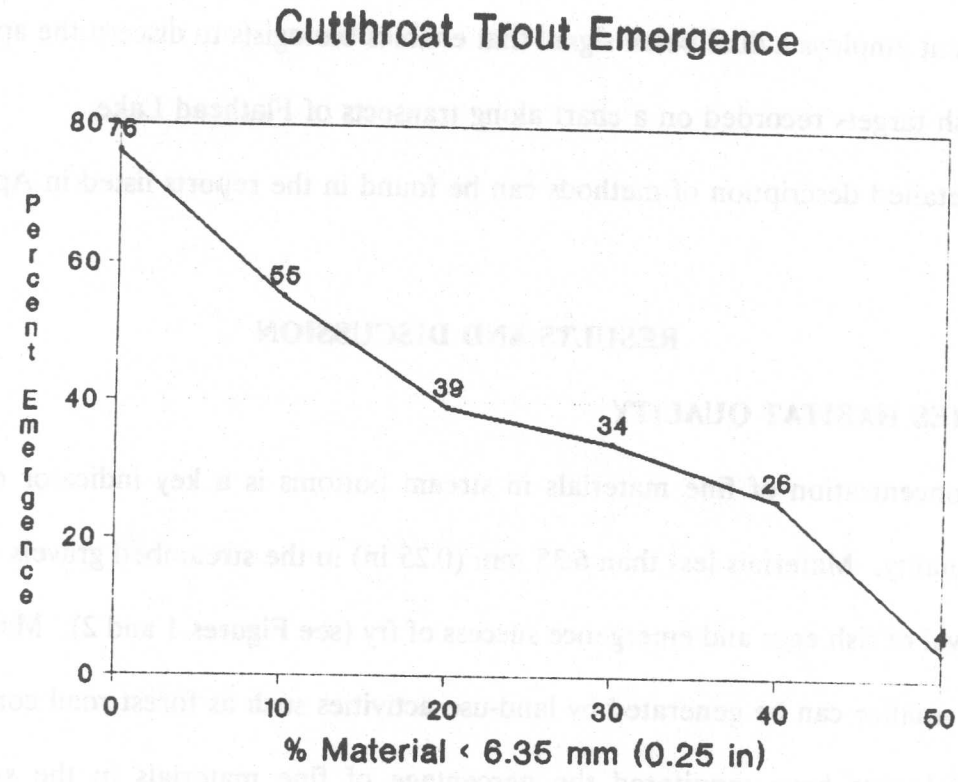

Figure 1. The relationship between the percentage of fine materials in the streambed and emergence success of westslope cutthroat fry from gravels in Langford Creek, North Fork Flathead Drainage, 1989.

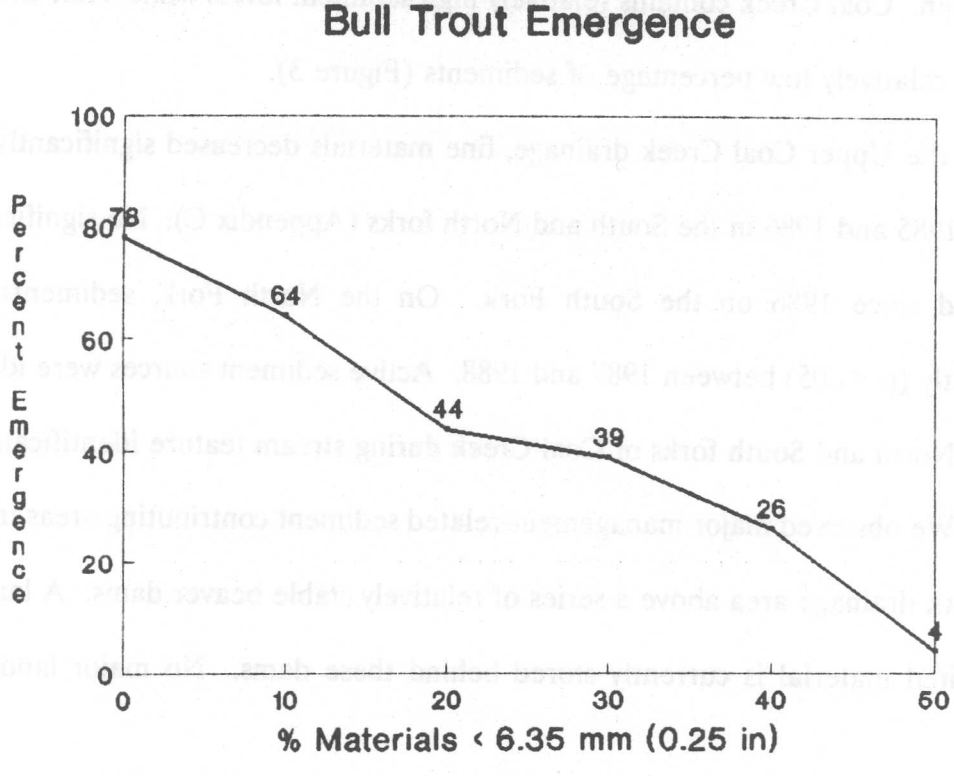

Figure 2. The relationship between the percentage of fine materials in the streambed and emergence success of bull trout fry from gravels in Coal Creek, North Fork Flathead Drainage, 1990.

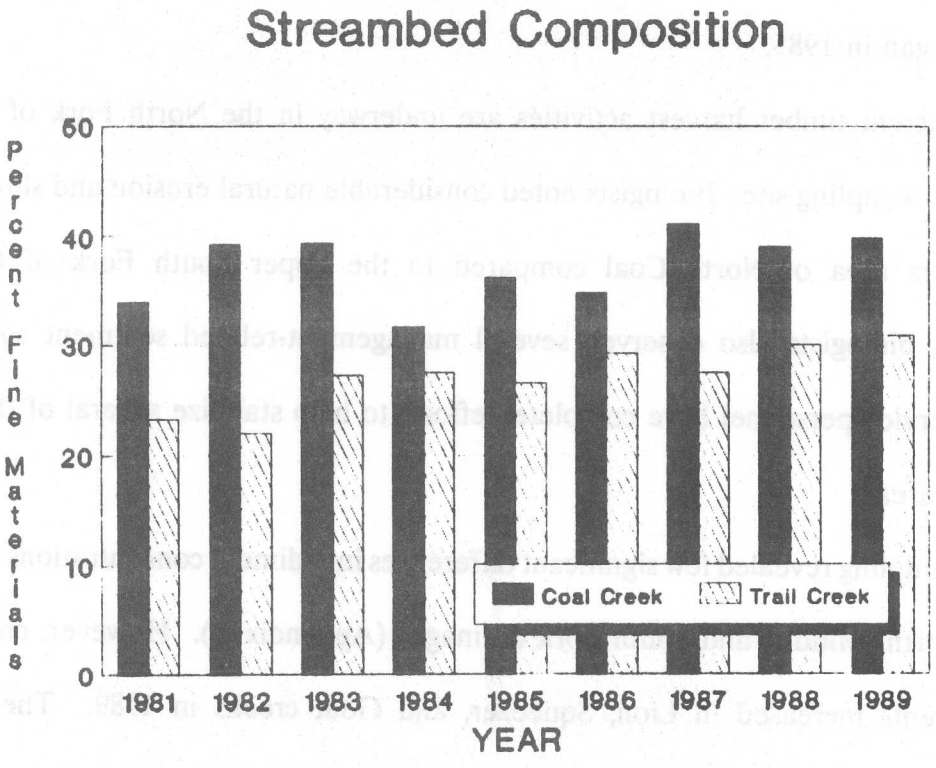

Figure 3. The percentage of material less than 0.25 inches in gravels of Coal and Trail Creek, North Fork Flathead Drainage.

activities have taken place in the drainage above this sampling site since our period of record began in 1985.

Current timber harvest activities are underway in the North Fork of Coal Creek above our sampling site. Biologists noted considerable natural erosion and slumping in the headwaters area of North Coal compared to the upper South Fork of Coal Creek. However, biologists also observed several management-related sediment sources. U.S. Forest Service personnel have completed efforts to help stabilize several of the identified problem areas.

Sampling revealed few significant differences in sediment concentrations at other sites in the North, Middle, and South Fork drainages (Appendix C). However, concentrations of sediments increased in Lion, Squeezer, and Goat creeks in 1989. The increase of sediments in Goat Creek was significant ($p < .05$).

Measurements of substrate imbeddedness in streams is an important indicator of rearing space for young trout. Young bull trout require unembedded, rocky substrate for rearing. Biologists have monitored imbeddedness at FBC sites using the substrate score, a transect measure that indicates rearing habitat quality (Appendix C). A substrate score greater than 11.0 indicates good rearing habitat for juvenile fish; scores less than 9.0 indicate unsuitable habitat. Substrate scores at all sites from 1983-1989 measured above 9.0. However, scores at the Coal Creek site in 1988 and 1989 had decreased to 9.8 and 9.6, respectively.

FISH POPULATIONS

Biologists monitored fish populations in streams by counting "redds" or nests built by spawning fish, or by electrofishing a given stream section. Lakes are sampled by using gill nets and hydroacoustic equipment. Long-term fish population monitoring is important in the Flathead Basin. Fish populations, particularly those of bull trout and cutthroat trout, respond to environmental disturbance, so are excellent indicators. But, long-term data must be examined to analyze and put into perspective natural fluctuations in fish populations.

Counts of Bull Trout Redds in Tributaries

Counts of bull trout spawning sites or redds at FBC sites in the North and Middle fork drainages are indicators of adult spawner escapement from Flathead Lake (Table 1). Counts in the eight index tributaries during the 1979-1989 period have ranged from 188 to 600 redds. Over 400 redds were present in 1987, 1988, and 1989. The overall redd counts in the drainage seem to indicate a relative stable trend in the bull trout spawning population (Figure 4). Studies have shown that an average of three bull trout construct each redd. Counts in these index tributaries represent one-quarter to one-third of the total spawning run. Biologists have estimated that about one-half of the adult bull trout in Flathead Lake embark on a spawning run each year.

In the Swan drainage, surveys have shown a steady increase from 109 to 371 redds from 1985-1989 in the four index tributaries. Swan Lake supports a much larger spawning population relative to its size than Flathead Lake.

Table 1. Summary of bull trout spawning inventories.

Drainage/ Stream	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
						Redd Numbers					
North Fork:											
Big	10	20	18	41	22	9	9	12	22	19	24
Coal	38	34	23	60	61	53	40	13	48	52	50
Whale	35	45	98	211	141	133	94	90	143	136	119
Trail	34[a]	31[a]	78	94	56	32	25	69	64	62	51
Total	**117**	**130**	**217**	**406**	**280**	**227**	**168[b]**	**184**	**277**	**269**	**244**
Middle Fork:											
Morrison	25[a]	75	32[a]	86	67	38	99	52	49	50	63
Granite	14	34	14[a]	34	31	47	24	37	34	32	31
Lodgepole	32	14	18	23	23	23	20	42	21	19	43
Ole	--	19	19	51	35	26	30	36	45	59	21
Total	**71**	**142**	**83**	**194**	**156**	**134**	**173[b]**	**167**	**149**	**160**	**158**
Flathead Drainage Total	188	272	300	600	436	361	341	351	426	429	402
Swan:											
Elk	--	--	--	56	91	93	19	53	162	201	186
Goat	--	--	--	33	39	31	40	56	31	46	34
Squeezer	--	--	--	41	57	83	24	55	64	9[b]	67
Lion	--	--	--	63	49	88	26	476	33	65	84
Total	**--**	**--**	**--**	**193**	**236**	**295**	**109**	**210**	**290**	**321**	**371**

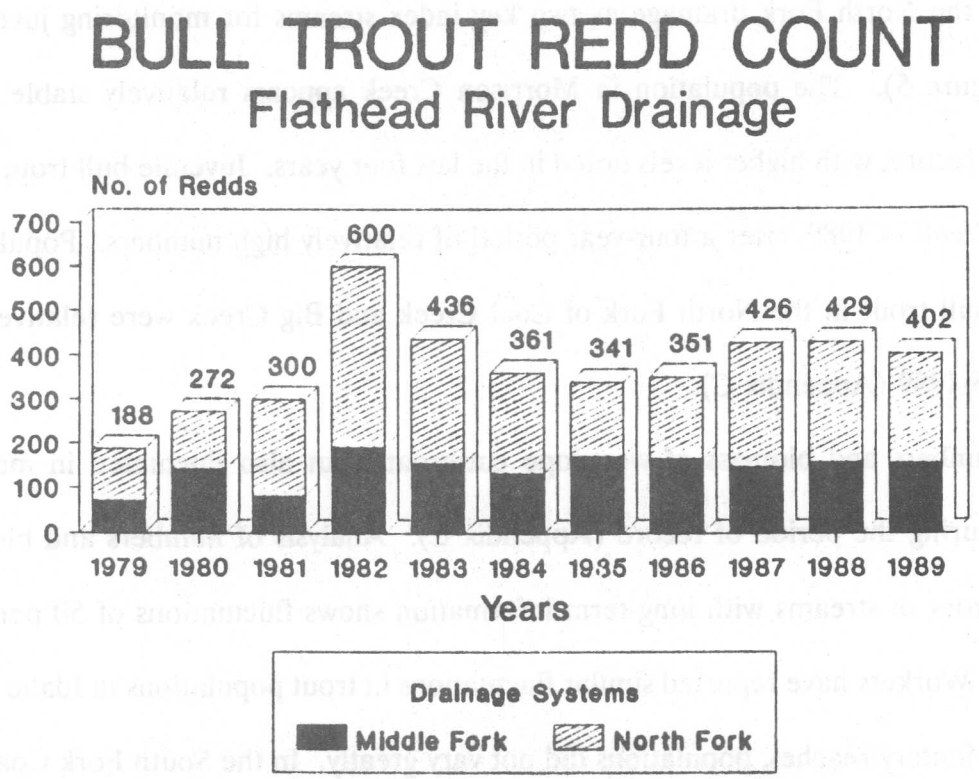

Figure 4. Trends in numbers of bull trout spawning nests or redds in North and Middle Fork index tributaries.

Juvenile Trout Abundance in Tributaries

Biologists have identified Morrison Creek in the Middle Fork drainage and Coal Creek in the North Fork drainage as two key index streams for monitoring juvenile bull trout (Figure 5). The population in Morrison Creek appears relatively stable over the period of record, with higher levels noted in the last four years. Juvenile bull trout declined in Coal Creek in 1989, after a four-year period of relatively high numbers. Populations of juvenile bull trout in the North Fork of Coal Creek and Big Creek were relatively stable from 1985-1989 (Appendix C).

Numbers and biomass of westslope cutthroat trout also fluctuated in most index streams during the period of record (Appendix C). Analysis of numbers and biomass of juvenile trout in streams with long-term information shows fluctuations of 50 percent are common. Workers have reported similar fluctuations in trout populations in Idaho streams. In some tributary reaches, populations did not vary greatly. In the South Fork Coal Creek, numbers of cutthroat ranged between 43-63 during a five-year period. Biologists have identified Red Meadow Creek in the North Fork drainage and Challenge Creek in he Middle Fork drainage as important streams for juvenile cutthroat (Figure 6). Overall, populations of this species of special concern appear relatively stable in Flathead Basin tributaries.

Fish Populations in Flathead Lake

Fish populations were monitored annually before 1988 using single-beam hydroacoustic equipment. In 1988 and 1989, biologists surveyed Flathead Lake with more

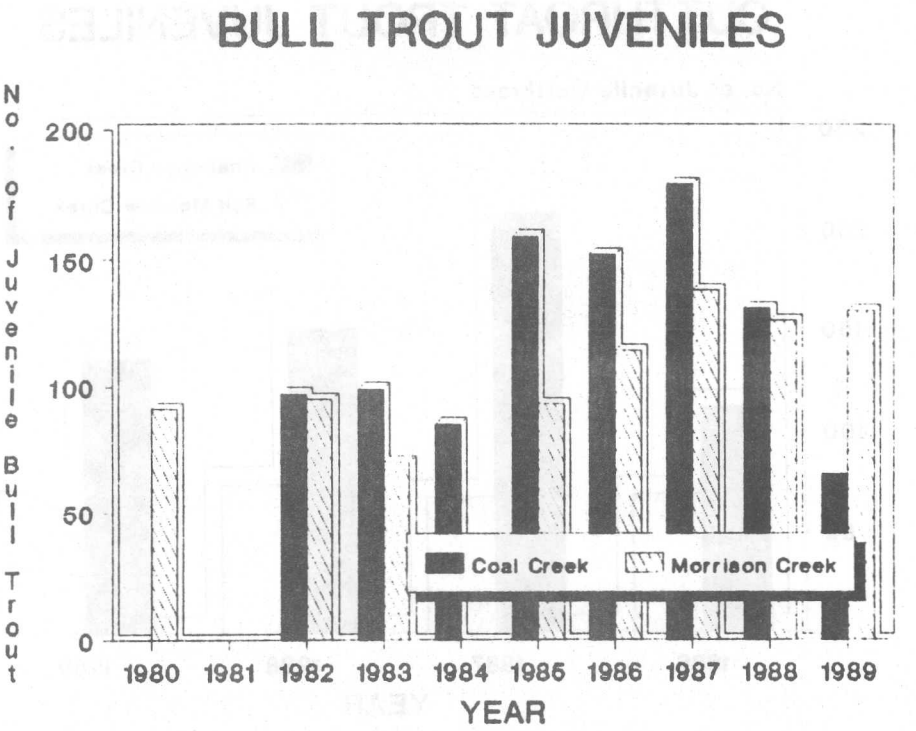

Figure 5. Numbers of young bull trout per 150 m (480 feet) of stream channel in Coal and Morrison creeks.

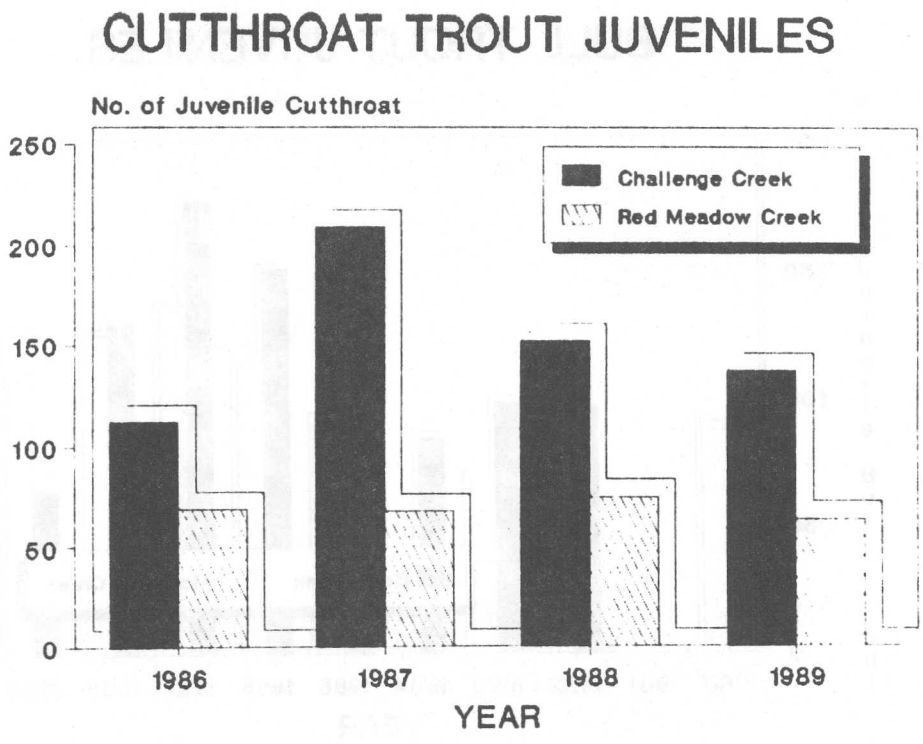

Figure 6. Numbers of westslope cutthroat trout per 150 m (480 feet) of stream channel in Challenge and Red Meadow creeks.

sophisticated dual-beam equipment, which allows determination of fish sizes. In 1989, surveys indicated 151.6 fish over 1.0 inch in length per acre (375 fish/hectare), for a lakewide estimate of 15.2 million fish (Figures 7 and 8). This estimate did not include fish species which reside in shallow, littoral areas of the lake, ie. cutthroat trout, yellow perch, peamouth squawfish, and suckers, and it did not include the South Bay of Flathead Lake. Most fish included in the estimate were deeper-water (limnetic) species such as lake trout, bull trout, and lake whitefish.

Fish density varied by depth and area (Figures 7 and 8). Area 3 supported the largest density of fish. This area extends along the east shoreline from Wood Bay to Yellow Bay out to mid-lake bar (Figure 9). Nearly one-third of the fish were found within the 10-15 meter (32-50 ft) depth range. The thermocline, or zone of rapid water temperature change, is also found within this depth range.

Biologists determined relative abundance of fish species in 24 areas of the lake using gill nets and trawls. This sampling was necessary to confirm the hydroacoustic estimate. Bull trout comprised 6 to 28 percent of the limnetic fish community. Lake trout comprised 5 to 38 percent; lake whitefish made up 45 to 89 percent.

The combination of dual-beam hydroacoustics and confirmation netting and trawling should prove to be a valuable tool to monitor the changing fish population in Flathead Lake. Department and tribal biologists will use these techniques annually for monitoring, and to evaluate the success of fisheries mitigation efforts in the basin planned to begin in 1991.

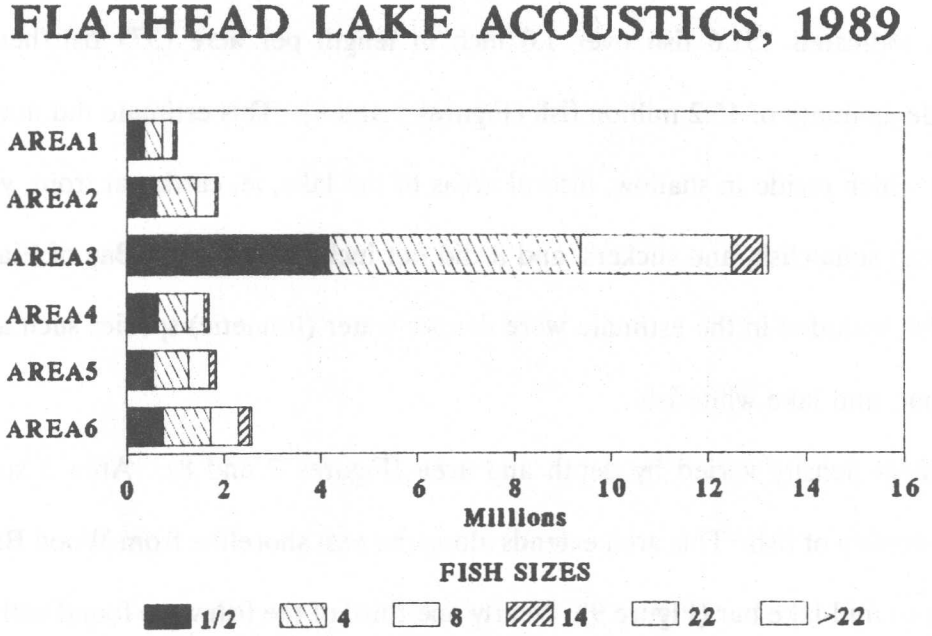

Figure 7. The number of fish by size interval within six geographic areas of Flathead Lake in August, 1989.

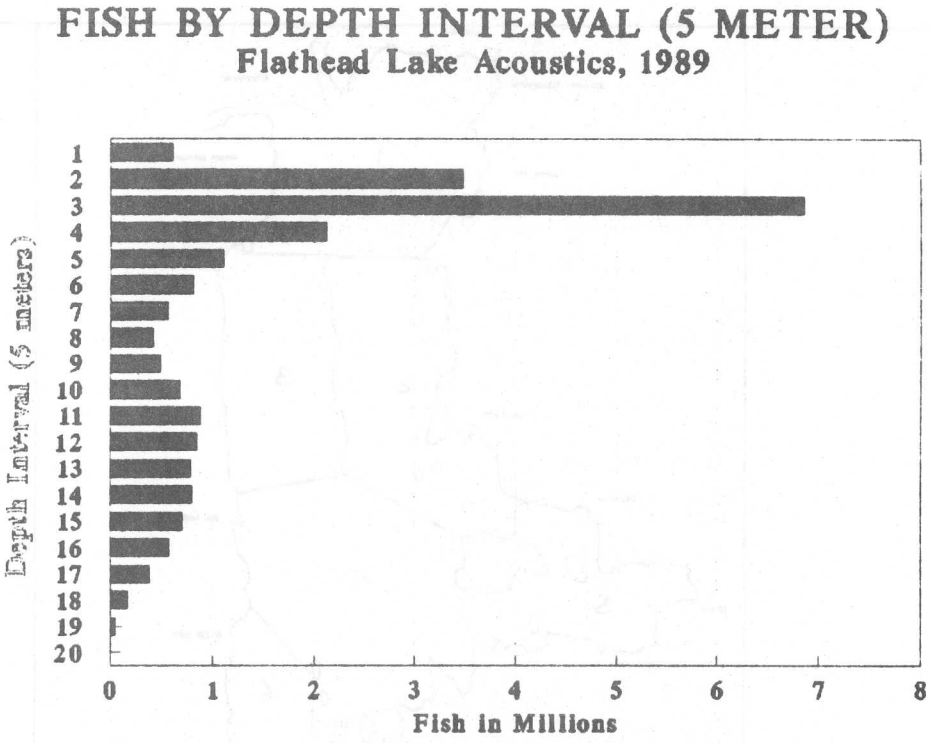

Figure 8. The number of fish by depth interval (5 meter) from a hydroacoustic estimate in Flathead Lake, August, 1989.

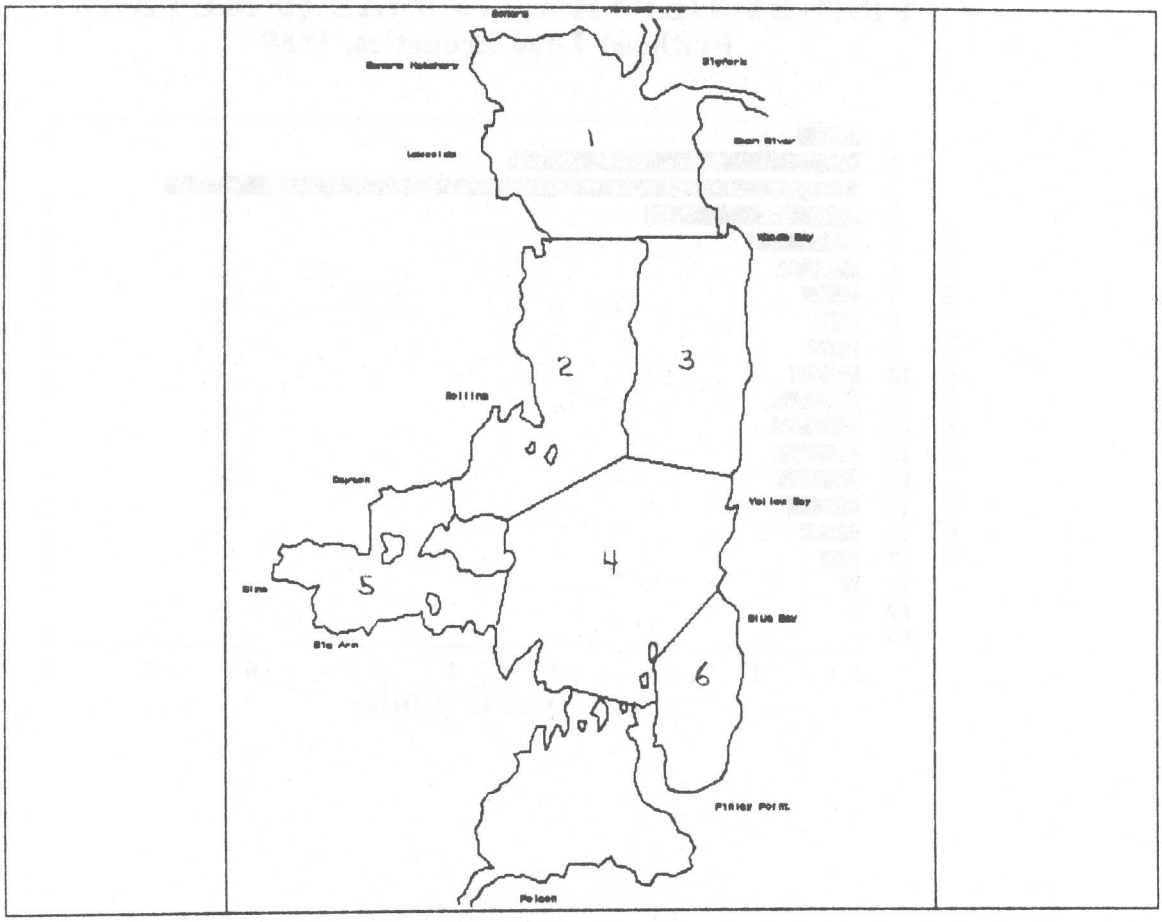

Figure 9. Map of Flathead Lake showing areas of hydroacoustic fish estimates.

Index of Kokanee Spawners in the Flathead River System

Kokanee have declined to very low levels in Flathead Lake and River. Biologists surveyed McDonald Creek in 1989, and counted 20 kokanee redds. Surveys also documented 22 redds at one main stem Flathead River site near Columbia Falls. No redds were seen at several Flathead lakeshore sites that were surveyed.

The Department and Tribes are engaged in an experimental kokanee recovery program. Several million fry and fingerlings have been held until June and released in each of the last four years. Biologists note limited reports of kokanee caught by anglers and found in the stomachs of lake trout. If these planted kokanee fry are surviving to maturity, spawning fish should be seen, beginning in the fall of 1991.

Populations of Westslope Cutthroat Trout in the South Fork Flathead River

Biologists estimated numbers of westslope cutthroat trout in the Upper South Fork Flathead River using a snorkel and mark-recapture method. The 1985 and 1989 estimates of westslope cutthroat were 527 ($\pm$59) and 416 ($\pm$83), respectively in a 2.4 mile section of river channel near Black Bear Creek.

Size distribution of westslope cutthroat in a section of the river near Youngs Creek has been monitored since 1985 (Figure 10). The percentage of fish greater than 254 mm (10.0 inches) ranged from 28-56. Average length ranged from 9.6 to 10.6 inches. Apparently, angling regulations are sufficient at this time to protect the population. Genetic tests in 1989 showed these fish to be pure westslope cutthroat trout.

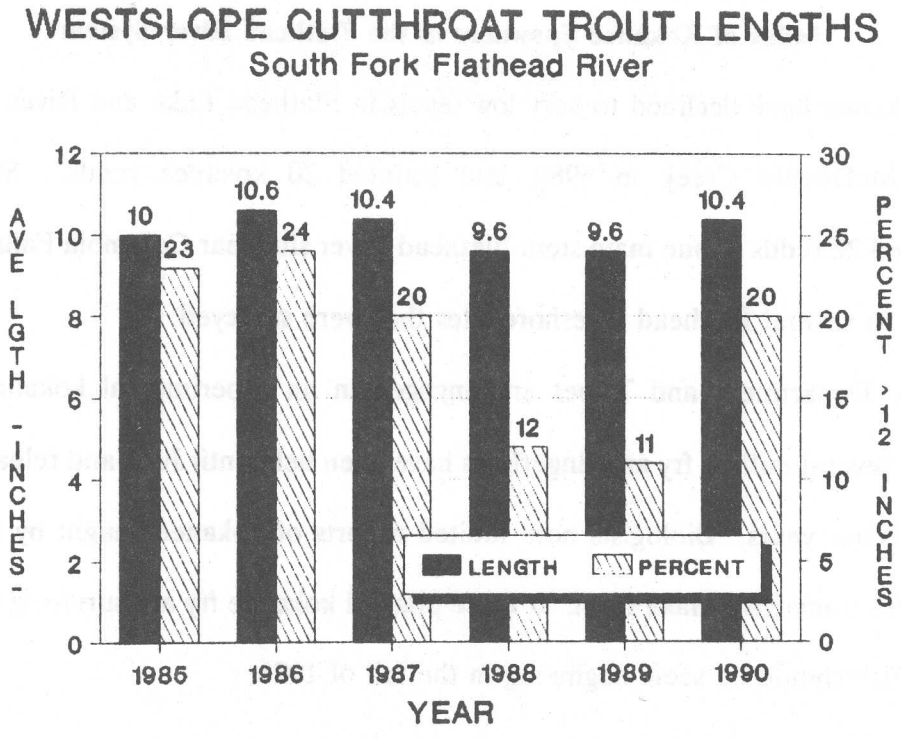

Figure 10. Average length and percentage of westslope cutthroat greater than 12 inches (305 mm) in the South Fork Flathead River near Youngs Creek.

Westslope cutthroat trout in the Upper South Fork Flathead River can be affected by angling, and by operations of Hungry Horse Dam. A percentage of these fish are migrants from Hungry Horse Reservoir.

Fish Populations and Limnological Monitoring in Hungry Horse Reservoir and Hungry Horse Creek

Populations of bull trout, westslope cutthroat and mountain whitefish have been monitored continually using gill nets in Hungry Horse Reservoir from 1983-1989 (Table 2, Figure 11). These surveys indicate that the bull trout population increased in relative abundance until 1989. Biologists are concerned that reservoir drawdown could affect westslope cutthroat more than bull trout; westslope cutthroat trout rely on insects and zooplankton which are reduced by fluctuating reservoir levels. Biologists monitored reservoir elevation, water temperatures, and depth of the euphotic zone (ie. sunlit zone) concurrent with fisheries sampling (see Appendix C).

Numbers of juvenile westslope cutthroat migrants leaving Hungry Horse Creek and entering the reservoir has ranged from 980 to 2,680 during the period of record (Figure 12). Outmigration of juvenile trout has not declined in recent years, despite reduced numbers of adult spawners in Hungry Horse Creek.

Mysis and Kokanee Monitoring in Swan, Ashley and Whitefish Lakes

Department biologists monitored densities of juvenile and adult Mysis in Swan,

Table 2. Percent composition by species and net type for gill net catches from Hungry Horse Reservoir 1983 to 1987.

	Percent of Catch													
	Floating Nets							Sinking Nets						
Species	1983	1984	1985	1986	1987	1988	1989	1983	1984	1985	1986	1987	1988	1989
Westslope cutthroat trout (WCT)	43.9	41.8	54.1	42.1	59.4	36.0	54.4	2.3	1.4	0.8	1.4	1.3	1.9	1.6
Bull trout (DV)	3.4	5.8	8.4	7.9	16.8	9.9	10.3	9.4	14.0	16.5	18.0	19.7	21.9	13.6
Mountain whitefish (MWF)	11.5	4.2	8.4	10.3	5.5	10.2	9.5	40.4	36.7	38.3	40.1	27.2	25.3	35.1
Northern squawfish (NSQ)	39.6	45.7	26.6	37.4	14.7	30.7	30.7	22.8	22.8	23.1	16.6	13.7	22.5	22.0
Largescale suckers (CSU)	1.4	2.2	2.4	1.7	1.8	8.6	3.6	10.1	9.1	8.7	9.1	11.2	14.4	13.6
Longnose sucker (LNSU)	0.2	0.3	0.1	0.6	1.8	4.6	0.4	15.0	15.9	12.5	13.1	26.9	13.9	13.7
Pygmy whitefish (PW)	--	--	--	--	--	--	--	<0.1	<0.1	<0.1	1.7	--	--	0.4
Total fish caught	712	1,147	711	828	453	886	632	963	2,110	1,772	2,132	960	1,106	1,125

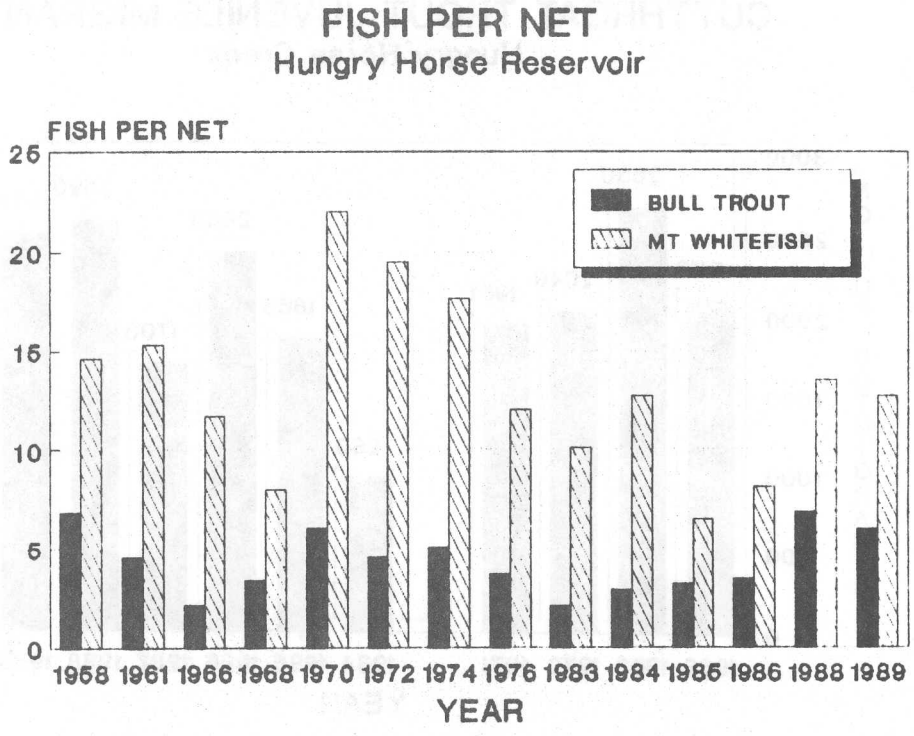

Figure 11. Average number of bull trout and mountain whitefish per sinking net in fall gill net series on Hungry Horse Reservoir.

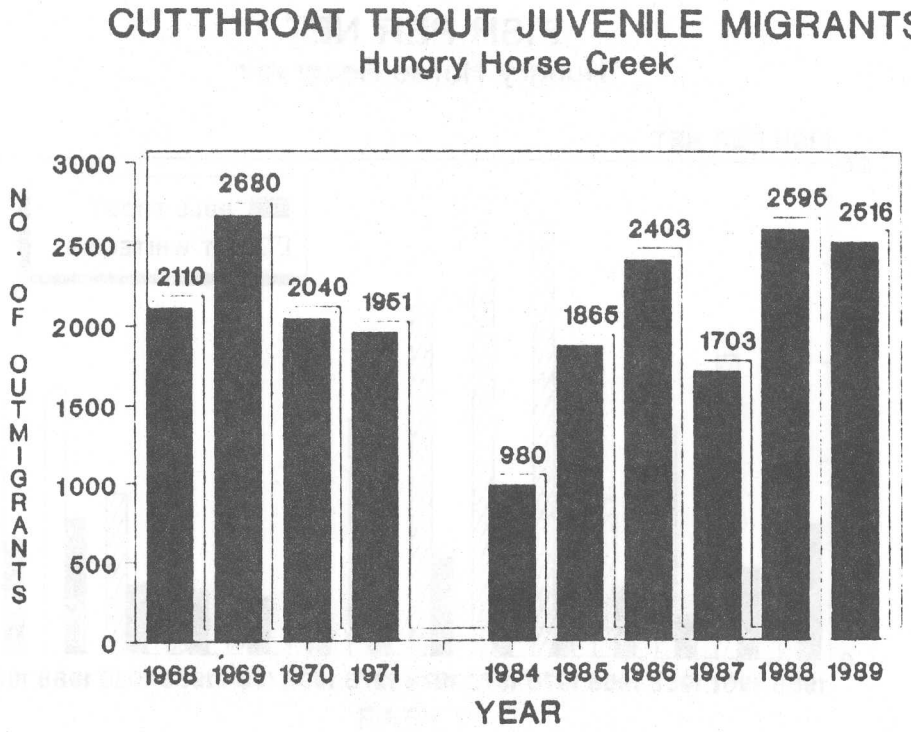

Figure 12. Estimated number of juvenile cutthroat outmigrating from Hungry Horse Creek, a tributary of Hungry Horse Reservoir.

Ashley, and Whitefish lakes from 1983 to 1990 (Figure 13). Mysis densities ranged from 20.1 to 251.6 individuals per m^2 of lake surface area. Kokanee have persisted in Swan Lake despite relatively high Mysis densities. Counts of kokanee redds in shoreline areas of the lake were 1,555, 1,855, and 1,941 in 1987, 1988, and 1989, respectively.

RECOMMENDATIONS

Monitoring of key fisheries variables at important sites is necessary to evaluate the FBC's basin-wide goal for the protection of aquatic resources. The Department designed its portion of the Master Plan to be interactive and subject to adjustment upon periodic evaluation. In this section, we recommend continued monitoring of many priority sites, changing priority on some sites, adding some new sites, and dropping some sites from the program. These recommendations are indicated on the site list in Appendix B.

In the North Fork drainage, Trail Creek, North Fork Coal Creek, and Big Creek are designated as priority sites. Because of the importance of Whale Creek and main Coal Creek for bull trout spawning, we recommend designating these as priority sites. North Fork Coal Creek could be lowered in priority. Sites FBC1001 and FBC1019 are monitored by the U.S. Geological Survey, and should be designated as USGS sites.

Challenge Creek and Granite Creek are currently designated as priority sites in the Middle Fork drainage because of their importance for juvenile cutthroat and bull trout spawning, respectively. We recommend designating Morrison Creek as a priority site because of its importance for bull trout spawning. Also, we recommend adding Schafer and Dolly Varden creeks as new sites for monitoring bull trout spawning trends in the drainage

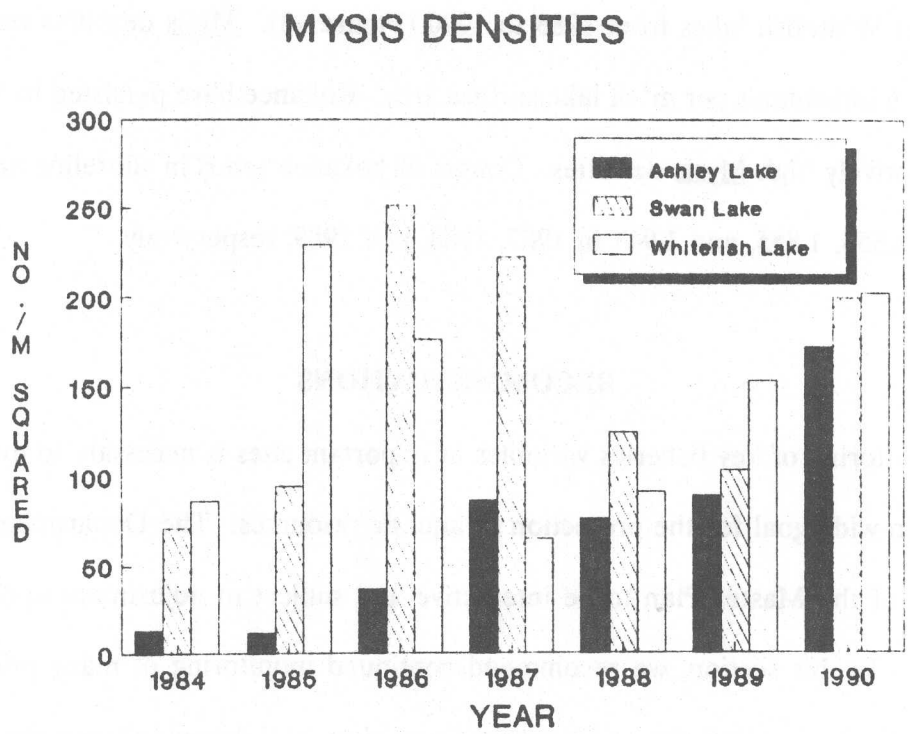

Figure 13. Densities of Mysis shrimp (no./m^2) in 30 m hauls in area lakes.

within the Great Bear Wilderness. Long-term data exist for all these sites.

In the Stillwater drainage, the Master Plan calls for fisheries monitoring at three sites. We recommend continued monitoring of fisheries variables only on Whitefish Lake. Incomplete data sets on the other two sites limit any interpretations that could be made.

We recommend upgrading to priority sites Goat, Elk, Squeezer, and Lion Creeks, all tributaries of the Swan River. These streams support 90 percent of all bull trout spawning in the Swan drainage and are extremely important to this species of special concern. Also, a good data record exists for these streams.

In the mainstem Flathead drainage, fisheries sampling on Flathead Lake is a priority and should remain so. Drastic declines in kokanee spawner abundance has changed the Department's efforts to monitor spawning areas along the Flathead River. These areas will be monitored closely only if aerial counts reveal a significant kokanee spawning run in the river system.

APPENDIX A

A list of reports and publications containing detailed descriptions of methods and analysis of data.

FISHERIES REPORTS AND PUBLICATIONS
CONCERNING THE FLATHEAD RIVER BASIN
June 1983 - March 1990
Montana Department of Fish, Wildlife and Parks

Anderson, Gary. 1987. Inventory of waters: Whitefish, Little Bitterroot, and McGregor lakes. Job progress report F-7-R-34-35, Job No. I-a supplement. MDFWP, Kalispell, MT.

Beattie, Will and P. Clancey. 1987. Effect of operation of Kerr and Hungry Horse Dams on the reproductive success of kokanee in the Flathead system, annual progress report FY 1986. BPA agreement DE-AI79-83BP39641, project 81S-5. MDFWP, Kalispell, MT. 56 pp.

Beattie, Will, P. Clancey, J. Decker-Hess and J. Fraley. 1985. Impacts of water level fluctuations on kokanee reproduction in Flathead Lake. BPA contract no. DE-AI79-83BP39641, project no. 81S-5. MDFWP, Kalispell, MT. 57 pp.

Beattie, W., P. Clancey and R. Zubik. 1988. Effect of the operation of Kerr and Hungry Horse dams on the reproductive success of kokanee in the Flathead system, final report FY 1987. BPA contract no. DE-AI79-86BP39641, project no. 81S-5. MDFWP, Kalispell, MT. 89 pp.

Beattie, W., J. Tohtz, B. Bukantis, and S. Miller. 1990. Effect of the operation of Kerr and Hungry Horse Dams on the reproductive success of kokanee in the Flathead system, final report. BPA contract no. DE-AI79-86BP39641, project no. 81S-5. MDFWP, Kalispell, MT. 67 pp.

Clancey, Pat and J. Fraley. 1985. Monitoring kokanee salmon escapement and spawning in the Flathead River System. MDFWP, Kalispell, MT. 14 pp.

Clancey, Pat and J. Fraley. 1986a. Monitoring kokanee salmon escapement and spawning in the Flathead River System. MDFWP, Kalispell, MT. 9 pp.

Clancey, Pat and J. Fraley. 1986b. Effects of the operation of Kerr and Hungry Horse Dams on the kokanee fishery in the Flathead River System, final research report 1979-1985. BPA Contract no. DE-AI79-83BP39641, project 81S-5. MDFWP, Kalispell, MT. 45 pp.

Decker-Hess, Janet. 1986. An inventory of the spring creeks in Montana. Prepared for The American Fisheries Society, in cooperation with MDFWP, Helena, MT. 123 pp.

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APPENDIX B

Sites monitored by the Montana Department of Fish, Wildlife and Parks under the Flathead Basin Commission's Master Plan.

Table B1. Monitoring sites sampled by the Montana Department of Fish, Wildlife and Parks. Key: "+" indicates the site was sampled in the year indicated, "o" indicates the site was not sampled.

North Fork

FBC Site No.	Agency	Name	Location	Activity	Year 1985	1986	1987	1988	1989
FBC1001	FWP1007[4/]	NF FHD River (international border)	(Lat. 29° 00'02"; Long. 1/4° 28'35")	Water temperature recording; contract with USGS	+	+	+	+	+
FBC1001	FWP1003[1/]	Trail Creek	SE1/4 25 37N 23W	Bull trout redd counts and abundance estimates, fish habitat	+	+	+	+	+
FBC1012	FWP1002[2/]	Whale Creek	SE1/4 30 36N 23W	Bull trout redd counts and abundance estimates, fish habitat	+	+	+	+	+
FBC1013	FWP1001	Red Meadow Cr.	NE1/4 11 36N 22W	Juvenile cutthroat abuncance	o	+	+	+	+
FBC1014	FWP1004[1,3/]	N FK Coal Cr.	SE1/4 24 32N 22W	Bull trout redd, juvenile abundance	+	+	+	+	+
FBC1016	FWP1005[2/]	Coal Creek (Deadhorse Br.)	SW1/4 28 34N 21W	Bull trout redd counts and juvenile abundance, fish habitat	+	+	+	+	+
FBC1017	FWP1006[1/]	Big Creek (Upper)	NE1/4 33 33N 21W	Bull trout juvenile abuncance, fish habitat	o	+	+	+	+
FBC1019	FWP1008[4/]	NF FHD River	NW1/4 35 32N 20W	Water temperature, USGGS contract	+	+	+	+	+

[1/] Currently designated as a priority site.

[2/] Recommended for upgrade to a priority site.

[3/] Recommended for downgrade from a priority site.

[4/] Recommend dropping as a FWP site.

Table B1 continued.

South Fork

FBC Site No.	Agency	Name	Location	Activity	Year 1985	1986	1987	1988	1989
FBC2001	FWP2001	SF FHD River	NW1/4 22 22N 14W	Cutthroat lengths, and cutthroat population estimates	+	+	+	+	+
FBC2008	FWP2003	Sullivan Cr.[4/]	NE1/4 23 26N 17W	Cutthroat trout redd counts population estimates	o	o	+	+	+
FBC2009	FWP2002	Hungry Horse Cr.	NW1/4 22 30N 18W	Cutthroat population estimates and downstream migrant trapping	+	+	+	+	+
FBC2010	FWP2004	Hungry Horse Res.	NE1/4 27 30N 19W	Spring/fall gillnetting limnological sampling	+	+	+	+	+
FBC2012	FWP2005	SF FHD River[4/]	SW1/4 16 30N 19W	Water temperature, USGS Contract	+	+	+	+	+

Middle Fork

FBC Site No.	Agency	Name	Location	Activity	Year 1985	1986	1987	1988	1989
FBC3003	FWP3001	Ole Creek	NE1/4 14 29N 16W	Bull trout redd counts juvenile abundance	+	+	+	+	+
FBC3004	FWP3002	McDonand Cr.	NW1/4 23 32N 19W	Kokanee spawner counts	+	+	+	+	+
FBC3006	FWP3005[1/]	Challenge Cr.	SW1/4 32 29N 13W	Cutthroat trout juvenile abundance, fish habitat	+	+	+	+	+
FBC3008	FWP3003[2/]	Morrison Cr.	NW1/4 9 28N 18W	Bull trout redd counts and juvenile abundance, fish habitat	+	+	+	+	+
FBC3009	FWP3004	Lodgepole Cr.	SE1/4 2 27N 13W	Bull trout redd counts	+	+	+	+	+
FBC3010	FWP3006[1/]	Granite Cr.	SW1/4 7 28N 13W	Bull trout redd counts, fish habitat	+	+	+	+	+
FBC3012	FWP3007[4/]	MF FHD River (W. Glacier)	SW1/4 34 32N 19W	Water temperature	+	+	+	o	o

Table B1 continued.

Stillwater-Whitefish Drainage

FBC Site No.	Agency	Name	Location	Activity	Year 1985	1986	1987	1988	1989
FBC4008	FWP4003[4/]	Tally Lake	NE1/4 31 31N 23W	Kokanee lenghts	o	o	o	o	o
FBC4018	FWP4001	Whitefish Lake	NE1/4 22 31N 22W	Fisheries monitoring--gill net series	+	o	o	+	+
FBC4021	FWP4002[4/]	Whitefish River	NW1/4 27 30N 21W	Kokanee redd counts	+	o	o	o	o

Swan Drainage

FBC Site No.	Agency	Name	Location	Activity	Year 1985	1986	1987	1988	1989
FBC6002	FWP6001[2/]	Lion Creek	NE1/4 14 22N 17W	Bull trout redd counts	+	+	+	+	+
FBC6003	FWP6002[2/]	Goat Creek	NE1/4 16 23N 17W	Bull trout redd counts	+	+	+	+	+
FBC6004	FWP6003[2/]	Elk Creek	SE1/4 16 20N 17W	Bull trout redd counts	+	+	+	+	+
FBC6005	FWP6004[2/]	Squezzer Cr.	SE1/4 21 23N 17W	Bull trout redd counts	+	+	+	+	+
FBC6007	FWP6005	Swan Lake	14 25N 18W	Kokanee redd counts, *Mysis* density	o +	o +	+ +	+ +	+ +

[1/] Currently designated as a priority site.

[2/] Recommended for upgrade to a priority site.

[3/] Recommended for downgrade from a priority site.

[4/] Recommend dropping as a FWP site.

Table B1 continued.

Upper Main Stem Flathead River Drainage

FBC Site No.	Agency	Name	Location	Activity	Year 1985	1986	1987	1988	1989
FBC5001	FWP5007	FHD River (Columbia Falls)	SE1/4 17 30N 20W	Kokanee redd counts	+	+	+	o	o
FBC5002	FWP5009	Lake Blaine[4/]	26 29N 20W	Kokanee lengths and age	o	o	o	+	o
FBC5004	FWP5004	Ashley Lake	14 28N 23W	Kokanee lengths	+	+	+	+	+
FBC5005	FWP5002	Ashley Creek (L. outlet)	NE1/4 23 28N 24W	Discharge - continous	+	+	+	+	+
FBC5006	FWP5003	Ashley Creek (Meridian Br.)	SE1/4 13 28N 22W	Discharge - guage	+	+	+	+	o
FBC5007	FWP5010	FHD River (Brenneman Slough)	SE1/4 22 28N 21W	Kokanee redd counts	+	+	+	+	+
FBC5008	FWP5011	FHD River (House of Mystery)	SW1/4 3 30N 20W	Kokanee redd counts	+	+	+	+	+
FBC5010	FWP5013[4/]	Green Mtn. Creek	NE1/4 28 28N 23W	Cutthroat redd counts	o	o	+	+	+
FBC5011	FWP5008[4/]	Echo Lake	5 27N 19W	No annual sampling					
FBC5014	FWP5005[1/]	Flathead Lake	SW1/4 5 24N 19W	Acoustics, gillnetting	+	+	+	+	+
FBC5015	FWP5001[4/]	Fish Creek	NW1/4 15 28N 24W	Cutthroat redd counts	o	o	+	+	+

[1/] Currently designated as a priority site.

[2/] Recommended for upgrade to a priority site.

[3/] Recommended for downgrade from a priority site.

[4/] Recommend dropping as a FWP site.

APPENDIX C

Detailed information on fisheries habitat and populations referred to in this report.

Table C1. Summary of median cumulative percentages of substrate material smaller than 6.35 mm (0.25 inches) in diameter from annual McNeil core samplings in known cutthroat and bull trout spawning areas.

Stream	Species	Year	Sample Size	Median % Sediments <6.35mm
	North Fork Drainage			
Whale Creek	bull trout	1981	13	26.7
		1982	11	31.2
		1983	12	32.6
		1984	12	28.9
		1985	11	19.3
		1986	12	27.6
		1987	12	27.9
		1988	12	36.9
		1989	12	35.4
Coal Creek-- Dead Horse Bridge	bull trout	1981	20	34.0
		1982	20	39.2
		1983	20	39.3
		1984	20	31.7
		1985	20	36.2
		1986	20	34.8
		1987	20	41.1
		1988	20	39.0
		1989	20	39.8
North Coal Creek	bull trout	1985	12	34.8
		1986	12	29.3
		1987	12	30.2
		1988	12	39.4
		1989	12	37.8
South Fork Coal Creek	bull trout	1985	12	35.8
		1986	12	31.1
		1987	12	31.4
		1988	12	31.4
		1989	12	36.1

continued

Table C1 continued

Stream	Species	Year	Sample Size	Median % Sediments <6.35mm
	North Fork Drainage - continued			
Big Creek	bull trout	1981	12	21.6
		1982	10	31.3
		1983	12	28.2
		1984	12	27.1
		1985	12	28.6
		1986	12	21.6
		1987	12	29.0
		1988	12	39.8
		1989	12	48.0
Trail Creek	bull trout	1981	19	23.3
		1982	19	22.0
		1983	12	27.2
		1984	12	27.4
		1985	12	26.5
		1986	12	29.2
		1987	12	27.4
		1988	12	30.0
		1989	12	30.8
	Middle Fork Drainage			
Granite Creek-- Trail Crossing	bull trout	1982	12	44.6
		1986	6	50.6
		1987	6	47.6
		1988	6	44.6
		1989	6	39.0
Other Sites		1982	--	---
		1986	8	32.6
		1987	6	39.8
		1988	6	44.0
		1989	6	44.4
Challenge Creek	cutthroat trout	1986	12	---
		1987	12	33.4
		1988	12	41.0
		1989	12	43.5

Table C2 Summary of annual substrate scoring in important westslope cutthroat and juvenile bull trout rearing areas in the Flathead drainage.

Streams	Rearing Area	Year	Substrate Score
	North Fork Drainage		
Big Creek	Skookoleel Bridge	1986	12.2
		1987	11.5
		1988	11.2
		1989	11.8
Coal Creek	Dead Horse Bridge	1983	10.3
		1984	10.2
		1985	11.6
		1986	12.3
		1987	10.0
		1988	9.8
		1989	9.6
North Coal Creek		1983	14.0
		1984	12.2
		1985	13.5
		1986	14.2
		1987	13.7
		1988	13.0
		1989	12.3
South Fork Coal Creek		1985	12.8
		1986	12.0
		1987	12.2
		1988	12.0
		1989	11.8
	Middle Fork Drainage		
Morrison Creek	Reach IV	1986	12.3
		1987	12.8
		1988	12.8
		1989	13.0

Table C3 Summary of electrofishing population estimates for Age I+ bull trout in 150m sections selected for annual monitoring between 1982 and 1989.

Creek	Section	Date	Pop. Est.	95% C.I.	p Value
		North Fork Drainage			
Coal	Cyclone Bridge	08/10/82	50	±43	.40
		08/24/83	34	± 7	.71
		08/30/84	52	±13	.63
		08/10/87	18	± 3	.78
		08/16/88	18	± 3	.78
		1989	---	---	---
	Dead Horse Bridge	08/05/82	97	±23	---
		08/23/83	99	±33	---
		08/28/84	85	± 7	---
		08/26/85	159	±61	---
		09/05/86	152	±45	---
		09/01/87	179	±55	---
		09/06/88	131	---	---
		09/15/89	65	±50	---
	North Coal Bridge	08/04/82	17	± 9	.60
		08/25/83	18	± 3	.78
		08/29/84	48	±12	.63
		08/27/85	41	± 5	.77
		09/03/86	29	±12	.59
		09/05/87	47	±17	.56
		08/16/88	39	± 5	.67
		09/08/89	44	±18	.54
South Fork Coal	Section 26	08/28/85	62	± 8	.74
		08/06/87	12	± 2	.48
		08/08/88	24	± 2	.85
		09/29/89	14	± 2	.83
Big	Skookoleel Bridge	09/15/86	47	± 5	.78
		08/19/87	48	± 6	.75
		08/18/88	67	± 6	.56
		09/22/89	83	±11	.54

continued

Table C3 Continued.

Creek	Section	Date	Pop. Est.	95% C.I.	p Value
Red Meadow	1st Bridge RMC Rd	08/15/83	75	±11	.69
		09/16/86	69	± 8	.74
		08/18/87	47	± 4	.82
		10/28/88	44	±19	.54
		09/09/89	20	±15	.50
Whale	Shorty Creek	08/22/83	38	± 8	.69
		09/04/86	32	---	.74
		08/13/87	63	±17	.60
		1988	---	---	---
		09/25/89	33	±11	.60
	Middle Fork Drainage				
Ole	Fielding Trail	09/13/82	25	±12	.57
		09/12/86	39	± 5	.76
		08/27/87	42	±14	.60
		1988	---	---	---
		10/12/89	45	± 2	.90
Morrison	Reach IV	09/01/82	95	± 6	.82
		08/1983	70	±11	.69
		09/25/85	93	±27	.54
		08/27/86	114	±15	.67
		08/25/87	138	±10	.76
		08/30/88	126	±15	.69
		08/23/89	130	±31	.56

Table C4 Summary of electrofishing population estimates for age I+ westslope cutthroat trout in 150m sections for selected monitoring between 1982 and 1989.

Creek	Section	Date	Pop. Est.	95% C.I.	p Value
		North Fork Drainage			
Coal	Cyclone Bridge	08/10/82	41	±18	.55
		08/24/83	17	± 7	.64
		08/30/84	25	±11	.56
		08/10/87	23	± 2	.66
		08/16/88	25	± 6	.70
		1989	---	----	---
	North Coal Bridge	08/04/82	32	± 6	.74
		08/25/83	27	± 4	.82
		08/29/84	31	± 9	.65
		08/27/85	36	±12	.33
		09/03/86	40	±11	.64
		08/05/87	63	± 2	.91
		08/16/88	51	± 9	.69
		09/08/89	51	± 9	.69
South Fork Coal	Section 26	08/28/85	63	±35	.33
		08/06/87	43	± 4	.47
		08/08/88	43	± 3	.83
		09/29/89	59	±10	.67
Red Meadow	1st Bridge RMC Rd.	08/15/83	121	± 5	.46
		09/16/86	69	±12	.63
		08/18/87	58	± 4	.88
		10/28/88	75	±18	.60
		09/09/89	64	±55	.38
		Middle Fork Drainage			
Challenge	Skyland Rd. Bridge	09/23/80	90	±33	---
		07/18/81	183	±50	---
		07/15/82	78	± 5	.82
		07/22/83	66	± 7	.76
		08/28/86	112	± 9	.76
		08/24/87	209	± 9	.80
		08/31/88	152	±18	.66
		08/24/89	137	±18	.66

Table C-5. Reservoir elevations, surface water temperatures and water transparency for gill net sampling dates in Hungry Horse Reservoir, 1983 through 1989.

Date	Reservoir Elevation (ft)	Surface Water Temperature (°C)			Depth euphotic zone (m)		
		Emery	Murray	Sullivan	Emery	Murray	Sullivan
1983							
07/26-28	3,560	16.6	17.8	17.2	--	--	--
08/23-25	3,560	20.6	20.6	20.0	18.3	19.1	18.9
09/27-29	3,547-49	14.7	14.8	13.9	26.0	18.5	20.5
10/31-11/2	3,534	8.6	8.4	8.0	23.0	16.5	19.3
11/29-30	3,536	7.1	6.5	--	20.5	14.0	--
12/14-16	3,534			4.3	20.3	16.5	19.1
1984							
04/24-27	3,500	4.2	5.6	5.7	15.1	10.3	5.2
05/31-31	3,519-23	10.5	9.9	8.6	14.5	13.0	5.8
06/26-28	3,549-51	17.0	19.6	18.4	17.8	14.3	8.3
08/13-22	3,557-59	20.0	21.0	20.0	18.3	16.7	16.3
10/11-15	3,540-41	--	12.6	12.1	17.8	19.6	14.6
1985							
05/14-21	3,512-22	7.2	8.1	7.1	12.0	7.5	3.9
08/14-20	3,544-45	20.1	18.3	20.1	15.8	14.0	17.0
10/31-11/4	3,524-27	7.9	8.3	8.0	13.6	14.8	11.4
1986							
05/16-22	3,536-39	7.0	10.0	7.9	16.0	15.1	15.0
08/12-20	3,557-59	20.1	20.0	19.9	17.7	15.5	15.4
10/30-11/7	3,530	9.4	9.7	9.7	17.5	11.5	15.2
1987							
05/12-20	3,543-48	12.3	12.6	10.3	13.5	10.7	4.7
08/12-20	3,559-56	18.4	18.1	17.6	18.0	17.9	17.1
10/31-11/3	3,507-06	9.7	10.7	9.9	17.0	17.7	15.9
1988							
05/18-24	3,442-52	13.0	13.5	--a/	8.8	5.8	--
08/23-25	3,480-79	18.9	19.5	19.2	11.8	17.3	13.0
11/1-3	3,468	10.8	10.0	10.2	13.8	16.3	11.8
1989							
05/16-18	3,490-93	11.7	9.6	7.0	7.5	5.0	3.8
08/15-17	3,532-31	19.3	19.0	18.8	14.5	15.2	15.2
10/31-11/2	3,494	10.3	10.7	9.4	12.6	14.0	17.0

a/Sullivan area dewatered.