## Mountain Whitefish Summit April 29, 2009 Helena, Montana Kootenai River Mountain Whitefish By Ryan Sylvester

All,

Here's a short summary (or maybe not so short) of the mountain whitefish sampling, data, etc. in the Kootenai River drainage and Lake Koocanusa, Montana.

## Kootenai River

Mountain whitefish sampling in the Kootenai River started as a result of the construction of Libby Dam to assess the affects on fish populations downstream of the Dam. The dam was constructed from 1968-1972, filled from 1972-1974 and regulated flows began in 1975. Selective withdrawal began in 1977 in an attempt to meet daily temperature targets to maximize rainbow trout growth in the Kootenai River. The Dam significantly altered the hydrograph, mainly spring and winter operations, of the Kootenai River and operations have changed since completion of the Dam in 1972 (Table 1; Figure 1). Early operations included deep drawdown of the newly formed Libby Reservoir (Lake Koocanusa) and power peaking. These operations continued into the late 1980's and early 1990's. Listing of white sturgeon (1994) and bull trout (1998) and several species of anadromous salmon have caused operations to further change since the mid 1990's and include reduced reservoir drawdown, no power peaking, establishment of minimum flows, and a shaped spring freshet with temperatures suitable for white sturgeon spawning.

Metric	Pre-Dam	Post-Dam
Min Temp	32 ice cover	35
Max Temp	66	60
Max Q (cfs)	130,000	26,000 (spill events 40,000 and 55,000)
Min Q (cfs)	500	4000
Average Peak (cfs)	65,000	25,000

Table 1. Summary of pre and post Libby Dam metrics for the Kootenai River, Montana.



Figure 1. Summary of how dam operations have affected water temperature (upper panel) and high discharge (lower panel) of the Kootenai river since completion of Libby Dam in 1972.

Sampling for mountain whitefish began in the early 1970's in 5 sections of the Kootenai River, which were spread out from areas near the Fisher River confluence approximately 30 miles downstream to the town of Troy, Montana. Electrofishing efforts were grouped into 2 groups, population estimates and CPUE / species composition, much of the work was discontinued in the early 1980's. Sample reaches were as follows:

-Jennings (1970-75, 1977, 1980-81)

–Elkhorn (1970-75, 1980)

-Troy (1971-74, 1981, 1990)

-China Rapids (1982), left out only one year of data

-Flower-Pipe (1973-75, 77-81, 1989-90, 1995-96, 2003, 2008)

Catch per unit effort decreased in the Kootenaifrom 1972-1975 as a result of high gas levels in water released through the sluiceways at Libby Dam. TDG issues were resolved in 1975 and CPUE levels responded by 1981 in the more upstream sections of the Kootenai River (Table 2). CPUE and population estimate losses during this period were mainly in younger age classes.

River	1970	1971	1972	1973	1974	1975	1977	1980	1981
Section									
Jennings	45	130	9	16	34	24	36		97
Elkhorn	40	78	39	21	14			56	
Flower-Pipe			46	34					
Troy		8	13	4	12				122

 Table 2. Summary of CPUE (# per boat hour) Data on the Kootenai River

Mountain whitefish condition initially increased following completion of Libby Dam in the Jennings and Elkhorn sections of the Kootenai River (Figure 2). By 1980, condition started to decrease in the Elkhorn section of the Kootenai River.



Figure 2. Mountain whitefish condition in the Jennings, Elkhorn, and Troy sections of the Kootenai River, Montana.

The Flower-Pipe section of the Kootenai River is the best long-term dataset in the Kootenai River dating back to 1973. The population appears to have increased from the mid 1970's but has remained fairly stable since monitoring started in this section (Figure 3 and 4; Table 3). Estimates are all spring (March-May) with the exception of 1989 and 1990 (September / October), which likely influenced the inflated the estimates, due to a large number of spawning area near Libby, Montana identified in the early 1980's. Number of fish marked in this section typically ranged from about 1000-2500 with similar numbers on the recapture run. Electofishing currently consists of 2 jet boats, one on each bank, 3-5 amps, 300V, straight DC. We usually don't see any hemorrhaging of MWF gills however, we do hit some fish really hard occasionally. If a mortality, they are not marked or included in the estimate. In the early days of the section, they held fish over night in cages and worked them the next morning. We currently have 2 crews shocking, and 1 crew working fish. All fish are allowed to recover and are released at the end of the night (2-3a.m.). Recapture run is typically 1 week after the mark run. Condition of whitefish has decreased since the 1970's in average for older age classes (Figure 5).



Figure 3. Kootenai River mountain whitefish estimate in the Flower-Pipe section of the Kootenai River from 1973-2008.

Table 3. Mountain whitefish population estimates in the Flower-Pipe section of the Kootenai River from 1973-2008. Numbers with asterisks following are lumped estimates for that length group and all longer groups. Most of the length groups under 200mm (age 1 fish in spring) failed the Robson-Reiger criteria.

Size Group (mm)	1973	1974	1975	1977	1978	1979	1980	1981	1989	1990	1995	1996	2003	2008
100-124	0	0	0	1	0	0	0	0	13	0	0	0	12	0
125-149	49	44	2	8	0	1	3	3	0	0	0	3	92	5
150-174	10	203	59	4	0	2	4	3	5	10	0	10	21	4
175-199	25	65	149	1	1	1	1	3	20	107	0	0	3	1
200-224	99	1	8	1	1	12	1	31	127	96	17	2	112	16
225-249	212	11	15	54	17	136	14	242	457	105	134	32	120	16
250-274	127	51	96	221	66	118	48	78	690	619	124	35	181	99
275-299	30	48	61	59	48	24	109	42	358	408	87	151	301	215
300-324	9	47	41	2	294	66	142	142	369	510*	364	253	140	203
325-349	7*	22*	37*	5	126	126	119	130	141		256	225	34	106
350-374				28	14	36	74	74	50		46	53	16	22*
375-399	8			78*	29	14	17	29	15*		8	10*	4	
400-424					47*	10	14	14			3		2*	
425-449						6*	6	8			1*			
450-474							4*	7*						



Figure 4. Average length frequency histogram of mountain whitefish in the Flower-Pipe section of the Kootenai River, Montana by decade. 1989 and 1990 were omitted because they were fall estimates.



Figure 5. Average relative weight of mountain whitefish in the Kootenai River, Flower-Pipe section by decade. 1989 and 1990 were omitted because they were fall estimates.

Number of fish marked in this section typically ranged from about 1000-2500 with similar numbers on the recapture run. Electofishing currently consists of 2 jet boats, one on each bank, 3-5 amps, 300V, straight DC. We usually don't see any hemorrhaging of MWF gills however, we do hit some fish really hard occasionally. In the early days of the section, they held fish over night in cages and worked them the next morning. We currently have 2 crews shocking, and 1 crew working fish. All fish are allowed to recover and are released at the end of the night.

Recapture efficiencies have been consistently 10-20% in the Flower-Pipe section since 1977, with the exception of the 1973-1975 spring and 1989 and 1990 fall estimates (Table 3). No effort was made in this summary to assess discharge conditions during these estimates.

Table 3. Recapture efficiencies of mountain whitefish population estimates in the Flower-Pipe section of the Kootenai River from 1973-2008. Min and max values represent the range of C/R values observed for each 25mm length group.

	1973	1974	1975	1977	1978	1979	1980	1981	1989	1990	1995	1996	2003	2008
C/R	7	6	4	13	11	15	16	14	4	6	20	15	20	16
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max	20	20	7	20	17	22	26	19	33	8	100	25	44	33

Initially after dam closure and filling the reservoir, growth of all age classes of MWF increased (Figure 6), however, decreases in age 3-5 mountain whitefish growth were beginning in the early 1980's. Mountain whitefish growth has not been assessed since the mid 1990's but scales are collected during all population estimates (10 fish per cm group).



Figure 6. Back-calculated length at age for mountain whitefish in the Flower-Pipe section of the Kootenai River.

The rainbow trout population in the Flower-Pipe section (fall estimate) has increased about 300% on average compared to numbers in the early 1970's (Figure 7). Most of the rainbow trout in this section are <300mm. Condition of larger rainbow trout (>300mm) has decreased in the Flower-Pipe section (Figure 8) since the 1970's similar to result seen in mountain whitefish in the same section of river. Fish greater than 350m have become rare in this section in the last couple decades. Given the high rainbow trout and whitefish population numbers in this section of river and affected (i.e., small size composition) invertebrate community and high diet overlap, there may come competition for food resources if habitat use is similar.



Figure 7. Population estimate if rainbow and westslope cutthroat trout in the Flower-Pipe section of the Kootenai River from 1973-2007.



Figure 8. Average relative weight of rainbow trout in the Flower-Pipe section of the Kootenai River, Montana.

the late 1970's followed by decreases beginning in the early 1980's. increased followed by decreased after about 1980 (Figure 9). Increases in length at age in Rainbow trout growth has mirrored mountain whitefish growth patterns with initial



Figure 9. Kootenai River, Montana. Back-calculated length at age of rainbow trout in the Flower-Pipe section of the

A diet study was performed on the Kootenai River in the early 1980's in 2 sections of the Kootenai River approximately 8 miles (Elkhorn) and 16 miles (Pipe Creek) downstream of the Dam. Chironomids were and are still believed to be the dominant food item for mountain whitefish in the Kootenai River (Figure 10 upper panel). There was significant diet overlap between rainbow trout and mountain whitefish during most months of the year for all sizes of rainbow and mountain whitefish in the early 1980's (Figure 10 lower panel).



Figure 10. Mountain whitefish prey items (% by volume upper panel) and overlap with rainbow trout (lower panel) in the early 1980's in the Elkhorn and Pipe Creek sections of the Kootenai River.

Total dissolved gas was an issue in the Kootenai from 1972-1975 as water released from Libby Dam was supersaturated (107-139% TDG), and gas levels depended on discharge volume released. Mortality was high at TDG levels greater than 120%. Spill events in 2002 and 2006 also elevated TDG levels to greater than 20%, and high levels of mountain whitefish, rainbow trout, and bull trout exhibited symptoms of gas bubble disease although no mass mortality was seen in efforts following the spill event (population estimates and looking for dead fish). It is possible they got flushed through the system as flows were 40,000 and 55,000 cfs in 2002 and 2006.

*Didymosphenia geminata* appeared in the Kootenai River around 2000. Levels of the diatom appear to have leveled off since the initial blooms in the Kootenai River, possibly due to higher flows in the spill events of 2002 and 2006. The diatom completely excludes mayflies and caddisflies at ash free dry mass levels of periphyton > 8mg per cm<sup>2</sup> and begins to affect the invertebrate community at levels near 3mg per cm<sup>2</sup>. The invertebrate community downstream of Libby Dam has high densities of chironomids and in some locations black flies. Densities of invertebrates in 2007 near the Elkhorn section of the Kootenai River ranged from 10,000 to 40,000 per square meter in the baseflow channel with chironomids being the most abundant species.

Kootenai River remains free of whirling disease as of 2008. Bacterial gill disease was found in Libby Creek spawning runs in the 1970's causing high mortality of adult mountain whitefish.

Angling does not appear to be a significant issue for mountain whitefish in the Kootenai River. While some anglers no doubt catch and harvest their fair share of them, most anglers do not. Commercial fisheries were attempted in the Kootenai River drainage (Fisher River and Libby Creek) and were largely unsuccessful during the 1970's and again in the 1990's. Extended whitefish seasons in Libby Creek and the Fisher River were discontinued in 2008.

## Lake Koocanusa

Libby Reservoir / Lake Koocanusa Mountain Whitefish information does not show a lot other than they are not common in terms of species composition, typically <2% since the in both the spring all fall gill nets (Table 5). Shortly after the reservoir filled in 1974, other species currently abundant may not have increased as rapidly in abundance, based on initially abundances in the Kootenai River upstream of Libby and subsequent isolation by dam construction. The bull trout population has become much more abundant as have several other species including kokanee, peamouth, and northern pikeminnow.

Year	Spring (% Composition)	Fall (% Composition)
1973	31	7
1974		8
1975		9
1976	13	7
1977	16	3
1978	14	3
1979		6
1980	2	3
1981	4	10
1982	3	3
1983		2
1984	18	2
1985	19	1
1986	9	2
1987	4	0
1988	2	0
1989	1	0
1990	0	1
1991	1	1
1992	1	1
1993	0	1
1994	0	1
1995	1	2
1996	2	0
1997	1	1
1998	1	1
1999	1	0
2000	1	0
2001	0	2
2002	1	0
2003	1	1
2004	1	2
2005	0	0
2006	1	1
2007	1	1
2008	1	0

Table 5. Mountain whitefish % composition of fish caught in the spring and fall gill nets in Lake Koocanusa (Libby Reservoir), Montana from 1973-2008.

Mountain whitefish condition (mean Wr) has been steady in the fall (range 90-100) and spring nets (range 80-90) since 1973 with the exception of a few larger length categories (Figure 11). Small sample sizes may be a cause for those small values.



Figure 11. Mean Wr of mountain whitefish in the fall and spring gill nets in Lake Koocanusa, Montana from 1973-2008.