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Lewistown Area Fisheries Management

2004 Annual Report

by

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ABSTRACT

Seven trout reservoirs were sampled in the Lewistown Management Area including Ackley Lake, Bair Reservoir, Martinsdale Reservoir, Big Casino Reservoir, Hanson Creek Reservoir, Peterson Reservoir and Rhoda Lake. In Ackley Lake, rainbow trout (*Oncorhynchus mykiss)* catch in gill nets was excellent but mean relative weight (Wr) for rainbow trout was a record low. At Bair Reservoir, rainbow trout gill net catch rate increased to 33.5 per net, which is slightly higher than the long-term mean of 30.4. The largest trout captured was 1.74 pounds and 17.3 inches, but rainbow trout average weight was only 0.37 pounds. White suckers (*Catostomus commersoni*) were nearly 3 times more abundant in gill nets than rainbow trout. Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri)* were not captured in Bair Reservoir in 2004. Relative weight of rainbow trout and white suckers in Bair Reservoir remained low and continued the decline of the last 3 years. In Martinsdale Reservoir, rainbow trout numbers declined from 2003 but were similar to the long-term mean of 23.1 trout per net and 14 brown trout *(Salmo trutta)* with a mean weight of 2.0 lbs were captured. White suckers were the most abundant species in gill nets. Rainbow trout Wr declined dramatically and white sucker Wr increased at Martinsdale Reservoir. At Big Casino Reservoir, white sucker numbers are still lower than prior to the removal of two tons of white suckers in 2001. The yellow perch (*Perca flavescens)*, illegally introduced into Big Casino Reservoir circa 2001, are becoming more abundant and there is a large 2003-year class. By fall 2003, rainbow trout Wr declined to pre-white sucker removal levels and mean rainbow trout length declined by about 2 inches. In 2004, the city of Lewistown completed dredging of the Lower Frog Ponds, a Lewistown City Park. Both the Upper and Lower Frog Pond were stocked in 2004. In Rhoda Lake, cutthroat trout from 9.5 – 17 inches were captured by a sinking gill net. The arctic grayling *(Thymallus arcticus)* stocked in Rhoda Lake in 1997 and 2002 were not observed.

East Fork Reservoir, Petrolia Reservoir, and seven small warm water reservoirs were sampled in 2004. Most warm water reservoirs filled in spring 2004. At East Fork Reservoir the Schnabel estimate for northern pike (*Esox lucius*) was the lowest seen since 1998 (568 fish with 95% CI range of 496 – 663). However, trapped northern pike were the largest seen since 1998 with a mean weight of 2.51 pounds. Petrolia Reservoir maintained at least a 20 ft maximum depth throughout 2004. It was trap netted for the first time since 1998; a total of 65 northern pike and 56 walleye (*Sander vitreus*) were captured during 10 trap nights. Record low numbers of fish were seined in Petrolia, but yellow perch numbers were near the long-term average and were higher than seen for several years. In Jakes Reservoir, yellow perch had a longer mean total length and higher Wr than found for over a decade. Payola Reservoir filled during spring 2004 and gill nets captured 701 yellow perch with a mean total length of 5.8 inches but largemouth bass (*Micropterus salmoides*) were not captured. In Whisker Reservoir, black crappies (*Pomoxis nigromaculatus*) appear to have reproduced every year since they were stocked in 1997. Bluegill (*Lepomis macrochirus*) and largemouth bass remain common in Drag Reservoir.

In 2004, mark-recapture estimates were completed on four sections of Big Spring Creek, including the Hatchery, Burleigh and Brewery Flats sections above Lewistown, and the Carroll Trail section downstream of town The hatchery section was sampled for the first time since the 1960's. Rainbow trout (≥10 inches) declined to the lowest numbers since 1997 below town and were about 15% less than the 10 year mean of 1,490 fish per mile. In the Burleigh section, rainbow trout ≥10 inches continued a downward trend from the 2001 peak and at 267 per mile were much less than the 10 year mean of 405. However, at Brewery Flats, rainbow trout ≥10 inches increased to the second highest estimate reported and numbers were about 40% higher than the 10 year mean. Small rainbow trout (<10 inches) were less than the 10 year mean at all of the long-term monitoring sites. Brown trout numbers were similar to 2003

estimates at the Carroll Trail and Burleigh sections but increased in the Brewery Flats section. Brown trout numbers (≥10 inches) were higher than the 10 year mean at the three long-term monitoring sections.

At Brewery Flats, trout ≥ 10 inches have increased substantially since the stream meandering project was completed in September 2000. Between 2002 and 2004 trout ≥10 inches have increased by 66% at Brewery Flats compared to decreases of 36% and 23% in the other two sections. During the 6 years prior to the project there was a mean of 618 trout ≥10 inches per mile compared to 851 after the project at Brewery Flats. This increase in trout numbers is even more impressive considering the 1400-foot post-project increase in stream length. In the Brewery Flats section there was an average of 434 trout ≥10 inches in the 3700 ft section before the project, compared with a mean of 844 trout in the 5104 ft section after the project was completed. In contrast to larger trout, rainbow trout less than 10 inches have declined by 44% when pre and post project means per mile are compared.

The Hatchery Section, located immediately below the lower state hatchery, about 2 miles upstream of the Burleigh section, was sampled for the first time since the late 1960s. For all trout species and sizes, estimates were less in both the hatchery section and the Burleigh section in 2004 compared with 1967 and 1968. In the Hatchery Section this difference was most pronounced for rainbow less than 10 inches long, which had a population about 5 – 6 times higher in the late 1960's than in 2004. The Hatchery Section was sampled due to interest in high PCB levels in this reach of stream. However the decline in trout in this section cannot be attributed to any particular cause because numerous changes have occurred on Big Spring Creek since the late 1960's. For instance rainbow trout were stocked in Big Spring Creek until the 1970's.

Three sections of the Judith River were sampled in 2004. Twenty different species were captured during electrofishing surveys. Shorthead redhorse *(Moxostoma macrolepidotum)* and goldeye *(Hiodon alosoides)* were the most commons species downstream of Warm Springs Creek. Game species captured included walleye, sauger *(Sander canadense)*, channel catfish *(Ictalurus punctatus)* and brown trout. Larval fish samples were collected at two sites, the Anderson Bridge and PN Ranch on the Judith River.

Eleven electronic thermographs were placed on six different streams in 2004. Continuous flow monitoring for at least several months of the year was conducted on the Judith River three miles above Ross Fork Creek, on Warm Spring Creek (about 7 miles downstream from Warm Spring) and at two sites on the Big Spring Creek. The data indicate that Montana Fish, Wildlife and Parks' instream water rights and reservations are frequently not met on any of these streams. On the Judith River, the maximum flows near 400 cfs occurred in mid June and the Montana Fish, Wildlife & Parks instream water reservation of 25 cfs was met from early June – mid-July. The lowest flow was 3.4 cfs in April. On Warm Spring Creek flows were as low as 50 cfs, did not exceed 100 cfs except in late fall and did not reach the water reservation of 110 cfs during the measurement period of 6/22 – 1/1. On Big Spring Creek, base flows on the upper creek were typically close to the Murphy Right of 110 cfs, but were often less on the lower creek where flows as low as 62.5 cfs were measured in 2004.

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OBJECTIVES

The purpose of this project is to implement the Fisheries Program in the Lewistown Management area in the Missouri River drainage in northcentral Montana. Major watersheds include the Judith and Musselshell drainages.

The mission of the Fisheries Division of Montana Fish, Wildlife and Parks (MFWP) is to preserve and enhance aquatic species and their ecosystems to meet public demand for recreational opportunities while assuring stewardship of aquatic life. The Fisheries Program is divided into four major elements, with objectives and outcomes as follows:

The **Fisheries Management** element of the fisheries program has 21 objectives and the following desired outcomes:

1. A healthy aquatic resource, including native-species fisheries and sport fisheries.
2. Public satisfaction with available angling opportunities.
3. Public support for ongoing efforts to restore, maintain, and protect the state's aquatic resources.

The **Habitat** element of the fisheries program has 15 objectives and the following desired outcomes:

1. Diverse, high-quality aquatic ecosystems that support healthy fish populations and provide fishing opportunities.
2. Public participation in efforts (of MFWP as well as other state and federal agencies) to conserve and improve fish habitat through formation of watershed protection groups and partnerships for the protection and restoration of habitat.

The **Fishing Access** element of the fisheries program has 16 objectives and the following desired outcomes:

1. Provide a diversity of fishing opportunities throughout the state that might otherwise be unavailable.
2. Provide the public with a variety of incidental, non-angling recreational activities by maintaining access to Montana's waters through the fishing access site program.

The **Aquatic Education** element of the fisheries program has 11 objectives and the following desired outcomes:

1. Opportunities for the public, youth and adults, to learn about the state's aquatic ecosystems and their importance.
2. Fishing and water safety skills for program participants.
3. Enhanced public understanding of Montana's natural and cultural resources.
4. An educated public able to make informed decisions about using and preserving Montana's aquatic resources.

STUDY AREA AND PROCEDURES

The study area is located in the center of Montana on the eastern edge of Region 4. It does not include the Missouri River on its northern boundary. The eastern boundary is the Musselshell River and the western boundary is the headwaters of the Musselshell, Judith and Arrow drainages (Figure 1). It includes all of Fergus and Petroleum Counties and parts of Meagher, Judith Basin and Chouteau counties.

In still water, fish populations were sampled using 125 x 6 ft experimental multifilament nylon gill nets with 25 ft sections of 0.75, 1.0, 1.25, 1.5 and 2.0 inch square mesh; 4 x 6 ft frame trap nets (1.00 inch square mesh). Gill nets were fished either sinking or floating. On Rhoda Lake a monofilament sinking gill net was set with a float tube. Angling was also used to sample Rhoda Lake. Shoreline seining was completed with a 50 x 4 ft 1/8 inch mesh beach seine and a 100 x 10 ft ¼ inch mesh beach seine. Rainbow trout strains were marked with fin clips or tetracycline. Trout populations on Big Spring Creek and the Judith River were surveyed using a fiberglass drift boat equipped with a mobile electrode or a plastic scanoe equipped with a mobile electrode and a Coffelt VVP15 or Coffelt VVP10 to rectify AC to DC. Power was obtained from a 240-volt generator. Fish populations in small streams, the Judith River near Ross Fork and young of the year (YOY) trout in Big Spring Creek were sampled with a Smith Root Model 12-B battery powered backpack electrofishing unit. Fish total length was measured to the nearest 0.1 inch or 1 mm and weighed to the nearest 0.01 lb. Population estimates on small streams followed the methods of Leathe (1983). When the probability of capture during the second pass was less than 0.7, additional passes were usually made to reduce underestimates of trout populations as described by Riley and Fausch (1992). Depletion estimates were calculated using the Microfish program (Van Deventer and Platts 1985). Small streams were electrofished in either an upstream direction or downstream direction with a block net at the downstream end. Big Spring Creek mark-recapture estimates from 2004 were analyzed with the FA+ program (MFWP 2004a). Historical mark recapture estimates utilized the MR-4 program (MFWP 1994) or the FA+ program. Most estimates were completed using partial log-likelihood statistics. Modified Peterson estimates were used when data did not fit the partial log-likelihood model.

Dorsal spines from yellow perch (*Perca flavescens*) were collected from Big Casino Creek Reservoir, East Fork Reservoir, Petrolia Reservoir and Jakes Reservoir during spring trapping. Walleye (*Sander vitreus*) spines were collected from Petrolia Reservoir and Big Casino Creek Reservoir. Black crappie (*Pomoxis nigromaculatus*) spines were collected from Whisker Reservoir. All spines were frozen until prepared. During preparation, spines were scraped clean of all membranes with a scalpel and ½ inch of the proximal end was snapped off and glued to a 1x1/8x1/16 inch strip of balsa wood. The end of wood opposite the spine was secured in the clamp of an Isomet Low Speed Saw and two cross sections, each 0.025 inch in thickness, were cut at a speed level of 4. Cross sections were placed flat on a Petri-dish and covered with a drop of mineral oil. They were viewed under a dissecting microscope at a total magnification of 15X. Scales were taken from trout sampled from Big Spring Creek and were mounted in plastic and read with a microfish reader. Year classes were based on size structure, spine or scale analysis. Equations from Anderson and Neuman (1996) and Bister and Willis (2000) were used to calculate relative weight (Wr). Northern pike growth in East Fork Reservoir was estimated from tagged fish recaptured during fisheries surveys.

Habitat measurements on Big Spring Creek were taken using the methods of Overton et al. (1997) and were analyzed with the Fbase computer program (Wollrab 1999). Temperature was recorded on several streams with various models of Onset continuous recording data loggers. Water levels in area reservoirs

were determined from Montana Department of Natural Resources and Conservation (DNRC) reservoir contents reports at http://www.dnrc.state.mt.us/wrd/home.htm.

Continuous stage height near the Ash Street Bridge, Big Spring Creek, was measured with a Stevens Recorder. Stage height in the Judith River near Ross Fork, in Warm Spring Creek and in Big Spring Creek below Lewistown were measured electronically with an AquaRod. The AquaRod was encased in a metal pipe that was pounded into the stream bottom. A staff gauge was attached to the pipe. Discharge was measured with a Price AA Current meter or a Marsh McBirney Flowmate model 2000 to develop a rating curve.

Redd surveys were completed on Big Spring Creek by walking the stream once in early winter, during clear-water conditions. On Big Spring Creek wild trout were collected in late fall for whirling disease evaluation using backpack electrofishing. Whole heads were frozen and the diagnostic lab by express mail for diagnosis.

Larval fish sampling was used to evaluate spawning success and evaluate species presence in the Judith River. Larvae were sampled at two sites, Anderson Bridge and the PN Ranch using round plankton net samplers with a 6-foot long Nitex net (750 micron mesh) attached to a 20-inch diameter ring. Four nets were fished near shore, once weekly from 4/20/04 – 7/19/04. Two nets were fished near the channel bottom on each side of the stream. During high flow conditions 4 nets were fished on one side of the stream at the PN Ranch. The nets were attached to fence posts and fished for 7 – 37 minutes depending on flow conditions and amount of debris suspended in the river. The volume of water filtered was determined using a General Oceanic flow meter (Model 2030) suspended in the net opening. Larvae were preserved in alcohol in the field and identified to family using Auer (1982) and Wallus (1990). Samples of interest were sent to Dr. Darrel E. Snyder at the Larval Fish Laboratory, Colorado State University, for further identification.

Results and Discussion

Lakes and Reservoirs

Most reservoirs filled in 2004. Due to very low water, Yellow Water Reservoir was stocked with just a small catchable plant. In 2003, Eagle Lake rainbow trout (*Oncorhynchus mykiss)* were stocked in September and October to insure they were disease free. Buffalo Wallow, Bair, Ackley and Peterson reservoirs, which are typically stocked in spring or early summer, were all stocked in the fall 2003. Size similarities made it difficult to differentiate between 2003 and 2004 Eagle Lake plants during 2004 netting surveys. Crayfish in Ackley Reservoir, East Fork Reservoir, Martinsdale Reservoir and Petrolia Reservoirs are *Orconectes virilis*, one of two Montana native crayfish in the Missouri River drainage (Hobbs 1972).

Large Lakes – Three large trout lakes, Ackley, Bair and Martinsdale and two large warmwater lakes, East Fork and Petrolia were sampled in 2004.

Ackley Lake – Overall rainbow trout catch rate was excellent with nearly 50 rainbow trout captured per net, which was similar to the 2002 and 2003 catch rates (Table 1, Figure 2). Trout year class was based on size structure. About 70% of the rainbow trout stocked in Ackley Lake in 2003 and 2004 were Eagle Lake (MFWP 2003, hatchery planting records). In 2003, Eagle Lake rainbow trout were stocked in mid-September. It is likely sizes of the 2003 and 2004 plants were similar during October netting so size statistics for these year classes were combined (Table 1). Average Wr dropped from 2003 to 2004 (Figure 3). This is primarily due to declines in Wr of small rainbow trout. Typically first year rainbow trout in Ackley Lake have Wr near 100. Relative weight in Ackley Lake typically declines as size increases (for example Tews et al. 2005, Tews et al. 2004). In 2004, age 1 Eagle Lake rainbow trout had a Wr of 78 (Table 1). A possible cause is increased density of small rainbow trout due to the late 2003 plant. The size structure of gill netted rainbow trout indicates there were high numbers of small rainbow trout in the reservoir in 2004 (Figure 4). There were also very high numbers of 15 – 16 inch rainbow trout. One mountain whitefish (*Prosopium williamsoni*) and two brown trout *(Salmo trutta)* were also sampled. White sucker (*Catostomus commersoni*) numbers were high but declined from the record highs found in 2002 - 2003 (Figure 2). White suckers averaged 1.12 pounds and had a mean Wr of 104 (Table 1). Longnose sucker (*Catostomus catostomus*) numbers decreased to numbers similar to those found in 2002. DNRC reservoir contents reports indicate that Ackley Lake filled in 2004, and water levels were generally higher than in 2003.

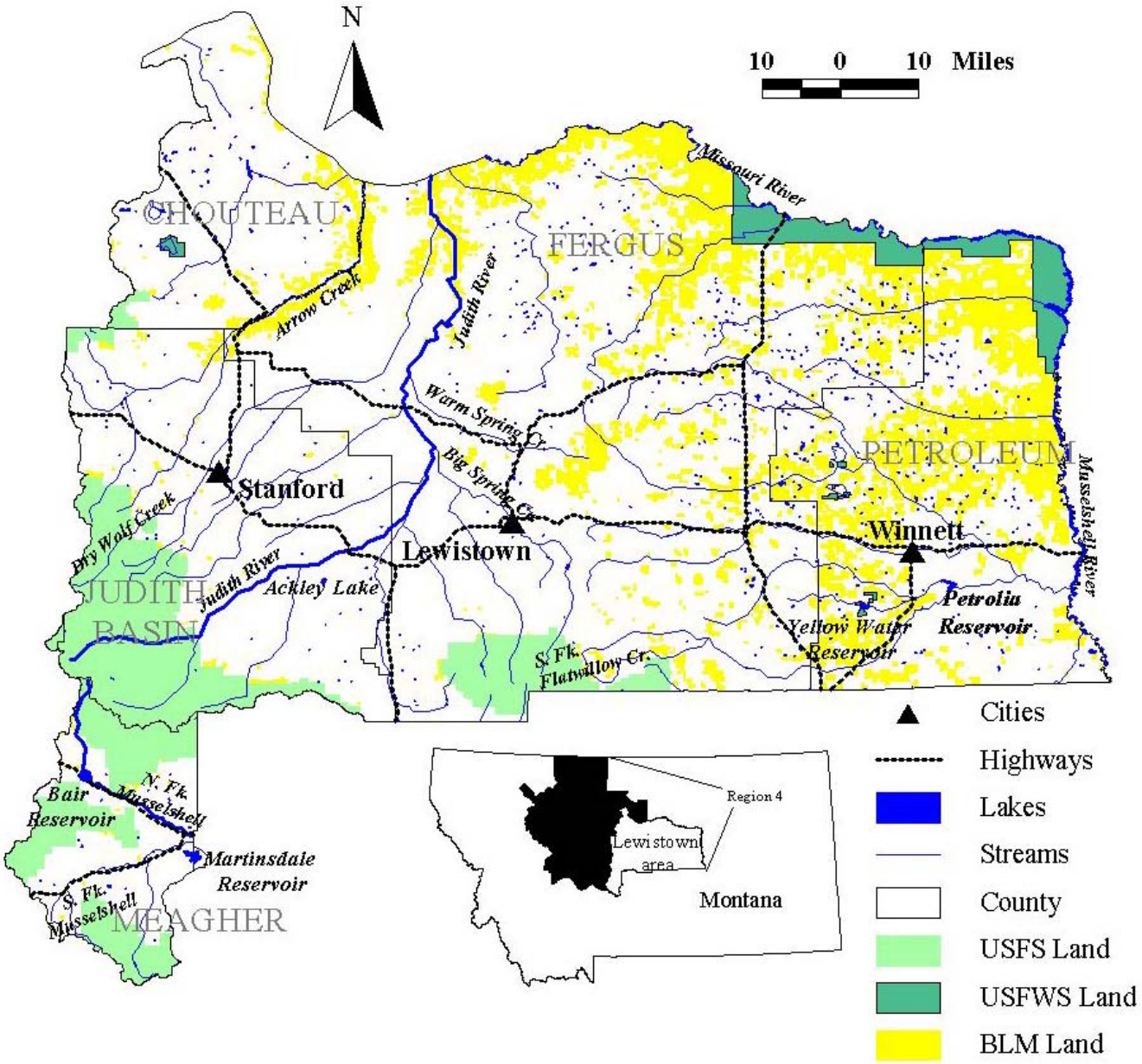

Figure 1. Map of the Lewistown fisheries management area.

Table 1. Statistics from fish captured by overnight gill netting in the Lewistown management area, 2004.

Reservoir (Date) # & Type Nets	Species[1]	N	Length (Inches) Min	Max	Mean	Weight (lbs.) Min	Max	Mean	Wr Mean
Ackley	Brown trout	2	18.4	19.2	18.8	2.16	2.99	2.58	
(9/20/04)	Longnose sucker	7	7.7	15.7	13.0	0.15	1.39	0.95	
1 Sinker	Mountain whitefish	1	15.4	15.4	15.4	1.57	1.57	1.57	117
1 Floater	Rainbow trout	32	6.6	9.4	8.5	0.12	0.27	0.20	78
	2004/2003-I								
	Rainbow trout	8	7.5	8.4	8.0	0.18	0.22	0.19	87
	2004-A								
	Rainbow trout	58	11.8	17.4	12.8	0.51	1.69	1.13	74
	2003+								
	Rainbow trout	98	6.6	17.4	12.4	0.12	1.69	0.75	77
	Total								
	White sucker [1]	99	9.2	19.5	13.1	0.27	5.40	1.12	104
Bair	Rainbow trout	67	7.0	17.3	10.1	0.10	1.74	0.37	73
(9/13/04)	White sucker[1]	193	7.4	15.4	12.0	0.13	1.20	0.62	74
1 Sinker									
1 Floater									
Big Casino	Rainbow trout	9	11.3	18.4	13.7	0.63	2.05	1.05	90
(5/4/04)	Walleye	3	9.0	14.8	12.5	0.29	1.15	0.76	101
1 Sinker	White sucker	48	8.7	17.5	13.5	0.31	2.33	1.23	109
1 Floater	Yellow perch	69	6.5	10.8	8.4	0.10	0.56	0.29	91
Big Casino	Rainbow trout	3	13.3	17.0	15.3	0.84	1.48	1.19	76
(9/15/04)	Walleye	1	17.1	17.1	17.1	1.70	1.70	1.70	89
1 Sinker	White sucker[1]	110	9.9	17.8	13.6	0.44	2.12	1.12	98
1 Floater	Yellow perch[1]	94	5.1	11.4	6.5	0.05	0.70	0.16	85
Drag									
(4/29/04)	Bluegill	27	4.1	6.2	5.4	0.03	0.17	0.11	92
1 Sinker	Largemouth bass	4	8.0	10.0	8.8	0.25	0.27	0.26	94
1 Floater									
Dry Blood	No fish								
(6/3/04)									
1 Sinker									

1 = sub sample

Table 1 continued. Statistics from fish captured by overnight gill netting in north central MT, 2004.

Reservoir (Date) # & Type Nets	Species[1]	N	Length (Inches) Min	Max	Mean	Weight (lbs.) Min	Max	Mean	Wr Mean
East Fork (9/15/04) 2 Sinkers 2 Floaters	Longnose sucker	2	18.1	18.1	18.1	2.28	2.30	2.29	
	Northern pike	10	20.0	25.9	22.7	1.78	4.15	2.88	99
	White sucker	50	14.8	18.6	17.2	1.27	2.81	2.19	97
	Yellow perch	76	5.3	13.3	6.9	0.05	1.36	0.17	84
	Crayfish *(Orconectes virilis)*	170							
Hanson (5/4/04) 1 Sinker	Long nose sucker	1	11.4	11.4	11.4	0.65	0.65	0.65	
	Rainbow trout	33	9.0	15.5	12.1	0.38	1.70	0.87	111
Lower Wolf Coulee (7/14/04) 1 Sinker	No Fish								
	Tiger Salamander	24							
Martinsdale (9/13/04) 1 Sinker 1 Floater	Brown trout	14	10.1	24.8	16.3	0.34	8.10	1.99	
	Rainbow trout 2004-A	27	9.0	11.1	10.3	0.27	0.54	0.43	90
	Rainbow trout 2003+-A	22	14.6	18.2	15.8	1.30	2.53	1.56	92
	Rainbow trout Total	49	9.0	18.2	12.8	0.27	2.53	0.94	91
	White sucker[1]	89	6.1	18.9	15.5	0.08	2.60	1.59	111
	Yellowstone cutthroat	4	9.4	16.3	14.1	0.28	1.47	1.12	93
Payola (6/03/04) 1 Sinker 1 Floater	Yellow perch (104 measured)	701[1]	4.8	11.6	5.8	0.05	0.97	0.11	112
	Tiger salamander	51							
Peterson (5/20/04) 1 Sinker	Lake chub	1	5.7	5.7	5.7				
	Rainbow trout	73	6.5	11.2	8.3	0.10	0.69	0.27	105

1 = sub sample

Table 1 continued. Statistics from fish captured by overnight gill netting in north central MT, 2004.

Reservoir (Date) # & Type Nets	Species[1]	N	Length (Inches) Min	Max	Mean	Weight (lbs.) Min	Max	Mean	Wr Mean
Petrolia Reservoir (9/09/04) 2 Sinkers 2 Floaters	Carp	91	7.2	23.3	10.5	0.21	4.94	0.70	89
	Northern pike	12	20.3	27.6	24.1	1.84	5.16	3.37	97
	Shorthead redhorse	1	17.6	17.6	17.6	1.74	1.74	1.74	
	Walleye	17	8.9	18.9	14.3	0.22	2.64	1.22	95
	White sucker	4	7.7	14.5	12.0	0.15	1.15	0.77	85
	Yellow perch	10	5.2	6.1	5.7	0.06	0.09	0.08	92
Rhoda (8/8/04) 1 sinker	Yellowstone cutthroat/ Westslope cutthroat	36	9.5	17.0	11.9	0.32	1.24	0.67[1]	100
South Fork Blood (4/29/04) 1 sinker	Largemouth bass	1	5.5	5.5	5.5	0.07	0.07	0.07	
	Tiger Salamander	34							
Whisker Reservoir (7/14/04) 1 Sinker 1 Floater	Black crappie	57	4.3	10.5	5.7	0.02	0.67	0.12	86
	Largemouth bass	12	6.4	11.6	7.7	0.12	0.28	0.21	104
	White sucker	22	8.9	10.3	9.6	0.28	0.44	0.35	87

1 = subsample

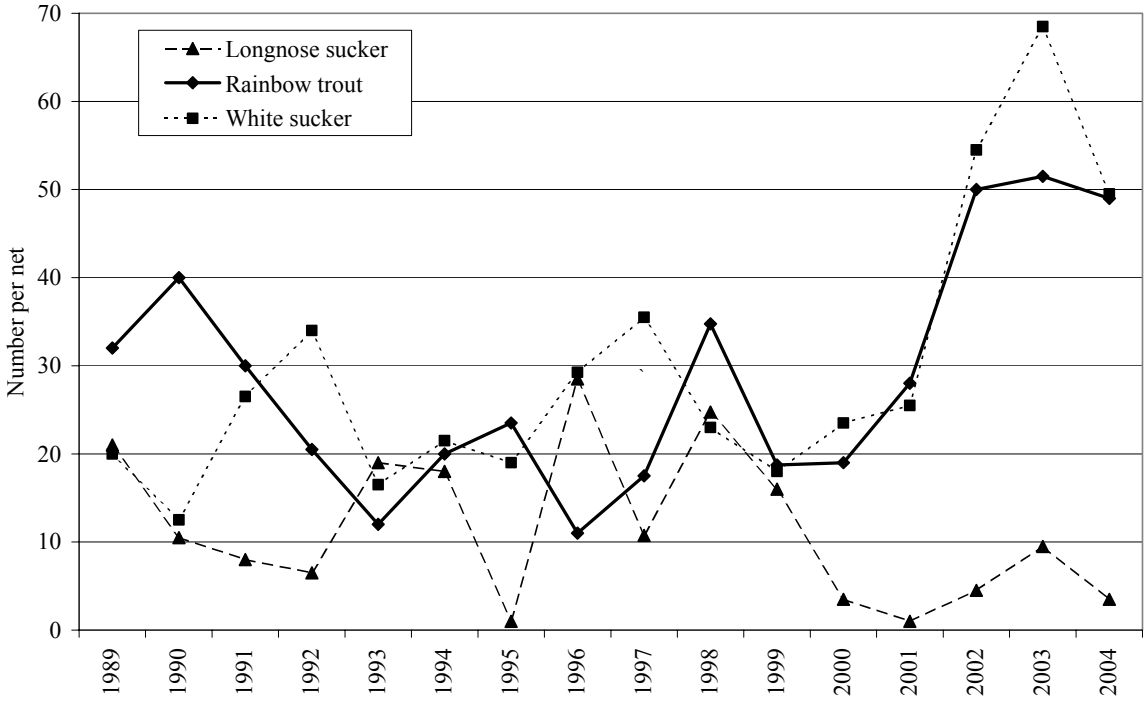

Figure 2. Catch rates of common species during fall gill netting in Ackley Lake, 1989 – 2004.

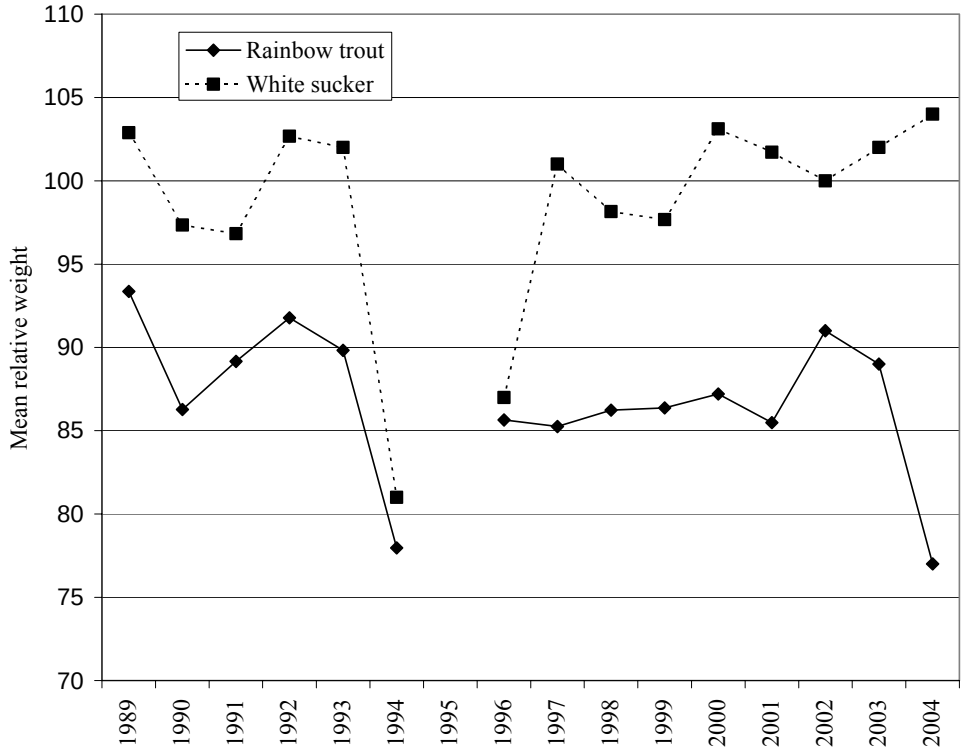

Figure 3. Mean Wr of common species in Ackley Lake during fall gill netting, 1989 – 2004.

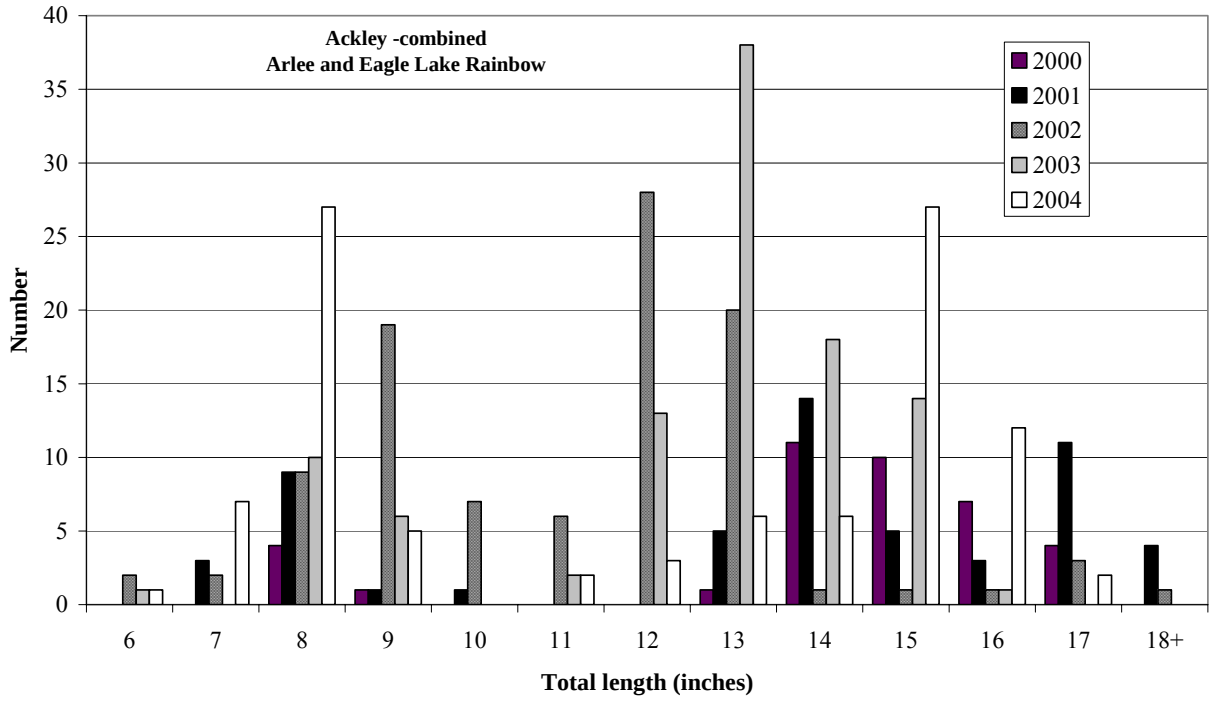

Figure 4. Size structure of rainbow trout captured in gill nets in Ackley Lake from 2000 – 2004.

Bair Reservoir – Figure 5 shows historical gill netting trends. Rainbow trout gill net catch rate increased to 33.5 per net, which is slightly higher than the long-term mean of 30.4. The largest trout captured was 1.74 pounds and 17.3 inches. Mean rainbow trout weight was only 0.37 pounds (Table 1). Trout Wr has remained low for several years in Bair Reservoir (Figure 6). Average rainbow trout Wr was 73 in 2004, which, was below the long-term mean of 78. Relative weight values below 85 likely indicate poor food availability (Flickinger and Bulow 1993). Rainbow trout were stocked in mid-September in 2003 and in May of 2004, which likely increased densities of small rainbow trout and may have influenced Wr. Yellowstone cutthroat trout (YCT), *Oncorhynchus clarki bouvieri,* were not captured in 2004. In 2005, Westslope cutthroat trout will be stocked instead of YCT and performance evaluated. White sucker catch rate declined to 96.5 per net, which is still higher than the long-term mean of 68.8 per net. White sucker Wr was also very low in 2004 (Figure 6). DNRC reservoir contents reports indicate that Bair Reservoir reached only about 50% of total capacity in 2004 but during late summer and fall water levels were about 20% capacity, which is higher than in 2003.

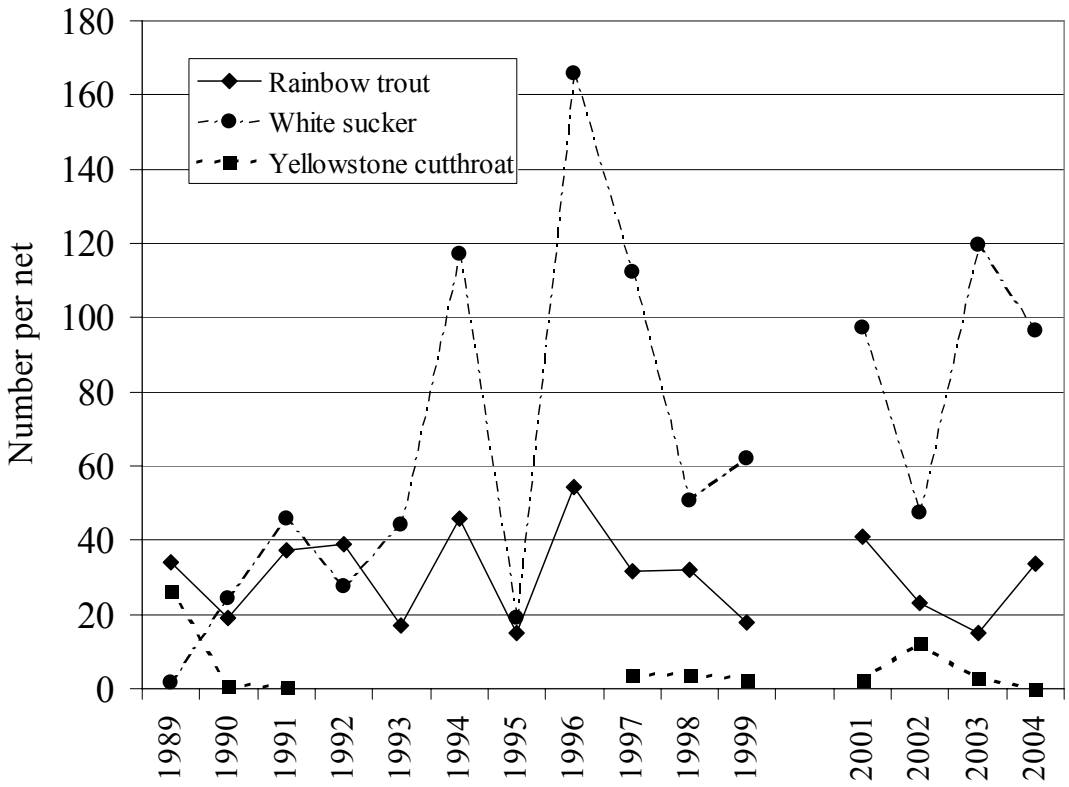

Figure 5. Catch rates of common species during fall gill netting in Bair Reservoir 1989 – 2004.

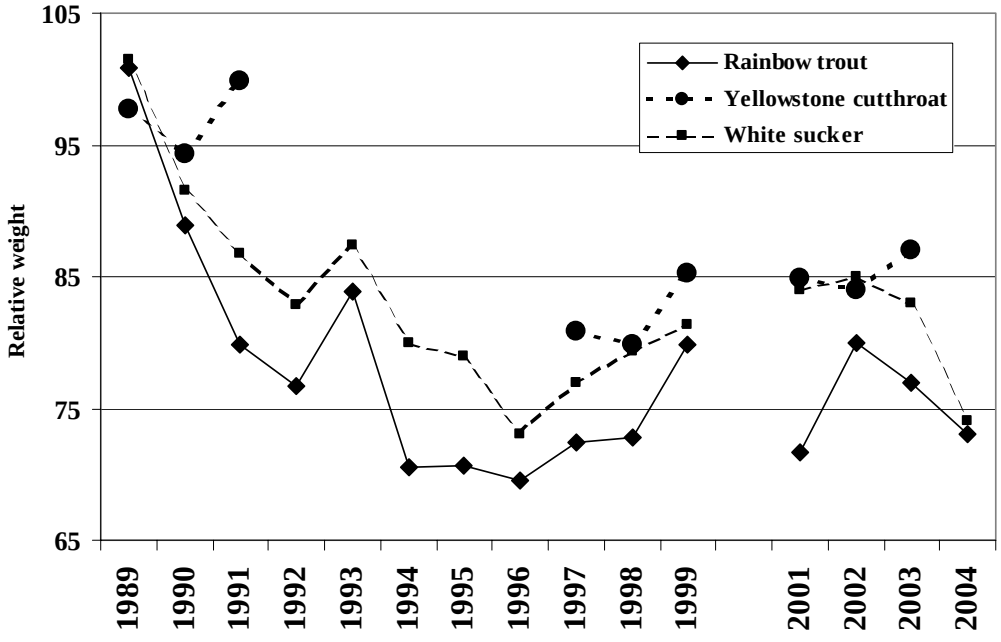

Figure 6. Mean Wr of common species in Bair Reservoir, during fall gill netting, 1989 – 2004.

East Fork Reservoir – Traps were set from 4/5 – 4/9, immediately after ice-off and on 4/15/04. During 25 trap nights, 240 northern pike, 1,347 white suckers, 24 longnose suckers and 353 yellow perch were captured (Table 2). Forty-eight northern pike (*Esox lucius*), 587 white suckers, 7 longnose suckers and 8 yellow perch were recaptured. The Schnabel estimate (Van Den Avyle 1993) for northern pike was 568 with a 95% CI of 496 – 663. This estimate is about half of the 2003 estimate and the CI suggests the lowest population since 1998 (Table 3). Pierce (1997) found that Schnabel estimates of spring-trapped northern pike underestimate populations by 21 – 51%, so this is probably an underestimate. In 2004, trapped pike were about 0.4 inches and 0.57 pounds lighter than found in 1998 but have the largest mean size observed since then (Table 3). The white sucker estimate was similar to 2003. Yellow perch catch was the highest seen in traps since 1997 (Table 3). Yellow perch mean total length was 6.7 inches, slightly more than in 2003. A 5.1-inch bluegill (*Lepomis macrochirus*) was trapped. A bluegill was sampled in this reservoir in 2003. These are the only 2 bluegills that have been sampled in East Fork Reservoir. Bluegill, like northern pike and yellow perch were not legally planted in East Fork Reservoir. In 2004, 42 previously tagged northern pike were captured during spring trapping (Table 4). These fish grew an average of 1.1 inches and 0.39 pounds compared with 1.4 inches and 0.44 pounds in 2002 – 2003 for 41 recaptured northern pike (Yerk et al. in preparation). Between 2001 and 2002, 46 recaptured pike grew an average of 0.8 inches and 0.43 pounds (Yerk et al. 2005). The vast majority of all captured northern pike (88%) have been males.

Gill net data are summarized in Table 1. Fall gill net numbers for northern pike have varied little for the past 6 years (Figure 7). At 2.5 per net, northern pike capture rate in 2004 was the same as the long-term average from 1989 – 2004. In contrast to the high numbers in traps, yellow perch declined substantially in gill nets, but at 19.0 per net were still much higher than the long-term average of 11.7 per net. White sucker numbers declined slightly to 12.5 per net and were lower than the long-term mean of 18.3. Relative weight for northern pike and white suckers was similar in 2003 and 2004, but declined for yellow perch from about 100 to 84. Northern pike size continues to increase in East Fork Reservoir from lows found in 2001 – 2002. In 2004, mean northern pike length in gill nets was the highest seen since 1997. Size structure from fish captured in gill nets and traps follow similar trends (Figure 8). Crayfish numbers in gill nets declined to about 42.5 per net in 2004, which is the lowest number sampled since 2001. In 2002, crayfish numbers peaked at about 250 per net. In 2004, seine hauls captured near record low numbers of yellow perch with 3.8 yellow perch < 4 inches per haul (Table 5). However, there was 14.5 yellow perch per haul when larger perch are included. Three white suckers and two northern pike were also captured during seine hauls. Age 4 and older yellow perch were about 1-inch longer at age in 2004 than in 2003 (Table 6, Yerk et al. in preparation). A 13.8-inch perch was 11 years old. The average total length of age 4 yellow perch in East Fork was 1.5 inches smaller than in Jakes Reservoir (Table 6).

Table 2. Trap net data from Lewistown area reservoirs, 2004.

Location (Date) # of trap nights	Species	New N	#/ night	Length (inches)			Weight (pounds)			W_r
				Min	Max	Mean	Min	Max	Mean	Mean
Big Casino Reservoir (4/12/04 – 4/14/04) 15	Rainbow trout	70	4.7	9.2	21.1	15.0	0.36	3.50	1.43	89
	Walleye	54	3.6	8.2	26.1	13.7	0.17	8.50	1.17	93
	White sucker	428	28.5	8.8	18.2	13.8	0.29	2.70	1.37	112
	Yellow perch	648	43.2	6.2	10.7	8.7	0.09	0.61	0.29	88
East Fork (4/5/04 - 4/15/04) 25	Bluegill	1		5.1	5.1	5.1	0.1	0.1	0.1	106
	Longnose sucker	24	1.0	16.5	19.4	18.0	1.78	2.68	2.28	
	Northern pike	240	9.6	16.8	31.5	21.6	1.00	7.95	2.51	100
	Female	34	1.4	19.0	27.1	23.4	1.85	5.4	3.41	106
	Male	142	5.7	17.0	25.4	21.1	1.00	3.27	2.29	99
	White sucker[1]	1347	54	14.9	18.8	17.0	1.36	2.90	2.22	102
	Yellow perch	353	14.1	4.5	13.8	6.7	0.07	1.21	0.19	94
Jakes Reservoir (4/22/04) 1	Fathead minnow	1	1	2.4	2.4	2.4				
	White sucker	2	2	16.4	18.6	17.5	1.65	2.98	2.32	95
	Yellow perch	125	125	3.5	10.3	7.4	0.02	0.46	0.20	84
Petrolia (3/29/04 – 3/30/04) 10	Carp[1]	445	44.5	2.0	29.4	14.4	0.02	10.40	2.80	95
	Northern pike	65	6.5	14.9	19.5	17.2	0.79	2.12	1.37	112
	Walleye	56	5.6	8.2	25.8	15.2	0.12	7.90	1.55	102
	White sucker	3	0.3	11.3	15.8	14.2	0.61	1.85	1.42	102
	Yellow perch	2	0.2	10.7	12.3	11.5	0.80	1.31	1.06	124
Whisker (7/14/04) 1	Black crappie	67	67	4.4	10.0	5.8	0.05	0.57	0.23	101
	Largemouth bass	1	1	7.6	7.6	7.6	0.23	0.23	0.23	110

1 Sub sample

Table 3. Trapping summary statistics for several years from East Fork Reservoir (95% CI).

		Northern pike				White sucker			Yellow perch	
Year	Trap nights	New N	Estimate (range)[1]	Mean total length (in)	Mean weight (lbs)	New N	Estimate (range)	Mean total length (inches)	New N	Mean total length (inches)
1995	4	17	-	23.4	3.49	140	-	11.8	17	8.2
1997	12	81	-	22.1	3.35	679	-	13.8	359	7.8
1998	25	148	622 (347 -1266)	22.0	3.08	930	4223 (3519-5279)	14.4	38	8.5
2001	20	247	1090 (723-1739)	19.6	1.71	362	2640 (1695-4362)	15.7	61	10.6
2002	20	367	1166 (917-1602)	19.6	1.85	394	1225 (1123-1348)	16.8	117	8.1
2003	20	197	1180 (688-2223)	20.8	2.20	1354	1897 (1765-2051)	16.8	154	6.5
2004	25	240	568 (496-663)	21.6	2.51	1347	1927 (1851-2010)	17.0	353	6.7

Table 4. Growth of tagged northern pike captured in 2003 and recaptured in 2004 in East Fork Reservoir. Measurements taken in 2004 shown.

N	Sex	Mean total length (inches)	Mean change in total length (inches)	Mean weight (pounds)	Mean change in weight (pounds)	Mean Wr
37	Male	21.7	1.1	2.44	0.38	98
3	Female	26.6	1.5	5.12	0.50	105
42	Total	22.0	1.1	2.64	0.39	99

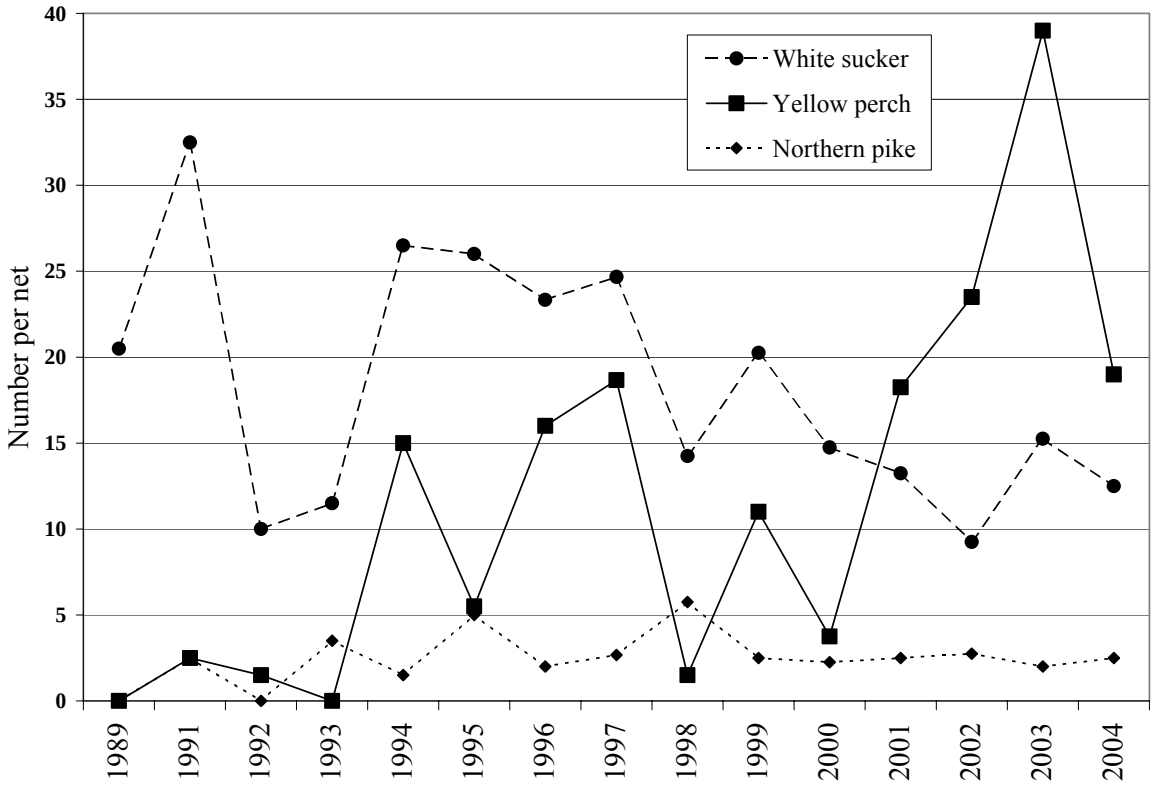

Figure 7. Catch rates of common species during fall gill netting in East Fork Reservoir, 1989 – 2004.

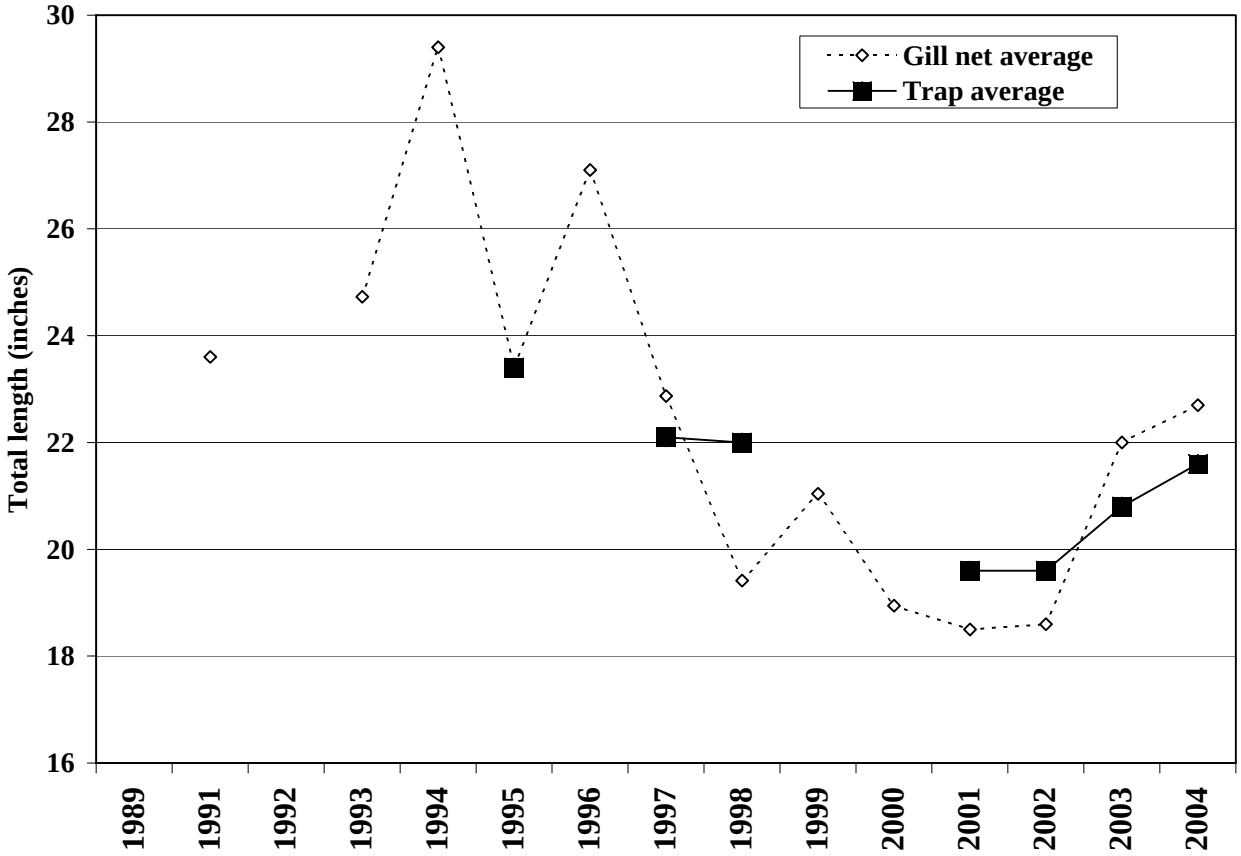

Figure 8. Mean length of northern pike in East Fork Reservoir captured during fall gill netting or spring trapping.

Table 5. Seining results from Lewistown area waters in 2004.

Reservoir (Date)	# of seine hauls	Species	Total N	Length (inches) Min	Max	Mean
Big Casino Reservoir (7/29/04)	4	Rainbow trout	14	7.4	17.4	12.5
		Yellow perch	93	4.3	6.1	4.9
East Fork Reservoir (7/27/04)	6	Northern pike	2	18.8	20.7	19.8
		Yellow perch (total)	87	3.4	9.8	4.9
		Yellow perch <4 inch	23	3.4	3.9	3.7
		White sucker	3	1.7	4.3	3.2
Petrolia Reservoir (7/28/04)	12	Carp	22	6.1	17.0	9.5
		Emerald shiner	1			2.2
		Fathead minnow	1			1.6
		Walleye	4	2.6	5.9	3.6
		Yellow perch	34	1.9	5.5	3.9
		Unknown minnow	3	2.0	2.2	2.1

Table 6. Mean total length at age for yellow perch spines collected from three reservoirs in 2004.

	Petrolia Reservoir				East Fork Reservoir				Jakes Reservoir			
	Total length (inches)				Total length (inches)				Total length (inches)			
Age	N	Min	Max	Mean	N	Min	Max	Mean	N	Min	Max	Mean
2					1			5.5				
3	1			10.7	18	5.7	7.2	6.3				
4					8	7.0	9.9	8.2	11	9.3	10.1	9.7
5	1			12.3	2	8.2	9.5	8.9	1			9.9
6					2	9.7	10.4	10.1	1			10.3
11					1			13.8				
Total N	2				32				22			

Martinsdale Reservoir – DNRC monthly dam reservoir reports indicate Martinsdale Reservoir briefly reached about 25% capacity but was only 10 – 13% full for most of 2004. Rainbow trout catch dropped from 32.5 in 2003 to 24.5 per net (Figure 9), which is similar to the long-term mean of 23.1 per net. Relative weight of rainbow trout dropped to a record low of 90 (Figure 10, Table 1) and 2004 was one of the few years when white sucker Wr exceeded rainbow Wr. Fourteen brown trout, a record high number, were captured and had an average weight of 1.99 pounds (Table 1). Four YCT were captured. Rainbow trout stocking rate in Martinsdale has been reduced for several years due to drought caused drawn-down. About 20,000 rainbow trout were planted in 2003 and about 43,000 in 2004. In 2005, WCT be stocked instead of YCT and performance will be evaluated.

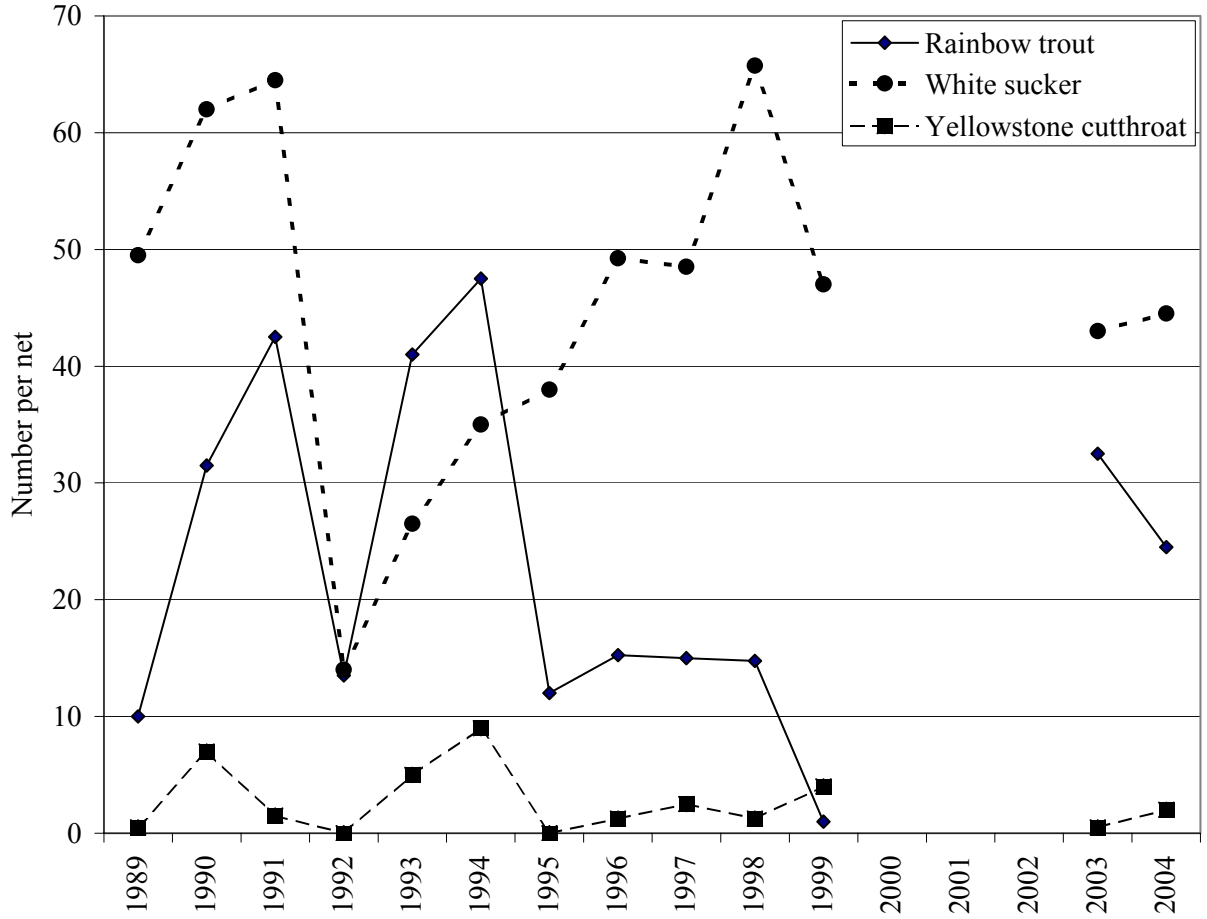

Figure 9. Catch rates of common species during fall gill netting in Martinsdale Reservoir 1989 – 2004.

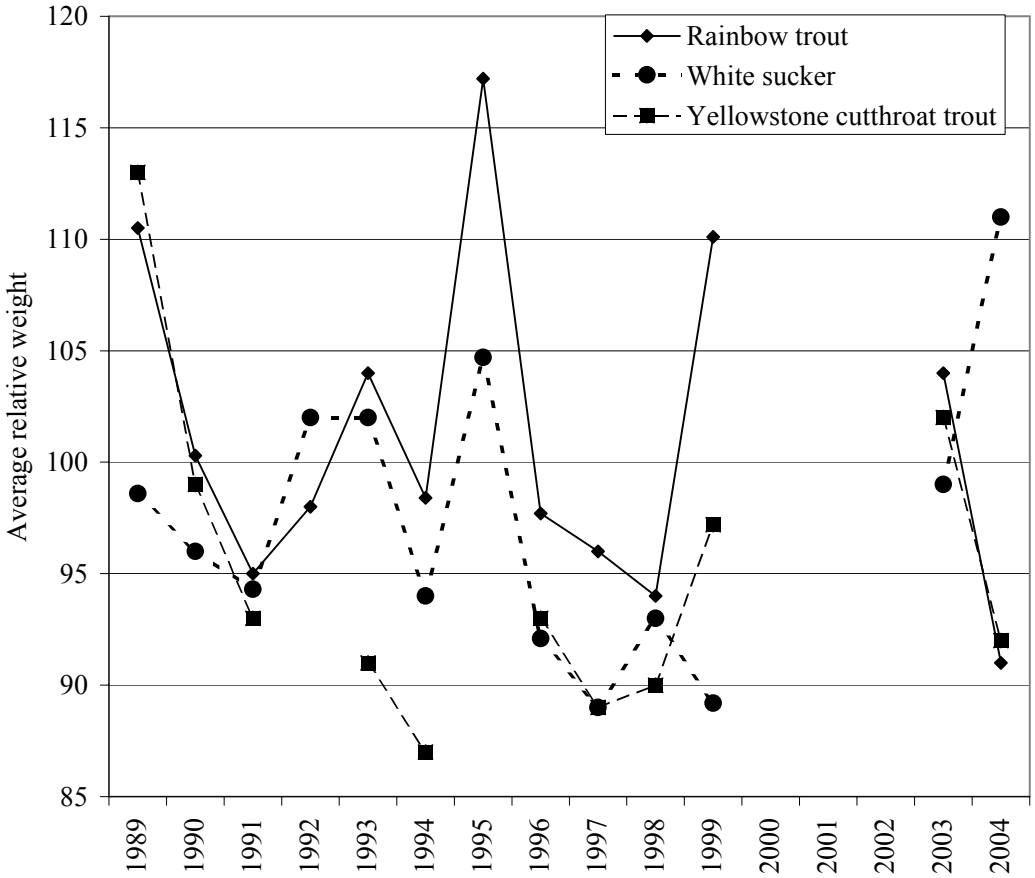

Figure 10. Mean Wr of common species captured during fall gill netting with overnight sets in Martinsdale Reservoir.

Petrolia Reservoir - A total of 445 carp (*Cyprinus carpio*), 56 walleye and 65 northern pike were captured during 10 trap nights from 3/29 – 3/30 (Table 2). One walleye was recaptured. Walleyes weighed up to 7.9 pounds and northern pike up to 2.12 pounds. Age 2 walleye averaged 9.2 inches and at Age 4 walleye had a mean total length of 15.6 inches (Table 7). Carp, northern pike, shorthead redhorse (*Moxostoma macrolepidotum*), walleye, white sucker and yellow perch were captured during gill netting (Table 1). Figure 11 shows the long-term gill netting trends in Petrolia Reservoir. Carp numbers declined to 22.8 per net, the third highest level reported and much higher than the long-term mean of 8.2 per net. Northern pike numbers increased slightly to 3.0 per net, which is nearly twice the long-term average of 1.6. Yellow perch were captured at the highest level seen since 1997 and at 2.5 per net were similar to the long-term mean of 2.3 per net. Walleye numbers have declined substantially in the past 3 years. Seining produced record low numbers of fish (Figure 12). Yellow perch were the most common (Table 5) and catch rate was higher than found for several years. Spottail shiners *(Notropis hudsonius)* were not captured for the third consecutive year. Seining efficiency was low this year due to woody vegetation that has colonized the shoreline during recent drought. Drought has limited irrigation from Petrolia Reservoir for several years. Maximum depth increased from a low of 9 ft during 2002/2003 to about 20 ft in September 2004. Throughout the 1990's, 20,000 walleye were stocked at 1-inch long in Petrolia. Starting in 2002, 100,000 walleye were stocked at 0.2 inches. Some of these smaller fish appear to be recruiting to the fishable population based on age distribution (Table 7).

Table 7. Total length at age for walleye collected from Petrolia Reservoir in March 2004.

Age	Year stocked	Total length (inches)			
		N	Min	Max	Mean
2	2002	5	8.2	11.8	9.2
3	2001	11	12.6	15.1	13.8
4	2000	25	14.9	16.8	15.6
5+		13	16.1	25.8	18.2

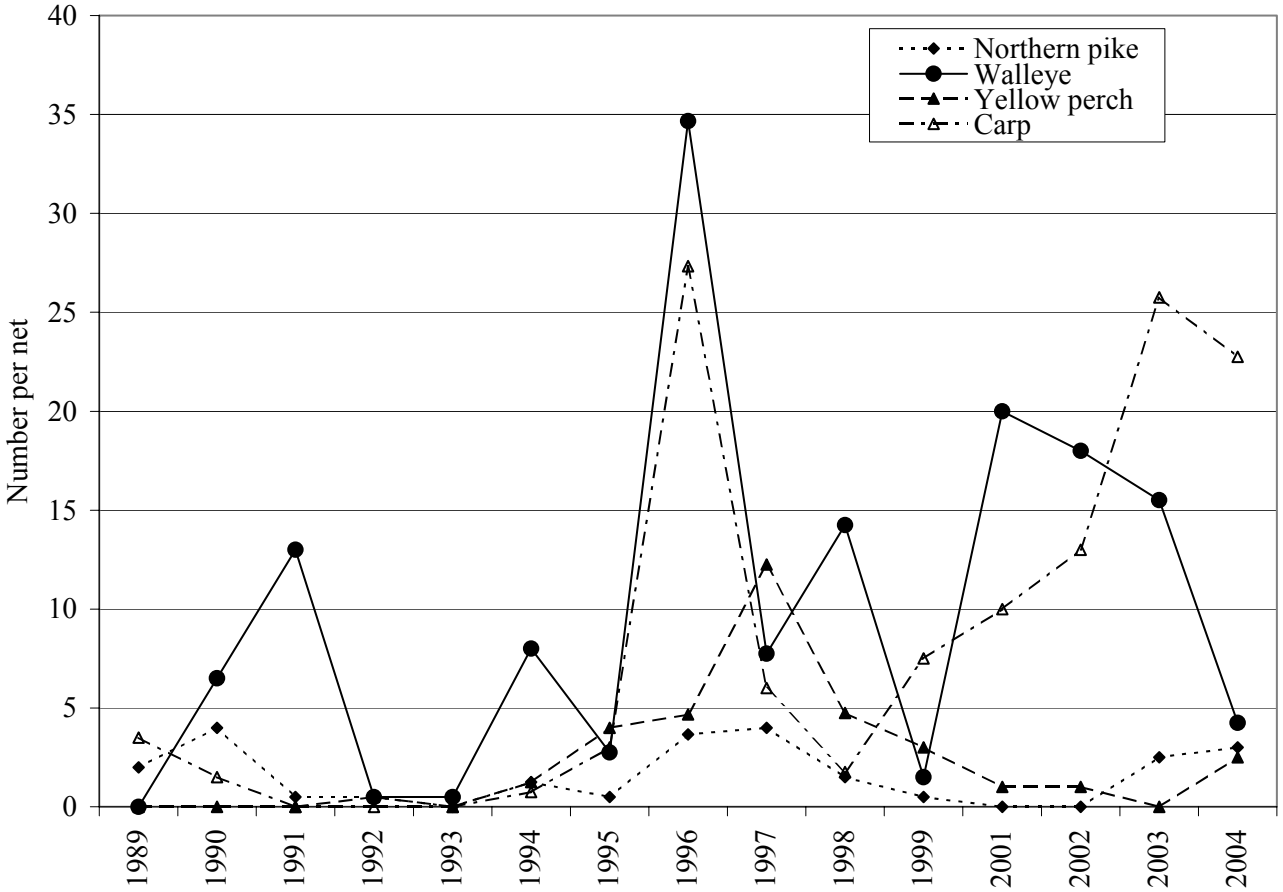

Figure 11. Catch rates of common species by fall gill netting with overnight sets in Petrolia Reservoir, 1989 – 2004.

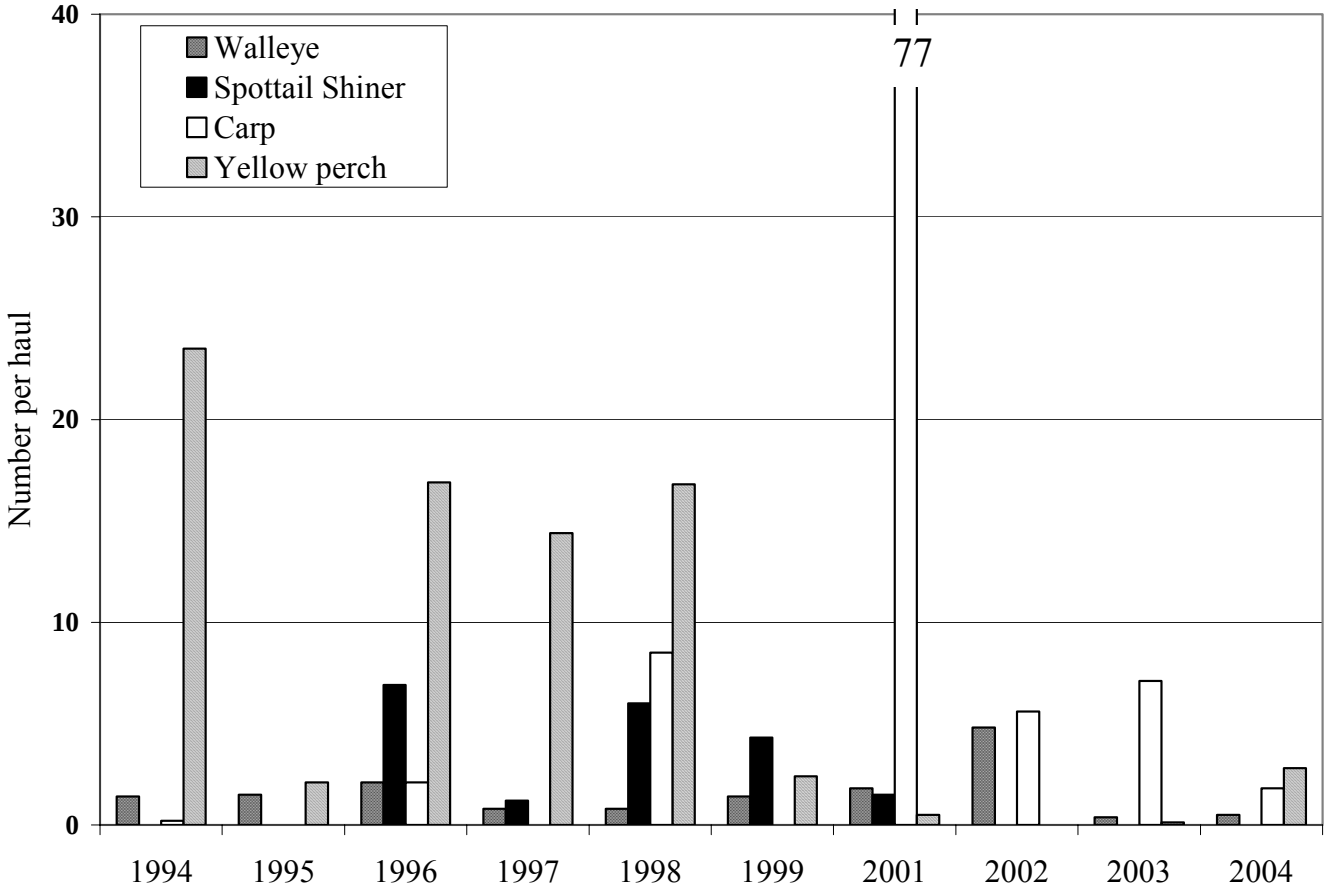

Figure 12. Fish capture rates from seine hauls, Petrolia Reservoir, 1994 – 2004.

Yellow Water Reservoir – This water has been at about 5% capacity or less for the past several years and was not sampled in 2004. In September, the reservoir was about 2 ft deep, which appeared to be 1 – 2 ft below the maximum 2004 water level.

Small Reservoirs

Four small trout reservoirs and seven small warm water reservoirs were sampled in 2004. Gill nets set in Dry Blood and Lower Wolf Coulee #2 (T20N R26E 13) did not capture any fish. Both ponds appeared to have had adequate water depth for fish in spring 2004.

Benes Pond (Nelson Reservoir) – On 7/27 this pond was surveyed for future stocking. It had a maximum depth of 12.1 feet and much of the pond exceeded 9 feet. Conductivity was about 6500 µS and pH was 7.03. In the early 1990's this pond was stocked with northern pike and yellow perch. Largemouth bass (*Micropterus salmoides*) will be stocked in 2006.

Big Casino Reservoir – About 1500 catchable rainbow trout were stocked in 2004. The stocking rate was reduced by about 50% due to a fish shortage. Record low numbers of rainbow trout were captured in traps (Figure 13) and rainbow trout numbers were the lowest found in gill nets for nearly a decade (Figure 14).

By September 2004, rainbow trout had record high total mean length (Figure 15). White suckers were removed from 2001 – 2004 to improve rainbow trout growth. Relative weight of rainbow trout in 2004 was similar to levels prior to white sucker removal and the lowest since 2000 (Figure 16). In 2004 both mean and maximum length of rainbow trout during trapping was about 1 inch less than in 2003 and Wr was 89 both years (Table 2, Tews et al. 2005). Trapped rainbow trout had a broad size distribution in 2004, with peaks at 17 and 13 inches (Figure 17). In 2004, a total of 420 pounds of the white suckers were removed during spring trapping. Trap netting (Figure 13) and gill netting (Figure 14) both showed increases in white suckers, but catch rates were lower than prior to the intense 2001 white sucker removal effort. Mean white sucker length remained at about 13 inches in gill nets (Figure 15). Relative weight remained near 100 for white suckers. During 2003 and 2004 Wr was higher in the spring for all species than in the fall (Figure 16). Walleye numbers increased slightly in traps and gill nets from 2004 and an 8.5 lb walleye was captured. Relative weight was near 90 for walleye during 2004 sampling and mean total length increased in traps from 12 inches in 2003 to 13.7 inches in 2004. Only one walleye, a 17-inch fish, was captured during fall netting. Walleye length and growth appears to be variable (Appendix 1). In 2004, at age 2, walleye were about 9.3 inches long. Yellow perch were captured at record high rates during trapping and gill netting. Mean yellow perch total length and Wr decreased from 2003, but yellow perch up to 11.4 inches long and 0.7 lbs were sampled. Numbers of YOY yellow perch in seine hauls decreased from 125 to 23 per haul.

Buffalo Wallow Reservoir – This reservoir was not sampled in 2004. The hole in the dam that had been developing for several years increased substantially in size but was repaired with a "short-term fix" by the Bureau of Land Management. They filled in the hole near the trickle tube on the downstream side of the dam and filled in the trickle tub, so the overflow "emergency" spillway is now the primary spillway.

Carter ponds – Upper and Lower Carter Pond were not netted in 2004. Lower Carter had at least partial winterkill in 2004; several dead trout were seen on the bank in early spring. Both Upper and Lower Carter dams had major problems in 2004. In March, the stand-pipe on the lower dam fell over into the reservoir, apparently due to corrosion. In July, there was a slow failure on Upper Carter Pond. About 8 feet of water leaked out of the dam through the tube structure over a 2-week period. Maximum depth remained about 10 feet after the pond was drained. Local agencies including the U.S. Natural Resource and Conservation Service, The Montana Department of Natural Resources, The United States Fish and Wildlife Service and MFWP as well as Ducks Unlimited and the landowner are working to develop a plan to repair both dams. Ducks Unlimited evaluated these dams for repair options, which will be used as a starting point for repairs.

Frog Ponds – In Spring 2004, the city of Lewistown completed dredging of the Lower Frog Pond. Both the Upper and Lower pond were stocked with rainbow trout in 2004.

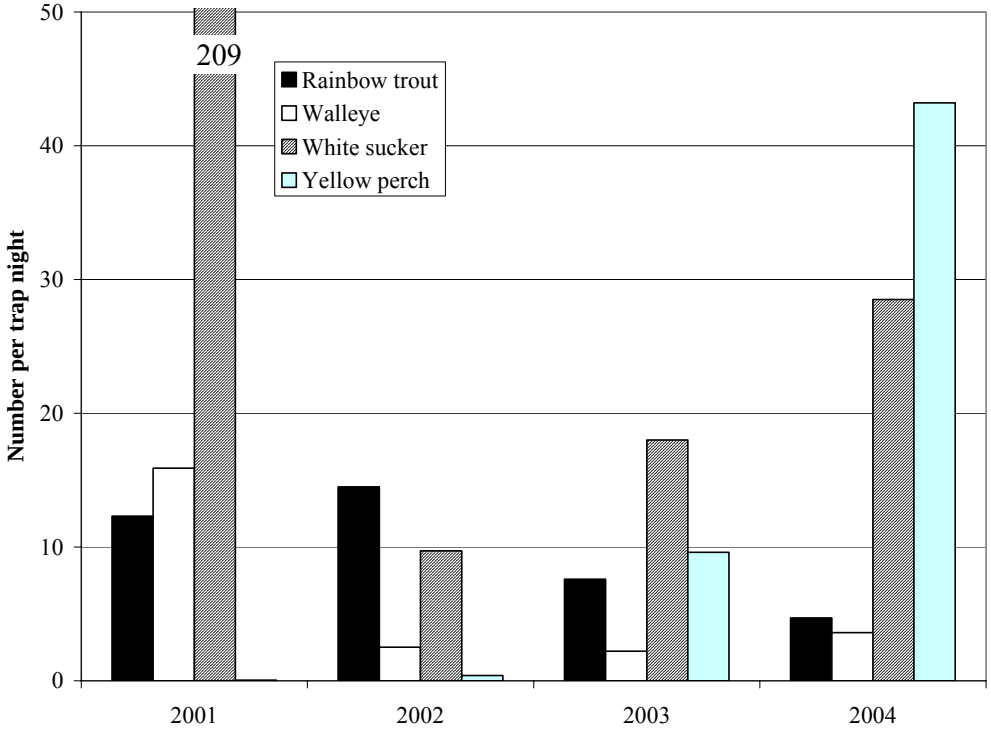

Figure 13. Catch rates per trap night during spring trapping in Big Casino Reservoir, 2001 – 2004.

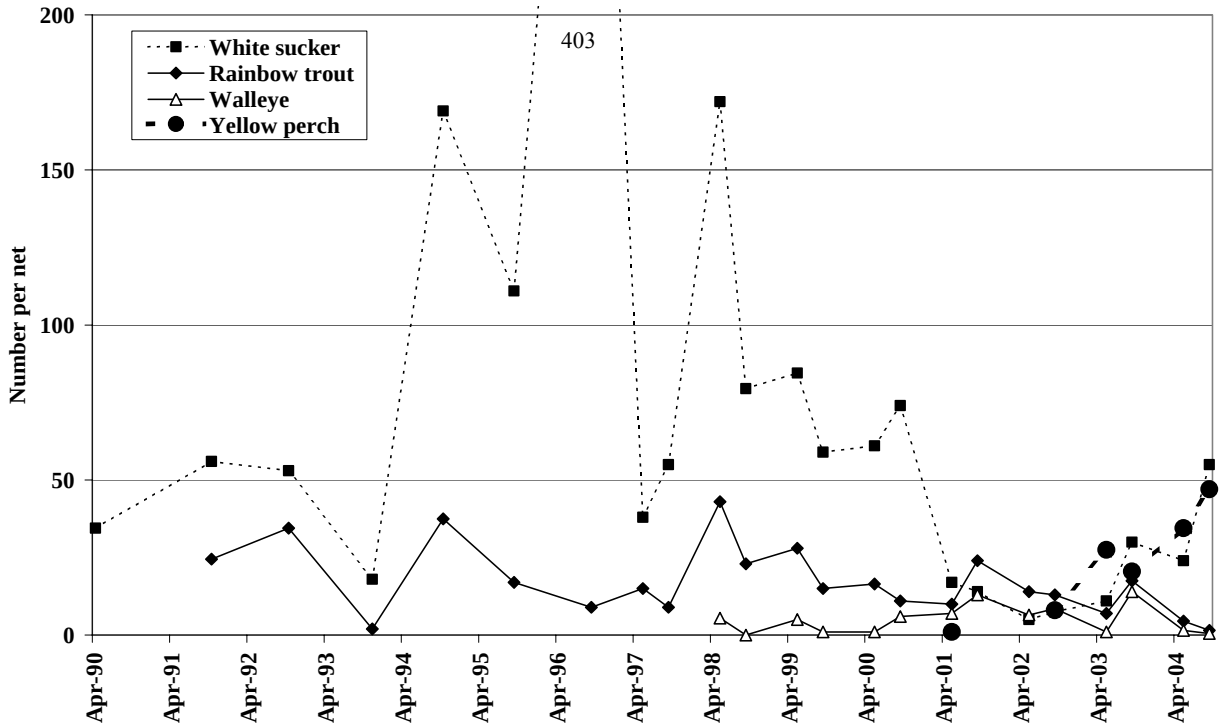

Figure 14. Catch rates of common species during spring and fall gill netting with overnight sets in Big Casino Reservoir 1990-2004.

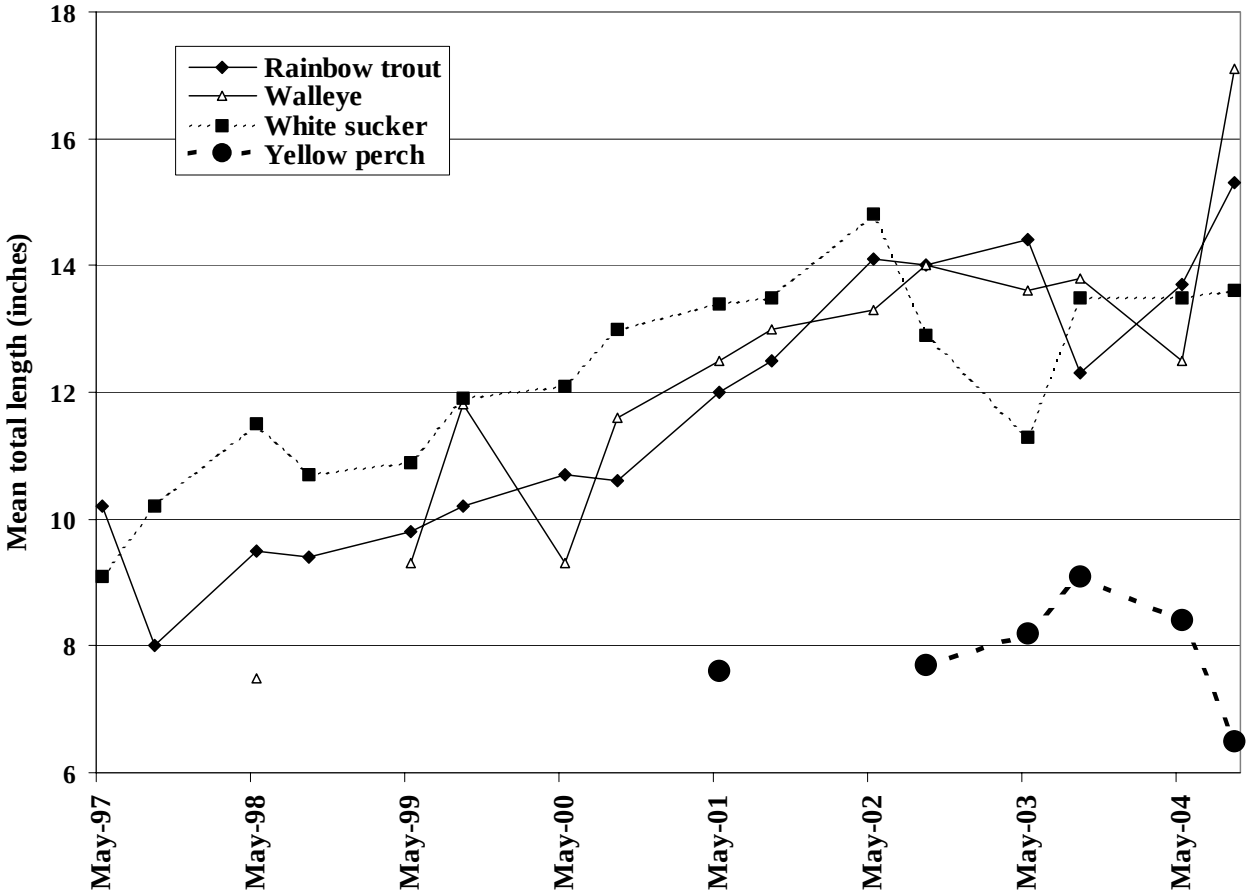

Figure 15. Mean total length of common species captured by gill netting in Big Casino Reservoir 1997 – 2004.

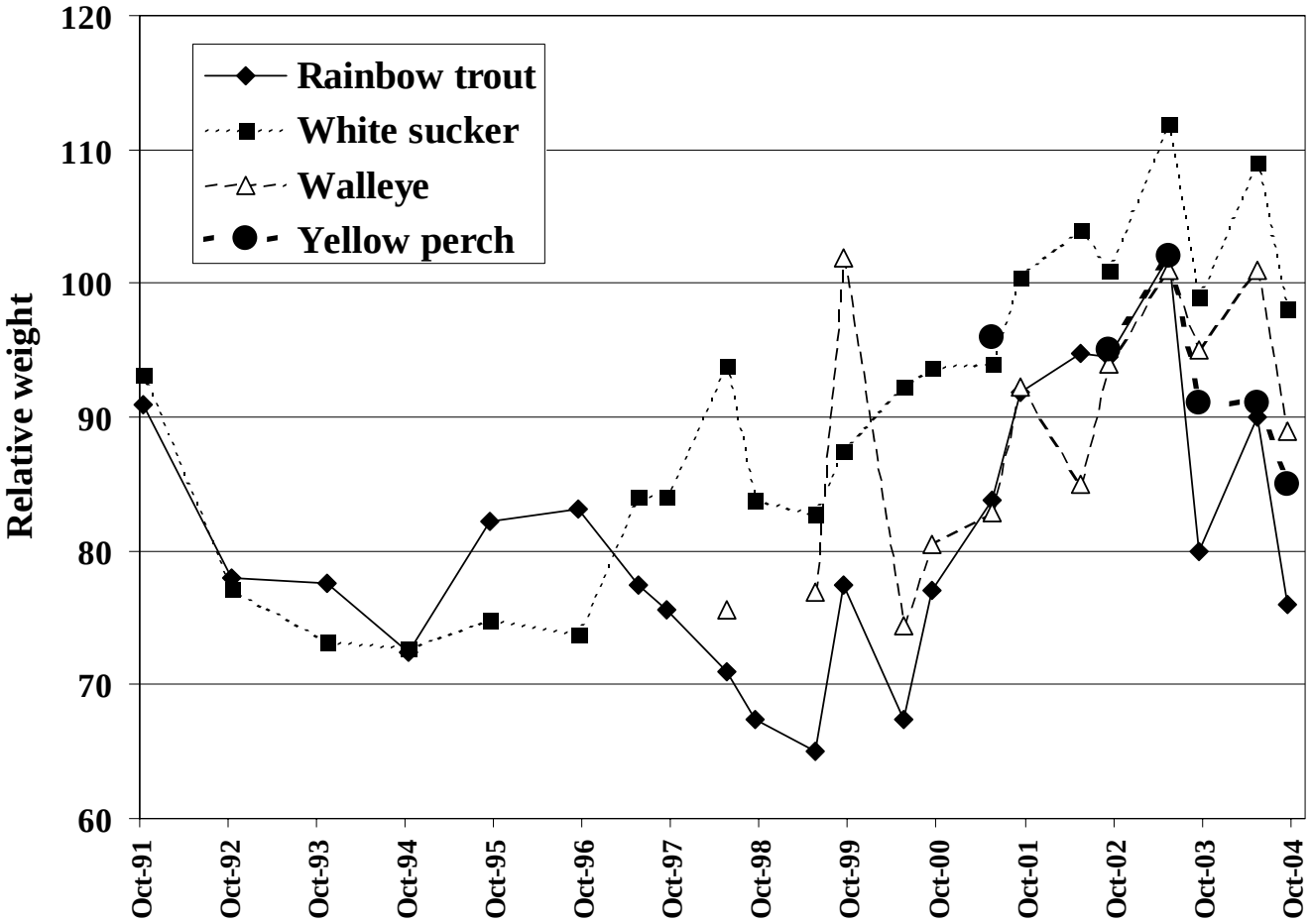

Figure 16. Relative weight of fish captured by gill netting in Big Casino Reservoir 1991 – 2004.

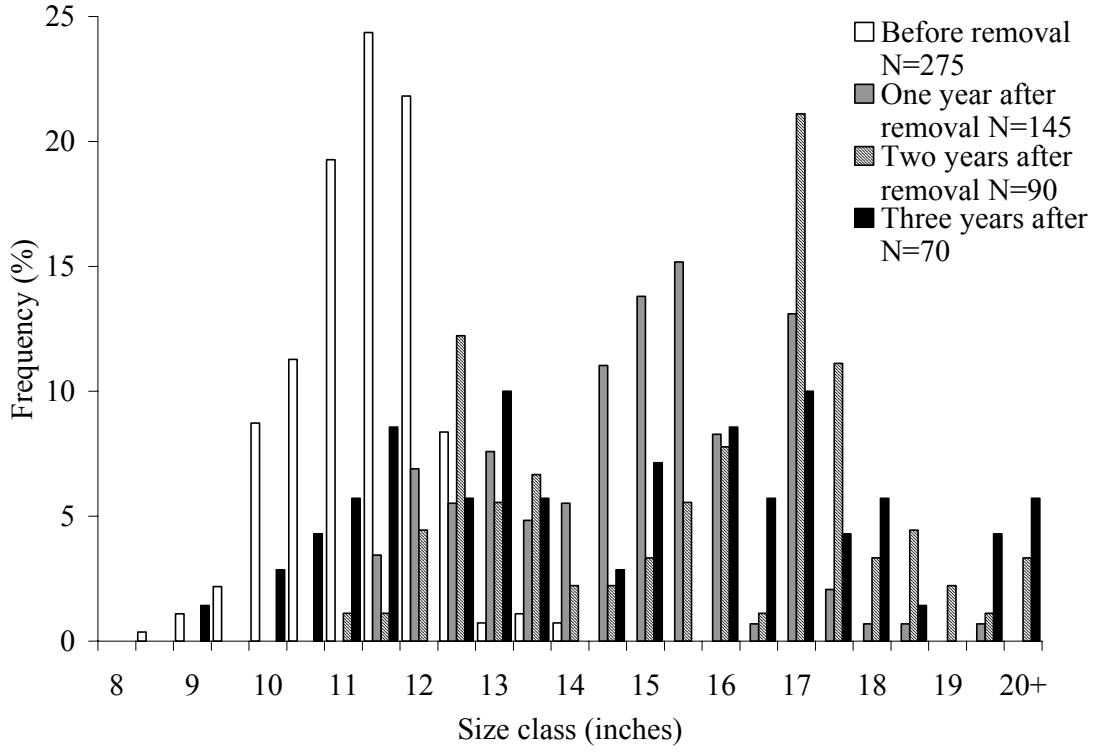

Figure 17. Rainbow trout size structure during trapping in Big Casino Reservoir before, one, two and three years after initial (2001) white sucker removal in Big Casino Reservoir.

Drag Reservoir – Water levels continue to be high in this reservoir. In 2004, 2.0 largemouth bass and 13.5 bluegills were captured per gill net (Table 1). Capture rates were lower in 2004 than in the past 2 years (Yerk et al. 2005, and in preparation). Total length was similar to 2003, but mean Wr for largemouth bass increased from 81 to 94. Largemouth bass were stocked in 2004 but not in 2003.

Hanson Creek Reservoir – A total of 33 rainbow trout with a mean length of 12.1 inches and a Wr of 111 were captured (Table 1). This is about an inch longer than the mean length of 11.0 inches found during May netting in 2002 (Tews et. al 2004) and 10.8 inches in 1998 (Zollweg et al. 1999). Relative weight has also increased from 88 in 1998 to 92 in 2002 to 111 in 2004.

Jakes Reservoir –This reservoir filled in spring 2003. The yellow perch population survived through several low water years and water level was fairly high throughout 2004. A total of 125 yellow perch, 2 white suckers and 1 fathead minnow (*Pimephales promelas*) were captured in one trap (Table 2). The mean length of captured yellow perch was 7.4 inches with a Wr of 84. These are the longest and fattest yellow perch seen in over a decade at Jakes. Sampling with traps may have influenced size structure but Wr in 2003 was 77, which was higher than reported for several years (Yerk et al. in preparation). In 2004,

yellow perch exceeding 9 inches were from 4 – 6 years old (Table 6). In August 2003, 460 sauger *(Sander canadense)* with a mean 5.8 inch total length, were stocked as an experimental predator to increase the average size of yellow perch. Sauger were not sampled during trapping. Anglers reported catching sauger that were about 10 inches long during winter 2004/2005. Sauger were not stocked in Jakes in 2004 due to lack of fish.

Payola Reservoir – This reservoir had an excellent fishery for largemouth bass and yellow perch until recent drought. After several years of low water, the pond filled and was 12.5 ft deep in early June. The reservoir was filled with fat, generally small yellow perch. There were two large yellow perch that weighed nearly one pound, but the vast majority were less than 6.5 inches long. Largemouth bass were not netted (Table 1) and were stocked this year for the first time since 2001.

Peterson Reservoir – Seventy-three rainbow trout from 6.5 – 11.2 inches were captured in one sinking gill net. A net set in April 2003 did not capture any fish (Tews et al. 2005). However trout size structure and the presence of lake chub *(Couesius plumbeus)* indicate that complete winter-kill was unlikely in 2002/2003.

Rhoda Lake – This high mountain lake, located in the headwaters of Dry Wolf Creek was gill netted for the first time since 1976 (Lewistown area data files). The 36 netted cutthroat trout had a mean length of 11.9 inches, but fish up to 17 inches were captured (Table 1). During 3 hours of fishing, one angler caught 26 fish with a mean total length of 11.3 inches (range of 8.0 – 16.0 inches). Yellowstone cutthroat trout were stocked in this lake until 1995. Cutthroat trout were not stocked from 1996 – 2001. Westslope cutthroat trout (*Oncorhynchus clarki lewisi)* were stocked in 2002 and 2003 due to concerns that YCT trout could migrate into Dry Wolf Creek and compromise the genetics of native fish. The WCT in Dry Wolf Creek are slightly hybridized with YCT and it is possible the hybridization originated from the Rhoda Lake fish. Trout could likely migrate from Rhoda Lake via the defined outlet during run-off but the area has not been well surveyed. The size structure of the cutthroat trout (Figure 18) indicates there is natural reproduction. The lake was stocked with arctic grayling *(Thymallus arcticus)* in 1997 and 2002, but they were not sampled and have not been reported by anglers. Due to lack of survival, arctic grayling will no longer stocked.

Whisker Reservoir – In 1999, 126 black crappie were transferred to this water (Lewistown data files). Largemouth bass were stocked for the first time in July 2003 and were also stocked in 2004. Gill netting in 2003 did not capture any fish. Fish surveys were far more successful in 2004, when 67 crappies and one largemouth bass were caught in a trap (Table 2), and 57 crappies and 12 bass were captured in gill nets (Table 1). Spine analysis indicated that crappies have reproduced successfully in Whisker Reservoir every year (Table 8). This pond is large and was 18 feet deep in July 2004. It should provide excellent fishing unless the dam, which is in poor shape, fails.

Table 8. Total length at age from black crappie collected at Whisker Reservoir July 2004.

	Total length (inches)			
	N	Min	Max	Mean
Age 1	4	4.4	4.6	4.5
Age 2	8	5.5	7.5	6.1
Age 3	4	8.0	8.4	8.2
Age 4	8	9.5	10.4	10.0

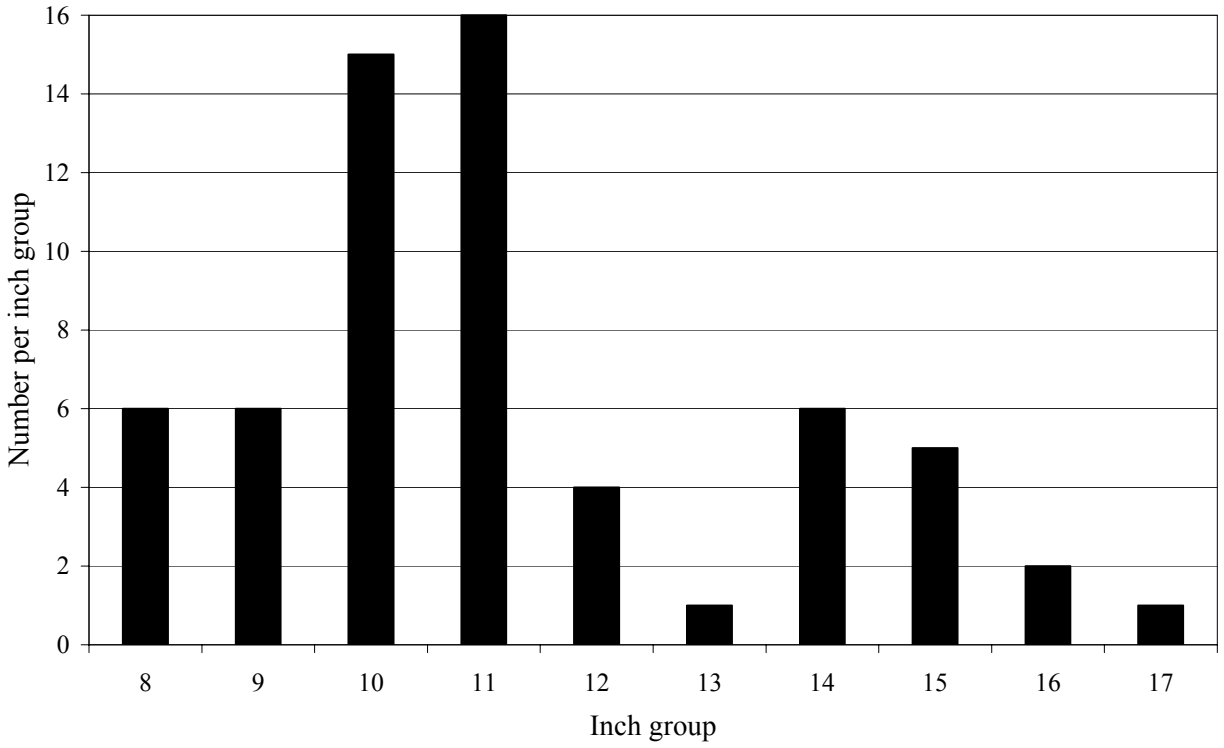

Figure 18. Cutthroat trout size distribution from gill netting and angling in Rhoda Lake in August 2004.

STREAMS

Big Spring Creek, the Judith River and several other streams were sampled in 2004. Many streams were sampled as part of the WCT recovery effort. Data collected from those streams is in a companion report (Moser et al. 2005). Statistics from additional streams are listed in Table 10. Sampling highlights are discussed below. In addition to the waters described below, a prairie stream survey conducted in 2004 sampled about 96 streams in northcentral Montana (Tabor 2004). Temperature data was collected on 9 sites in 2004 (Appendix 2). Temperature summaries for Big Spring Creek and Little Casino Creek are listed in Appendix 3. Temperature data from other streams are reported in Moser et al. (2005).

Big Spring Creek

In 2004, mark-recapture estimates were completed on four sections of Big Spring Creek, including the Hatchery, Burleigh and Brewery Flats sections above Lewistown, and the Carroll Trail section downstream of town (Figure 19). The Hatchery Section was sampled for the first time since the 1960's. Results are presented in Table 9. Fish population trends are summarized in Figures 20 – 22. Fish, sediment and aquatic invertebrates in Big Spring Creek and several tributary streams, including Big Casino Creek, East Fork Big Spring Creek, Hanson Creek and Little Casino Creek were sampled for PCBs in 2004 for risk assessments of human and ecological health due to PCBs in Big Spring Creek (Camp Dresser and McGee, 2004). Size statistics for fish sampled from these streams is listed in Table 10. Age statistics for the trout will be discussed in a future report.

Rainbow trout (≥10 inches) declined to1,262 per mile, the lowest estimate since 1997 in the Carroll Trail section (Figure 20). This is 15% less than the 10 year mean of 1,490. In the Burleigh section, rainbow trout ≥10 inches continued a downward trend from the 2001 peak and 2004 estimate (267 per mile) was lower than the 10-year mean of 405. However at Brewery Flats, the numbers of rainbow trout ≥10 inches was the second highest ever reported and about 40% higher than the 10 year mean. Estimates for small rainbow trout (<10 inches) were below the 10 year average at all of these long-term monitoring sites (Figure 21). Brown trout numbers were similar to 2003 levels at the Carroll Trail and Burleigh sections but increased in the Brewery Flats section (Figure 22). Brown trout numbers (≥10 inches) were higher than the 10 year mean at all three long-term monitoring sections.

At Brewery Flats, estimates for trout have increased substantially since the re-meandering project was completed in September 2000. In August 2000, trout (≥10 inches) were at or near record high numbers at all sampling sites on Big Spring Creek and trout populations at Brewery Flats were much higher than previously reported (Figure 23). Between 2002 and 2004 trout ≥10 inches have increased by 66% in the Brewery Flats section compared to decreases of 36% and 23% in the other two sections (Table 11). The number of trout in the Brewery Flats section has nearly doubled with the improved habitat and increased channel length. There were an average of 434 trout ≥10 inches in the 3700 ft section before the project, compared with 844 trout average, in the 5104 ft section for the four years after the project was completed. In contrast to larger trout, rainbow trout under 10 inches long declined by 44% when pre and post project mile averages are compared. In the Burleigh sections numbers of small rainbow declined by 36%.

The Hatchery Section is located immediately below the lower state hatchery, about 2 miles upstream of the Burleigh section. This section was sampled for the first time since the late 1960s. For all trout species and sizes, 2004 estimates were less in both the Hatchery Section and the Burleigh sections compared with

1967 and 1968 (Figures 20-22). This difference was most pronounced for rainbow less than 10 inches long, which had a population about 5 – 6 times higher in the late 1960's than in 2004 (Figure 21). The Hatchery Section was sampled due to interest in high PCB levels in this reach of stream. However the decline in trout in this area cannot be attributed to any particular cause due to the numerous changes that have occurred on Big Spring Creek since the late 1960's. A short list of the changes in Big Spring Creek includes the following: Big Spring Creek above Lewistown was stocked until 1973 with about 10,000 catchable rainbow trout annually; in the 1970's flood control dams were built on the major tributaries of Big Spring Creek including East Fork, Hanson Creek, Pike Creek and Big Casino Creek; the sewage treatment plant (about 0.5 miles upstream of the Carroll trail section) underwent a renovation in the mid 1980's that substantially cleaned up sewage effluent; most of the Brewery Flats section underwent restoration in the 2000 when a natural meander pattern was added to a straightened reach; harvest has declined substantially since the 1960's on upper Big Spring Creek and in December 2003 Big Spring Creek above Lewistown became catch and release fishing only. The region has also suffered from a drought during 2000 – 2004.

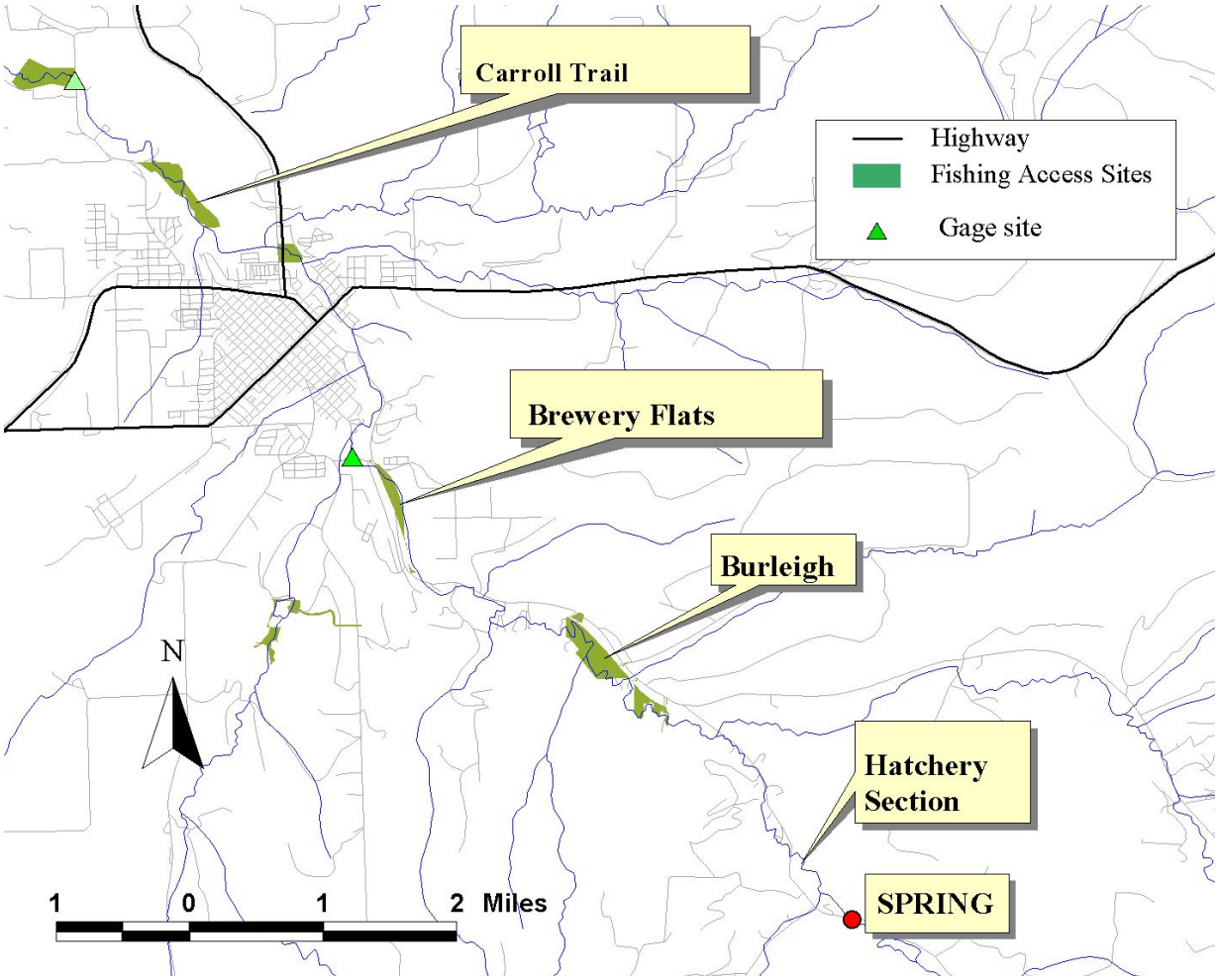

Figure 19. Map of fish population monitoring sections and flow measurement stations on Big Spring Creek.

Table 9. Mark recapture statistics from population estimates done on Big Spring Creek during 2004. SD in parenthesis.

Rainbow trout

Section	Date Marked	# Marked	# Captured	# Recaptured	Pooled (P)	#/mile 6-10 inches	#/mile ≥10 inches	#/mile ≥6 inches	Biomass/ Mile (lbs.)
Hatchery section	8/19	201	170	105	0.252	180	328	509 (27.1)	270.5 (29.7)
Burleigh	8/16	102	76	22	0.096	58	267	324 (44)	234.7 (39.3)
Brewery Flats	8/18	200	221	63	0.160	166	610	777 (53.9)	493.4 (53.8)
Carroll Trail	8/17	460	458	135	0.939	789	1262	2053 (78.6)	1340 (79.3)

Brown trout

Section	Date Marked	# Marked	# Captured	# Recaptured	Pooled (P)	#/mile 6-10 inches	#/mile ≥10 inches	#/mile ≥6 inches	Biomass/ Mile (lbs.)
Hatchery Section	8/19	55	59	39	0.159	9	124	133 (9.0)	216.9 (14.6)
Burleigh	8/16	75	48	21	**		151 (17.1)	151 (17.1)	248 (35.1)
Brewery Flats	8/18	144	112	35	0.086	46	461	507 (72.5)	484.9 (110.3)
Carroll Trail	8/17	223	255	82	0.175	263	637	899 (61.1)	655 (59.2)

** Pooled –P not applicable

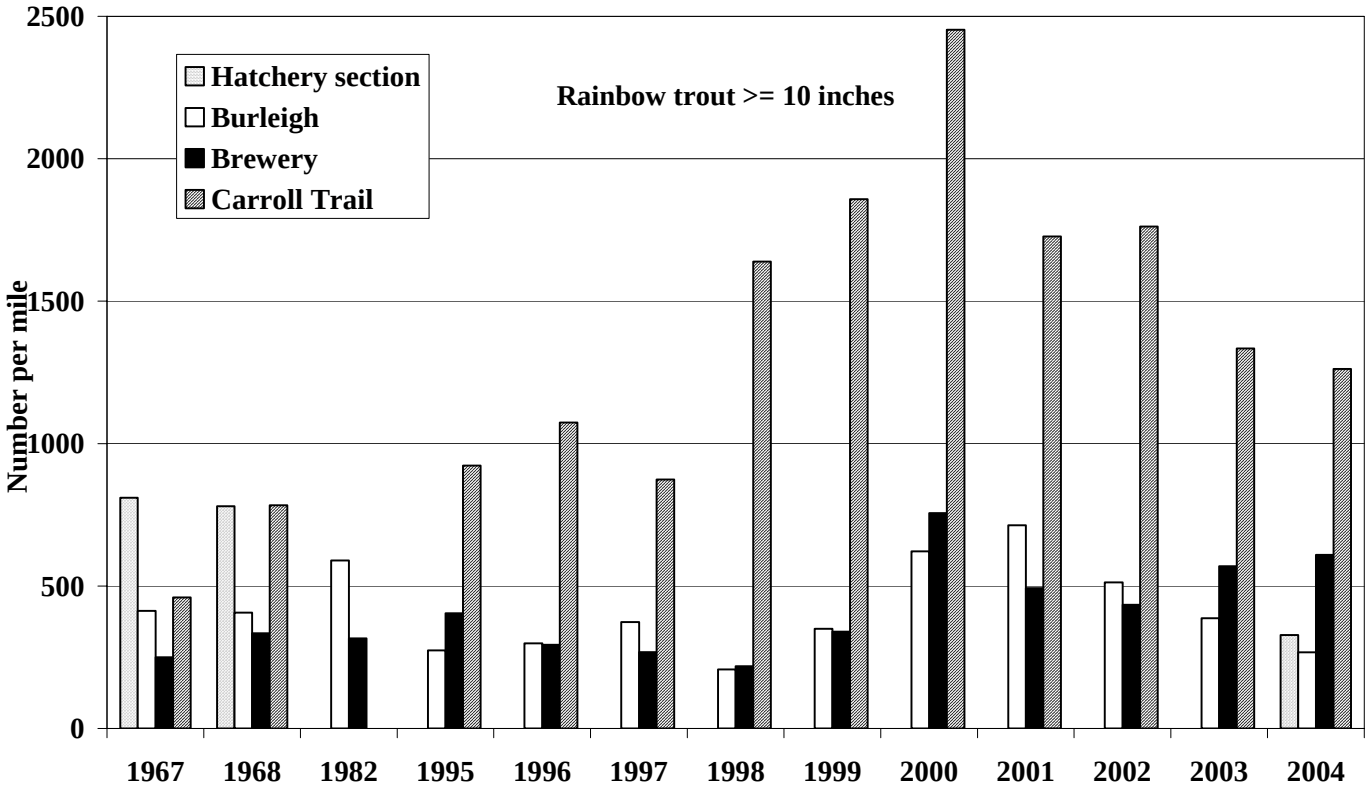

Figure 20. Rainbow trout (≥10 inches) population trends on four sections of Big Spring Creek.

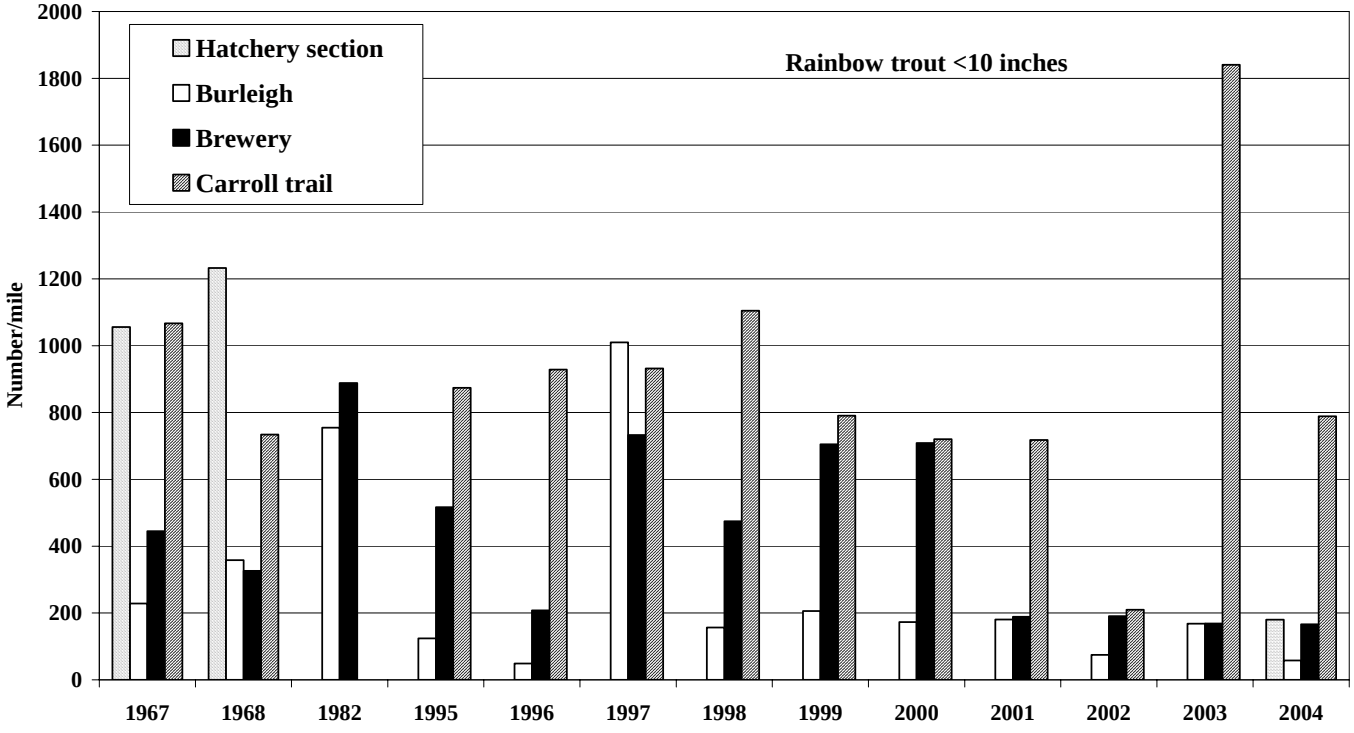

Figure 21. Rainbow trout (<10 inches) population trends on 4 sections of Big Spring Creek.

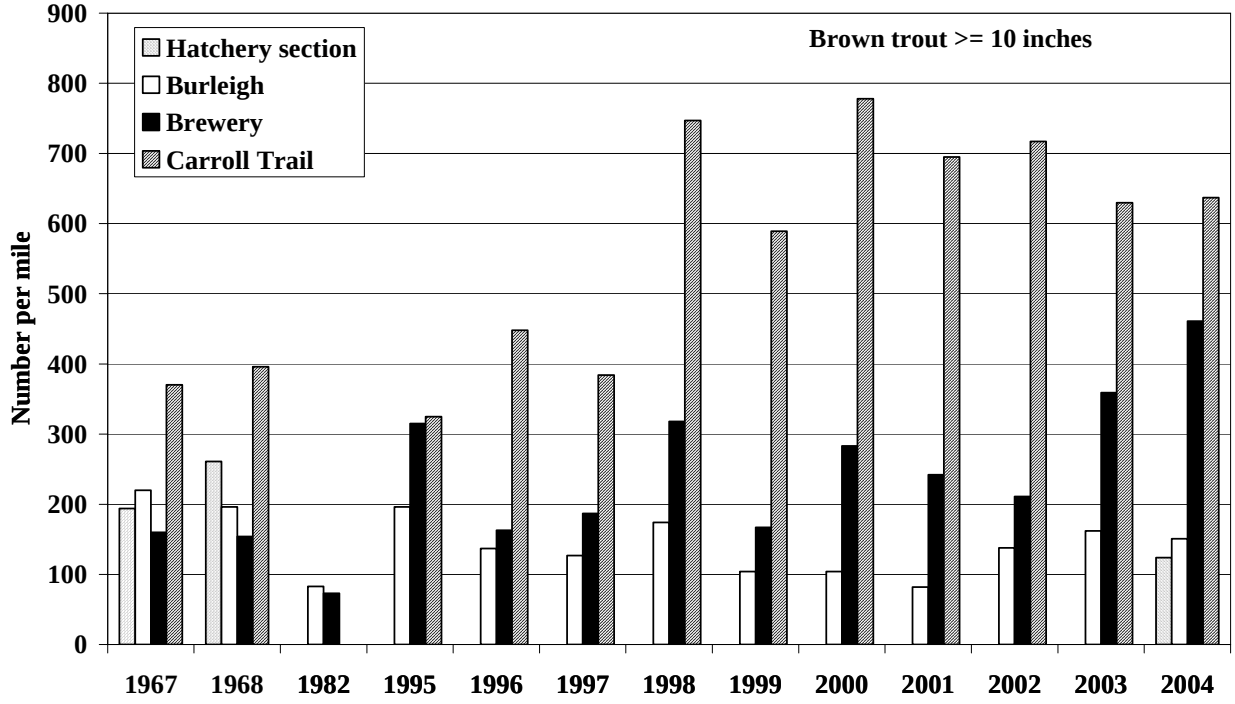

Figure 22. Brown trout (≥10 inches) population trends for four sections of Big Spring Creek.

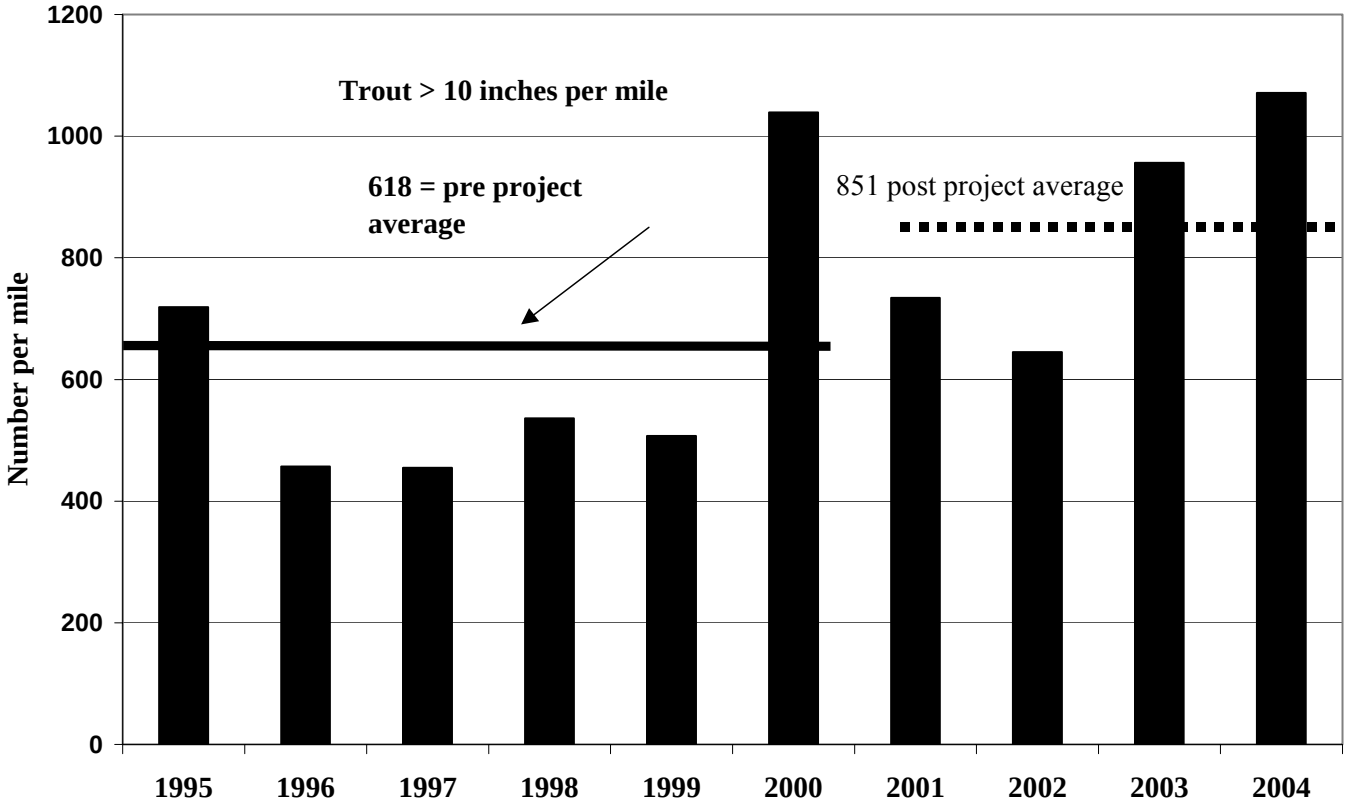

Figure 23. Estimates of total trout per mile (≥10 inches) in the Brewery Flats section before and after stream restoration.

Table 10. Statistics of fish sampled by electrofishing in 2004.

Water (Date) Location Length	Species	N	Total length (in) Min	Max	Mean	Weight (lbs.) Min	Max	Mean	Wr
Big Casino Creek	Fathead minnow	1	2.7	2.7	2.7				
(6/2/04)	Brown trout	5	7.1	16.9	13.5	0.14	1.78	1.04	98
Castle Creek Rd. Bridge 800 ft	Long nose dace	24	2.1	3.9	2.9				
	Long nose sucker	14	3.3	8.4	5.8				
	Mottled sculpin	15	2.3	3.4	2.9				
	White sucker[1]	30	2.6	11.5	5.4	0.04	0.69	0.18	92
	Yellow perch	119*	3.2	4.4	3.9				
Big Spring Creek	Brown trout	16	2.8	10.1	4.0				
(7/16/04)	Mottled sculpin	64*	2.4	3.5	3.0				
Brewery Flats T15N R18E S23 980 ft	Rainbow trout	15	1.8	11.5	3.8				
Big Spring Creek	Brown trout	2	3.1	3.5	3.3				
(7/23/04)	Rainbow trout	17	2.7	6.1	3.9				
Burleigh T15N R18E S28 2000 ft									
Big Spring Creek	Brown trout	31	2.8	4.6	3.7				
(8/11/04)	Rainbow trout	13	2.4	6.8	4.1				
Carroll Trail T15N R18E S9NE 640 ft									
Big Spring Creek	Rainbow trout	16	2.0	6.4	3.6				
(7/23/04) Garlic Farm T15NR19E S32 900 ft									
Big Spring Creek	Brown trout	20	10.3	16.4	13.6	0.35	1.33	0.87	97
(3/9/04)	Longnose sucker	1			12.2			0.78	
Hruska T15N R17E S36NE	Rainbow trout	20	8.9	17.7	13.4	0.28	2.14	1.00	97

1 sub sample fish or sub-sample of weights (typically fish ≥ 4 inches only)

Table 10 continued. Statistics of fish sampled by electrofishing in 2004.

Water (Date) Location Length	Species	N	Total length (in) Min	Max	Mean	Weight (lbs.) Min	Max	Mean	Wr
Big Spring Creek (7/23/04) Lower Hatchery T14N R19E S5 400 ft	Rainbow trout	21	2.8	6.6	4.2				
Big Spring Creek (6/16/04) Spring Creek Colony T16N R17E S18	Brown trout	8	12.2	17.3	13.6	0.71	1.70	0.98	110
	Mottled sculpin	15	2.8	4.2	3.5				
	Northern pike	1			19.1			1.49	89
	Rainbow trout	6	5.0	15.4	10.7	0.02	1.44	0.62	95
Big Spring Creek (7/16/04) Upper Hatchery T14N R19E S5 850 ft	Mottled sculpin	46*	1.8	4.2	3.2				
	Rainbow trout	24	1.8	4.7	3.0				
East Fork Big Spring Creek (6/07/04) Comes Ranch T15N R19E S28 1100 ft	Brown Trout	9	9.6	17.5	12.2	0.31	2.12	0.77	99
	Longnose dace	38*	1.9	3.7	2.9				
	Longnose sucker	3	4.3	7.5	5.4				
	Mottled Sculpin	60*	2.1	3.9	3.1				
	Rainbow trout	1			4.7				
	White sucker	62	2.4	15.8	6.1				
Flatwillow Creek, S. Fk. (6/29/04) T12N R21E S10,3 Lower site 377 ft	Brook trout	26	2.2	6.9	3.1				
	Lake chub	4	2.6	3.0	2.7				
	Long nose dace	1			2.5				
	Mottled sculpin	30	2.4	4.8	3.1				
T12N R21E S7 Upper site 295 ft	Brook trout	6	2.2	7.8	5.8				
	Mottled sculpin	29	2.2	4.5	3.3				

*1 sub sample measured

Table 10 continued. Statistics of fish sampled by electrofishing in 2004.

Water (Date) Location Length	Species	N	Total length (in) Min	Max	Mean	Weight (lbs.) Min	Max	Mean	Wr
Hansen Creek (7/24/04) T14N R19E S5 200 ft	Fathead minnow	15	1.6	3.0	2.4				
	Northern redbelly dace	17							
Judith River (5/6/04) T15N R15E S26 (Above Ross Fork)	Fathead minnow	4							
	Long nose dace[1]	121	1.5	3.5	2.5				
	Long nose sucker	4	3.0	3.3	3.1				
	Mottled sculpin	1			4.1				
	Mountain sucker[1]	39	3.2	5.5	4.6				
	Northern redbelly dace	1			2.1				
	Stone cat	4	3.5	7.0	5.7				
	White sucker[1]	86	2.2	7.9	4.4				
Judith River Beckman (4/22/04)	Brown trout	1	14.8	14.8	14.8	1.16	1.16	1.16	93
	Common carp	5	16.9	23.2	20.8	2.11	7.00	4.48	94
	Channel catfish	Present							
	Flathead chub[1]	9	4.1	7.6	5.2	0.09	0.18	0.12	
	Goldeye	6	11.4	12.6	11.9	0.42	0.67	0.54	
	Longnose sucker	28	3.6	17.3	12.2	0.08	2.14	0.93	
	Mountain sucker	3	5.4	6.2	5.9	0.04	0.15	0.10	
	Rainbow trout	6	4.9	11.2	8.5	0.09	0.60	0.33	131
	Stonecat	2	4.8	5.2	5.0	0.05	0.05	0.05	
	Shorthead redhorse	45	4.0	20.3	17.1	1.23	3.35	2.19	100
	White sucker	9	4.5	16.0	12.1	0.30	1.70	1.09	100

Table 10 continued. Statistics of fish sampled by electrofishing in 2004.

Water (Date) Location Length	Species	N	Total length (in)			Weight (lbs.)			Wr
			Min	Max	Mean	Min	Max	Mean	Mean
Judith River PN (4/20/04)	Blue sucker	3	28.0	29.1	28.6	7.50	9.50	8.67	
	Channel catfish	7	20.8	30.2	26.4	2.75	13.00	8.70	109
	Flathead chub[1]	16	4.6	7.1	5.7	0.05	0.15	0.10	
	Goldeye[1]	98	8.7	14.6	11.8	0.22	1.00	0.52	
	Longnose sucker	8	4.2	16.6	12.8	0.25	2.00	1.16	
	Northern pike	2	31.4	31.5	31.5	8.00	10.50	9.25	119
	River carpsucker	1	18.9	18.9	18.9	4.00	4.00	4.00	119
	Sauger	10	10.2	17.8	13.8	0.33	1.67	0.80	80
	Shorthead redhorse[1]	141	4.0	20.2	17.2	1.18	3.48	2.20	98
	Walleye	2	12.6	26.2	19.4	0.62	9.50	5.06	107
Little Casino Creek (5/27/04) Bebb Street 294 ft	Brown trout[1]	9	2.3	17.3	9.3	0.06	1.92	0.58	97
	Fathead minnow	4	2.4	2.9	2.6				
	Longnose dace	2	2.6	3.0	2.8				
	Longnose sucker[1]	11	6.0	11.0	8.0	0.10	0.49	0.20	
	Mottled sculpin	26*	2.6	3.9	3.4				
	Northern redbelly dace	5*			2.7				
	Rainbow trout[1]	6	2.7	4.5	4.0	0.02	0.03	0.02	
	White sucker	234[1]	2.8	10.1	4.4	0.06	0.36	0.14	
Warm Spring Ditch (8/5/04) T17N R17E S23 Spot shock	Longnose dace	65*	1.5	3.5	2.6				
	Northern redbelly dace	118*	2.0	2.7	2.3				
	Smallmouth bass	1			4.3				
	White sucker	8	4.9	7.9	6.0				
Whitetail Creek (10/25/04 T10N R10E S16 Above Exclosure 295 ft	Brook trout	204	2.2	7.8	3.9				
In exclosure 295 ft	Brook trout	170	2.1	7.8	3.8				

1 sub sample measured

Table 11. Mean number of trout (≥ 10 inches total length) for the 6 years before and 4 years after stream restoration and change for the past 3 years on three sections of Big Spring Creek.

Section	# /mile before	#/mile after	Change (before and after)	Change 2002 - 2004
Burleigh	494	603	22%	-23%
Brewery Flats	618	851	36%	+66%
Carroll Trail	2015	2191	0.9%	-36%

Trout condition in Big Spring Creek - Historical Wr values for rainbow and brown trout are listed in Appendices 4 - 9. In all sections, Wr typically exceeds 100 for rainbow trout less than 10 inches long (Figure 24), and drops considerably for longer rainbow trout. This trend is present but not nearly as pronounced for brown trout (Figure 25, Appendices 7 - 9). From 1995 – 2004, Carroll Trail rainbow trout Wr was higher than the two long-term monitoring sections above town; this difference was most pronounced for rainbow trout exceeding 12 inches (Figure 24). In 2004, rainbow trout Wr was lower than the long term mean for all size groups of rainbow trout except for 6 inch fish in both the Carroll Trail and Brewery Flats section. In the hatchery section, rainbow trout Wr for fish less than 11 inches was generally lower than other areas (Figure 24). Brown trout in the Hatchery Section generally had the highest Wr of any section (Figure 25). MacConnell (2004) found neoplastic lesions in the GI tract of brown trout sampled immediately below the lower hatchery and determined that these tumors may have been induced by chronic, long-term exposure to a contaminant and the cellular changes in fish could be associated with starvation. The Wr data do not indicate the brown trout are starving. Brown trout Wr usually exceeded 100, indicating these fish are in balance with food supply (Flickinger and Bulow 1993).

Whirling disease - Twenty YOY rainbow and 40 YOY brown trout collected on November 12, 2004, were sacrificed for whirling disease testing. One of the rainbow trout had a grade 1 (low-level) infection (Staigmiller 2005). In 2003, 25 rainbow trout and 36 brown trout were sampled from 3 sections of Big Spring Creek. One rainbow trout had a grade 1 infection. Both infected fish were captured downstream of Lewistown. These were the first reports of whirling disease infection in Big Spring Creek. Wild trout had been tested from 1995 – 2003 and no infection was found (Table 12). In 2005, caged rainbow trout will be placed on several sections of Big Spring Creek to evaluate the whirling disease infection level.

Brown trout redds were counted on 8 sites along Big Spring Creek from 12/6 – 12/15. Redd counts were lower than the previous two years at five of the sites, but increased at Brewery Flats FAS, Upper Hatchery (Lion's Park), and Lazy KB FAS (Table 13). The count at Brewery Flats increased from 70 redds last year to 159 this year. This increase was primarily due to 70 more redds in the restored section. The Upper Hatchery site had 14 redds this year compared to 6 redds two years ago. At both Carroll Trail and Reed & Bowles, counts about 50% of previous years. Redd counts at Hruska FAS and Burleigh FAS decreased slightly. The Gies site on upper spring creek was sampled for the first time this year. This reach corresponds to the hatchery electrofishing section on the upper creek, had 37 redds. This reach has a higher gradient with larger substrate and higher velocities than most of the creek and consequently less spawning habitat available.

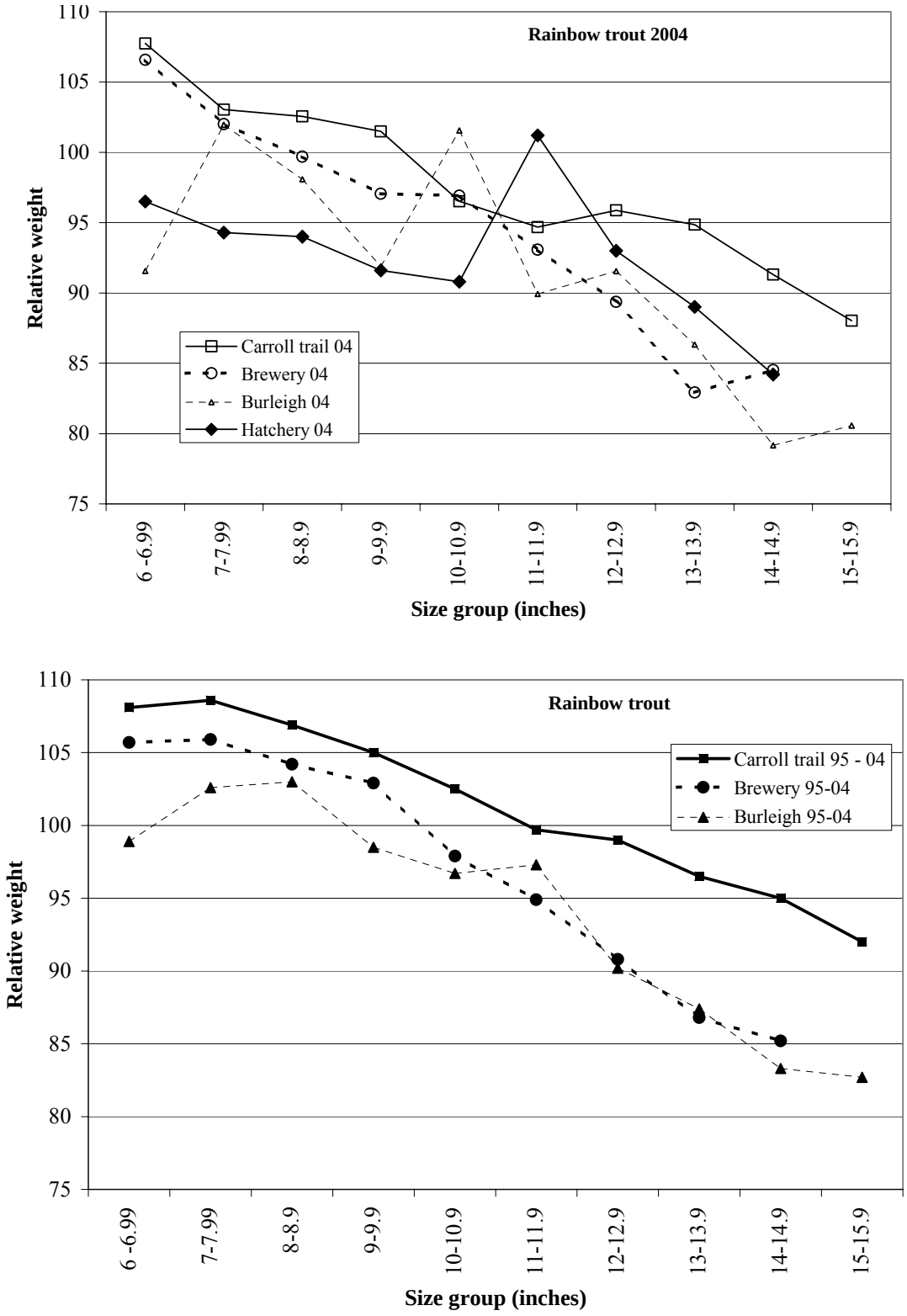

Figure 24. Mean Wr of rainbow trout by size on three sections of Big Spring Creek from 1995 – 2004 and on four sections of Big Spring Creek in 2004.

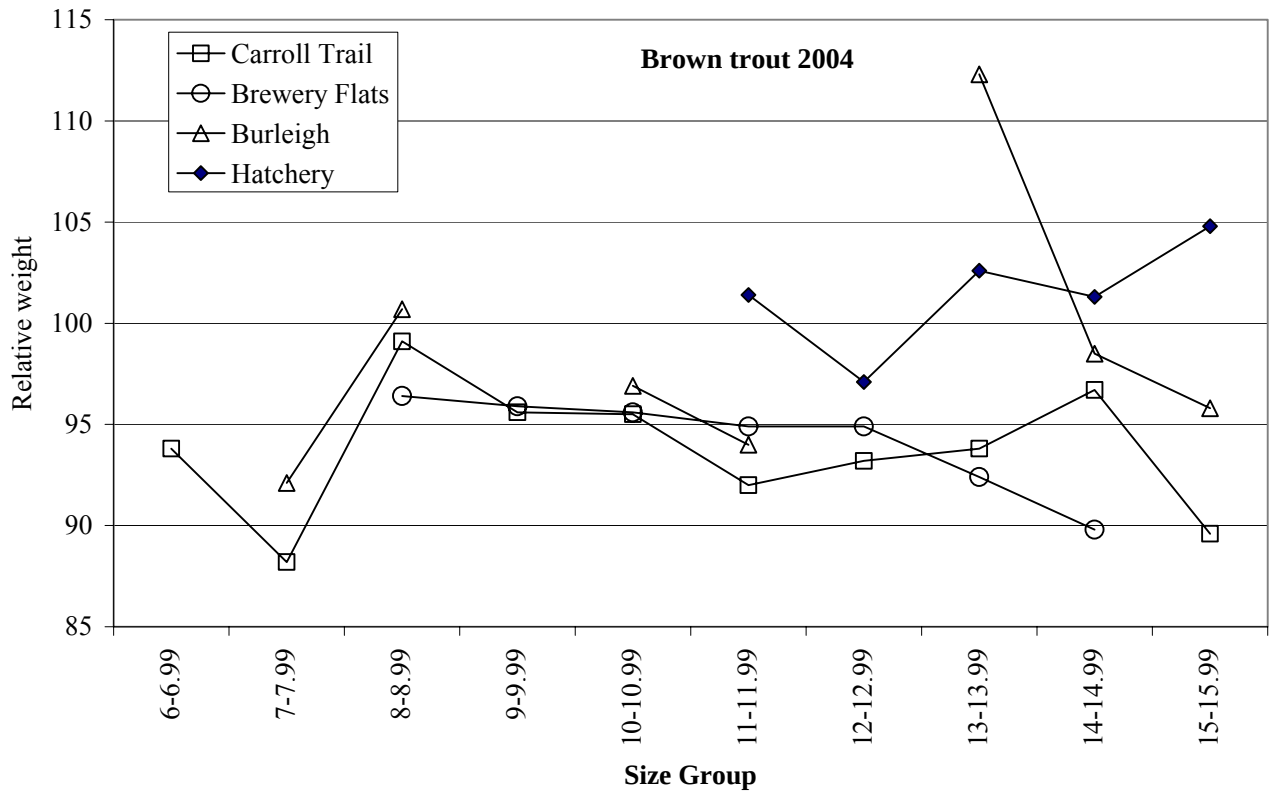

Figure 25. Brown trout Wr on four sections of Big Spring Creek in 2004.

Table 12. Historical results for whirling disease testing in Big Spring Creek. All positive results were at the level 1 infection.

Date	Area Collected	Species	Size (in.)	Number of Fish Tested	Number Positive	Percent Positive
Feb. 1995	Burleigh FAS	Rainbow Trout	2.8-5.2	31	0	0.0%
Apr. 1995	Brewery Flats/ Hruska (pooled)	Rainbow Trout	2.7-6.2	24	0	0.0%
Sept. 1995	Brewery Flats	Rainbow Trout	< 9	32	0	0.0%
Apr. 1996	Burleigh FAS	Rainbow Trout	2.4-4.5	29	0	0.0%
Aug. 1996	Carroll Trail FAS	Rainbow Trout	2.7-9.4	40	0	0.0%
Aug. 1997	Carrol1 Trail FAS	Rainbow Trout	3.5-7.7	17	0	0.0%
Nov. 1997	Carroll Trail FAS	Brown Trout	3.4-5.8	17	0	0.0%
		Rainbow Trout	2.5-5.7	44	0	0.0%
Nov. 2000	Brewery Flats	Rainbow Trout	2.7-3.7	15	0	0.0%
	Carroll Trail FAS	Brown Trout	3.8-5.7	14	0	0.0%
		Rainbow Trout	2.8-5.5	31	0	0.0%
Nov. 2001	Brewery Flats	Rainbow Trout	2.3-3.7	23	0	0.0%
	Carroll Trail FAS	Brown Trout	2.9-4.4	8	0	0.0%
		Rainbow Trout	2.7-5.2	31	0	0.0%
Oct. 2002	Lazy KB FAS	Rainbow Trout	3.3-4.2	10	0	0.0%
Nov. 2002	Carroll Trail FAS	Brown Trout	3.6-5.5	30	0	0.0%
		Rainbow Trout	3.1-5.2	20	0	0.0%
Dec. 2003	Brewery Flats	Brown Trout	3.8-6.4	4	0	0.0%
		Rainbow Trout	2.9-5.2	11	0	0.0%
	R&B FAS	Brown Trout	4.6-6.7	12	0	0.0%
		Rainbow Trout	3.5-4.3	4	1	25.0%
	Carroll Trail FAS	Brown Trout	3.8-6.4	14	0	0.0%
		Rainbow Trout	2.9-5.2	21	0	0.0%
Nov. 2004	Carroll Trail FAS	Brown Trout	3.8-6.3	40	0	0.0%
		Rainbow Trout	2.6-5.9	20	1	5.0%
April 2005	Lower Hatchery	Rainbow Trout	4.0-5.9	60	0	0.0%

Table 13. Brown trout redd counts on Big Spring Creek in 2004.

Section	Date	Number of redds	Section length (ft)	Number/1000 ft. 2002	2003	2004
Upper Hatchery	12/15/04	14	600			23
Gies	12/14/04	37	3600			10
Burleigh	12/13/04	168	5860	59	40	29
Brewery Flats	12/6/04	159	5104	12	14	31
Lazy KB	12/13/04	15	900		16	17
Carroll Trail	12/15/04	79	4382			18
Reed & Bowles	12/14/04	48	3168			15
Hruska	12/14/04	89	1425	109	81	62

Habitat measurements were taken at Brewery Flats before and 4 years after the stream restoration project was completed (Table 14). Total stream area increased by about 50% and pools increased substantially at Brewery Flats. Prior to the project, pools were formed by bedrock or culverts. After the project most pools were meander pools (Appendix 10). The mean pool depth increased by about 0.8 feet and overall depth increased slightly even though the flow was about 20% lower than 1999. Even within 4 years of project completion bank stability had increased substantially. By January 2005 undercut banks were still much less than prior to the project. Coir fabric (coconut fiber matting) was used on nearly all the restored banks at Brewery Flats and has only begun to disintegrate in the past 2 years allowing undercuts to form.

Flow measurements

Big Spring Creek flows were monitored using a Stevens Recorder near the Ash Street Bridge, immediately downstream of Big Casino Creek (Figure 26) and an AquaRod at the Reed and Bowles FAS downstream of Lewistown (Figure 27). Figure 19 shows the location of the stations. MFWP has operated an AquaRod installed at the downstream site periodically since 2003. Equipment malfunction and high flows have resulted in limited data at the Reed and Bowles site. In 2004, accurate data was collected until mid-July. Data from both sites indicate that MFWP Murphy Right of 110 CFS is often not met. In 2004, winter flows are often lower than 100 cfs (Figure 26) near Ash Street and by mid July flows at Reed and Bowles were well below 100 cfs (Figure 27). Discharge measurements were taken on several dates at the Reed and Bowles FAS and the lowest flow measured was 62.5 cfs on 7/30/04 (Appendix 11). Several large irrigation ditches divert water from Big Spring Creek, downstream of Lewistown and the Ash Street Bridge, so it was not surprising to observe low flows downstream of Lewistown.

Table 14. Pre and post habitat measurements taken at Brewery Flats.

	Pre 9/1999	Post 1/2005
Flow – CFS	127	107
Area (ft^2)	88,698	130,431
% Fast	91.3	62.0
% Slow (Pools)	8.7	38.0
Mean Max depth Pools (ft)	3.83	4.65
Pocket pools (N)	46	3
Depth (ft)	1.80	1.27
Overall		
Mean Depth (ft)	1.41	1.49
Mean width (ft)	35.3	36.6
% stable banks	15.6	83.1
% undercut banks	63.2	28.9

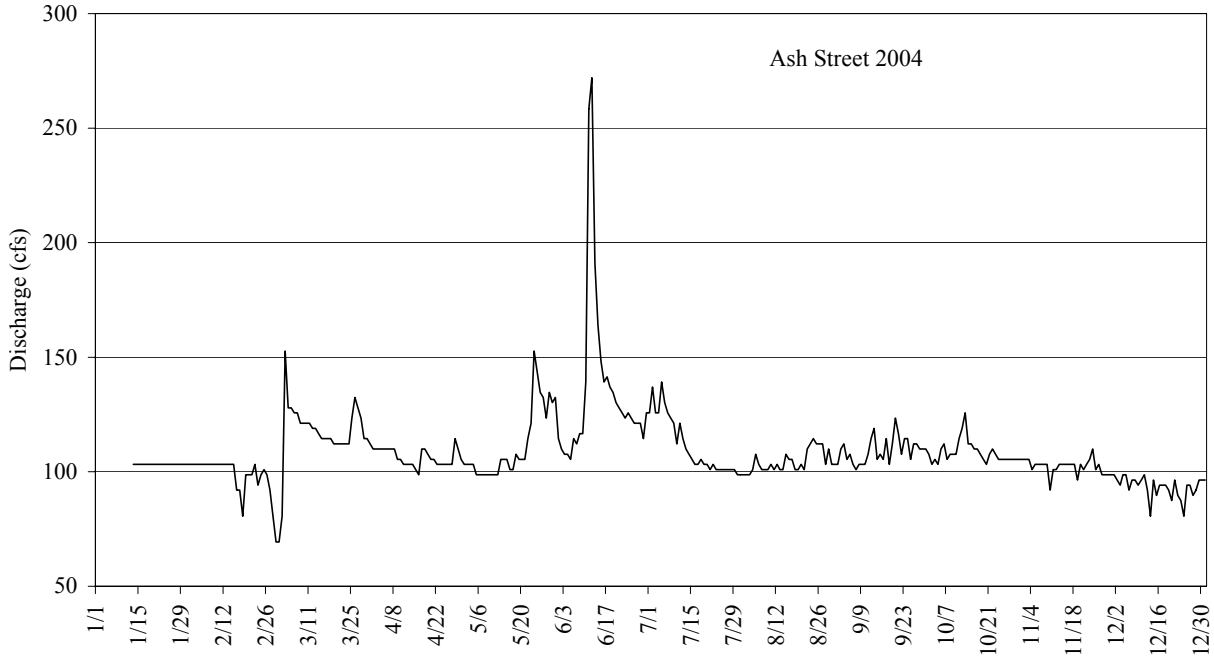

Figure 26. Big Spring Creek flow at Ash Street Bridge (river mile 24) in 2004.

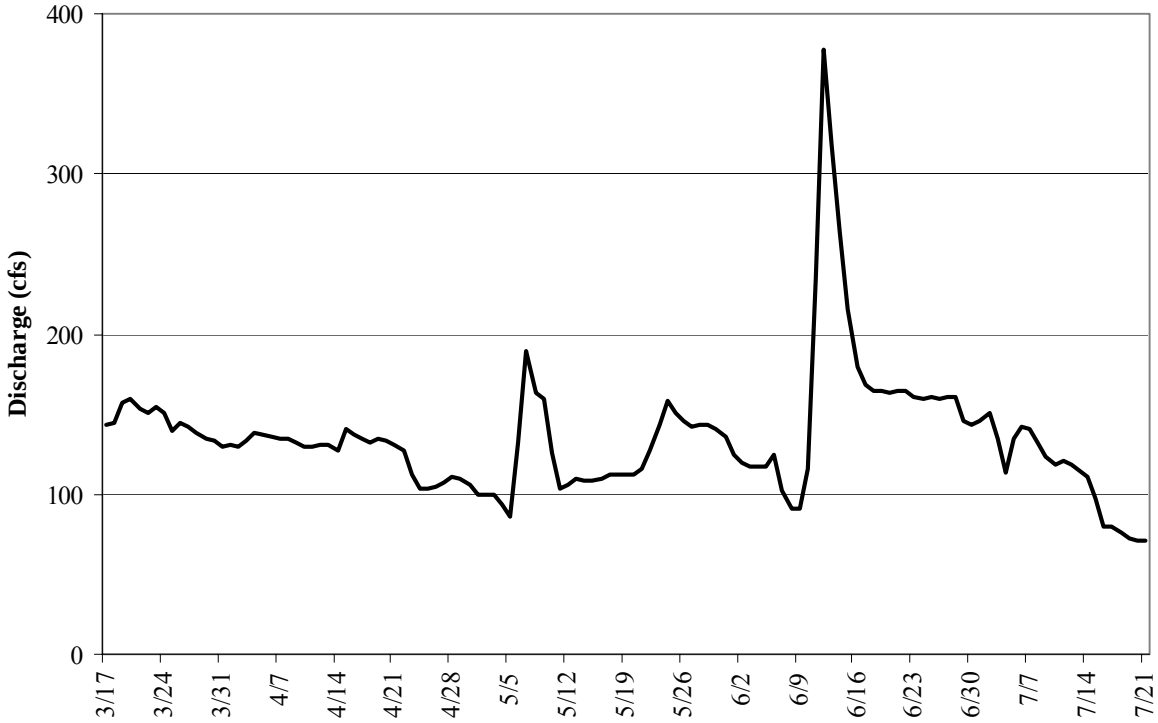

Figure 27. Big Spring Creek flow near Reed and Bowles FAS (river mile 18.8) March – July, 2004.

Judith River

Data from a USGS gauging station (river mile 8) indicate that the Judith had more water in late summer 2004 than in 2003 (Berkas et al 2005, Berkas et al. 2004). In 2004, flows always exceeded 100 cfs near the mouth and were only below the MFWP instream water reservation of 160 cfs for about 2 weeks in mid-summer. In 2003, flows reached a low of 55 cfs and instream flows were not met for several weeks between mid-July and early September. Flows were recorded using an AquaRod, four miles upstream of the mouth of Ross Fork Creek (river mile 92), from April – October 2004. The maximum flows of 400 cfs occurred in mid June and MFWP instream water reservation of 25 cfs was only met from early June – mid-July (Figure 28). In 2003, flows were generally lower than in 2004 (Tews et al. 2005).

Three sections of the mainstem Judith River were electrofished in 2004. Fish statistics are listed in Table 10. The headwaters of the Judith were also surveyed in 2004 and results are discussed in companion report (Moser et al. 2005). The section above the Ross Fork is located in the same area as our AquaRod and has had major dewatering problems in recent years. Three sucker species, two minnow species, mottled sculpin (*Cottus bairdi*) and stonecats (*Noturus flavus*) were the only species captured (Table 10). This stream reach was electrofished in June 2000 and brown trout and mountain whitefish were captured in addition (Tews et al. 2001). At the Beckman Wildlife Management area section, electrofishing did not capture as many fish as in 2002 (Yerk et al. 2005). In 2002, rainbow trout were one of the most common species captured at the Beckman Wildlife Management Area Section. In 2004, longnose sucker and shorthead redhorse were the most common species at the Beckman site. On the PN Ranch, 4.2 (non-contiguous) miles of the lowest 9 miles of the Judith River were electrofished. Species distribution was similar to results from 2002 (Yerk et al. 2005). During both years shorthead redhorse and goldeye (*Hiodon alosoides*) were very common. This year, 3 blue sucker (*Cycleptus elongatus*), 2 northern pike and 1 river carpsucker (*Carpiodes carpio*) were captured, while trout and burbot (*Lota lota*) were not. With the exception of northern pike, all of these species have previously been reported from this reach (MFWP 1989).

Larval fish sampling

Two sites on the Judith River, the PN ranch site (river mile 9 or 7) and the Anderson Bridge site (river mile 21.7) were sampled weekly for larval fish from 4/20 – 7/19. Physical measurements are summarized in Appendix 12. Mean daily flow ranged from 156 – 1180 cfs during the sampling period (Berkas et al. 2005). Larval fish densities were highest in July (Table 15). The PN section had the vast majority of the 105 eggs sampled but only slightly more than half of the 224 larvae sampled (Table 16).

A total of 16 larval fish and egg samples were sent to Darrell Snyder, Colorado State University, for identification. Most samples contained multiple specimens. His analysis positively identified shorthead redhorse, river carpsucker, *Hybognathus sp*., *Catostomus sp*., emerald shiner *(Notropis atherinoides)* and common carp. One April larvae was identified as "probably blue sucker" and several samples were identified as a probable sturgeon or sicklefin chub *(Macrhybopsis sp.).* Sicklefin and sturgeon chub have not been recorded from the Judith River, but sturgeon chub are found in the Missouri at the mouth of the Judith. Walleye or sauger eggs were suggested as a possibility; but the samples were from early June, which is likely too late for *Sander sp*. eggs. One salmonid larva was sampled in May (Table 16). Cyprinid larvae were the most common (Table 16) followed by catostomid larvae.

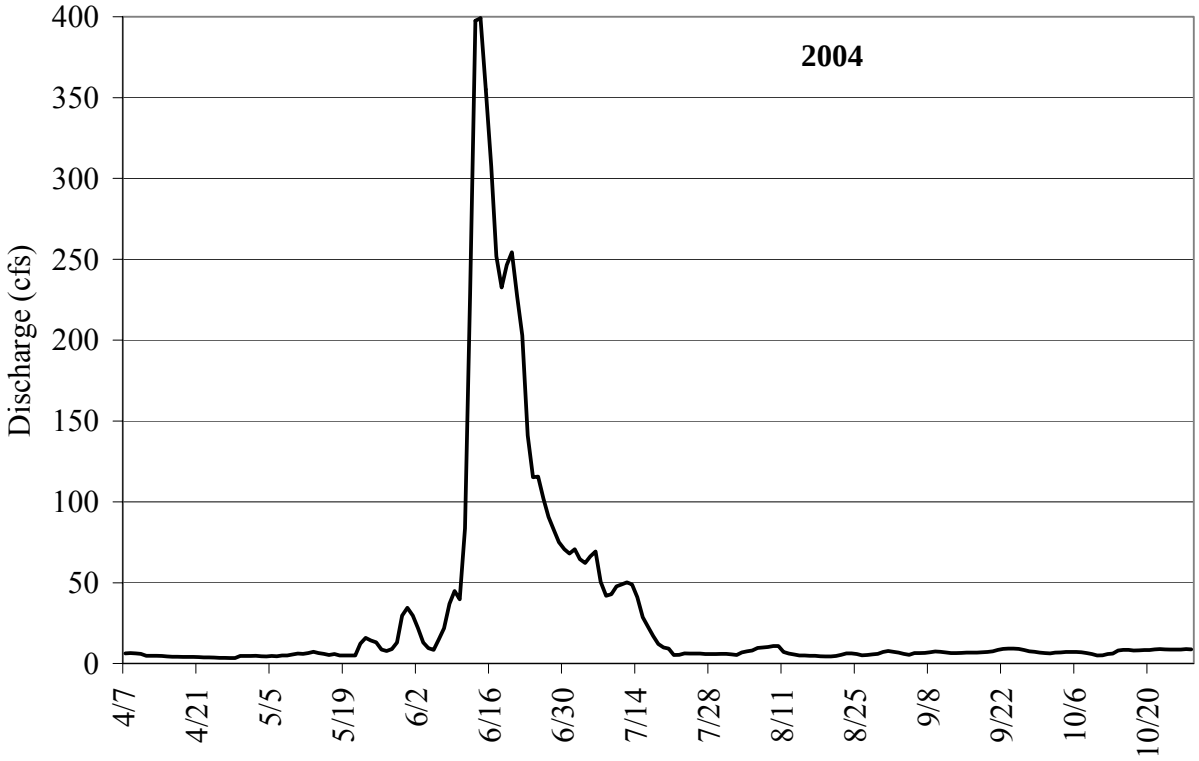

Figure 28. Flow information collected on the Judith River, four miles upstream of Ross Fork Creek in 2004.

Table 15. Average densities (number/10,000 ft^3) of larvae sampled with ½ meter round plankton nets in the Judith River, 2004. Blanks indicate no specimens were collected.

Taxon[1]		Sampling Period														Total #
	Station[2]	4/20	4/26	5/4	5/10	5/16	5/25	6/1	6/8	6/15	6/22	6/28	7/6	7/12	7/19	Larvae
Catostomid	PN		4.1	0.9		1.5		4.2	3.4			6.8	4.4	3.5	1.7	66
	AB		2.2		0.6	0.6		9.3	0.9		0.5	2.1		3.1	0.5	42
Cyprinid	PN								0.4	0.5		1.7	14.4	6.2	6.4	57
	AB									3.4		11.7	6.1	6.1	5.9	59
Salmonid	PN					0.5										1
	AB															0
Goldeye egg	PN								1.7	0.5	0.5					6
	AB							0.4		1.5	0.5					5
Unknown egg	PN		7.3	0.4		1.0	2.4	1.6	2.1	2.1	18.5	5.1	1.9	0.4		95
	AB		0.5			1.7				0.5	1.1				1.5	10

1: As identified by MFWP staff, 2 : PN = PN Ranch; AB = Anderson Bridge

Table 16. Total numbers of fish larvae sampled with ½ meter round plankton nets in the Judith River, 2004.

		Sampling Period														Total #
	Station[1]	4/20	4/26	5/4	5/10	5/16	5/25	6/1	6/8	6/15	6/22	6/28	7/6	7/12	7/19	Larvae
Catostomid	PN		14	2		3		8	8			12	7	8	4	66
	AB		4		1	1		23	2		1	4		5	1	42
	Both	0	18	2	1	4	0	31	10	0	1	16	7	13	5	108
Cyprinid	PN								1	1		3	23	14	15	57
	AB									7		22	8	10	12	59
	Both	0	0	0	0	0	0	0	1	8	0	25	31	24	27	116
Salmonid	PN					1										1
	AB															0
	Both	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
All Larvae	Total		18	2	1	5	0	31	11	8	1	41	38	37	32	225
Goldeye	PN								4	1	1					6
egg	AB							1		3	1					5
	Both	0	0	0	0	0	0	1	4	4	2	0	0	0	0	11
Unknown	PN		25	1		2	2	3	5	4	40	9	3	1		95
egg	AB		1			3				1	2				3	10
	Both	0	26	1	0	5	2	3	5	5	42	9	3	1	3	105
All Eggs		0	26	1	0	5	2	4	9	9	44	9	3	1	3	105

1: As identified by MFWP staff 1: PN = PN Ranch; AB = Anderson Bridge

Big Casino Creek - Brown trout up to 1.78 pounds and small yellow perch up to 4.4 inches were the only game species captured during electrofishing on Lower Big Casino Creek. Yellow perch were the most common species (Table 10). Big Casino Reservoir, located about 1.3 miles upstream of the sampling site, has a dense yellow perch population, which was likely the origin of these fish.

East Fork Big Spring Creek – Brown trout up to 2.12 pounds were captured and mottled sculpin and longnose dace were the most common species (Table 10).

Little Casino Creek – Two temperature loggers were placed in Little Casino Creek in 2004, one below the lower Frog Pond and one about one mile upstream in the CMR Refuge. Little Casino runs through 4 ponds between the two loggers. Daily mean temperature below the Frog Ponds was similar to those seen in 2003 (Horton and Tews 2005) but higher than recorded upstream (Appendix 3). Mean July temperature was 65.6˚ F below the Frog ponds and 57.7˚ F upstream. The highest mean daily high temperature in July was 69.2˚ F at both sites, while the mean daily low temperature in July was 62.9˚ F below the Frog Ponds and 48.6˚ F at the refuge. The highest temperatures occurred in July with 74.7˚ F below the ponds and 73.5˚ F at the upper site. Brown trout up to 1.9 pounds and small rainbow trout were the only game fish captured when Little Casino Creek was electrofished near the mouth. White suckers were the most common species (Table 10).

Warm Spring Creek - An AquaRod was installed on Warm Spring Creek in June 2004. The discharge rating curve was based on flows taken at 106, 64 and 77 cfs. Flows were as low as 50 cfs, did not exceed 100 cfs except in late fall and did not reach the instream flow of 110 cfs during the measurement period of 6/22 – 1/1 (Figure 29). Historic measurements from Warm Springs Creek are much higher. The average base flow immediately downstream from the spring was 151 for water years 1968 –1971 (MFWP 1989) and the springs' discharge was reported as 125 cfs (Decker-Hess 1986). An irrigation ditch at river mile upstream of the AquaRod has the capacity to divert about 50 cfs, so low summer flows were not surprising.

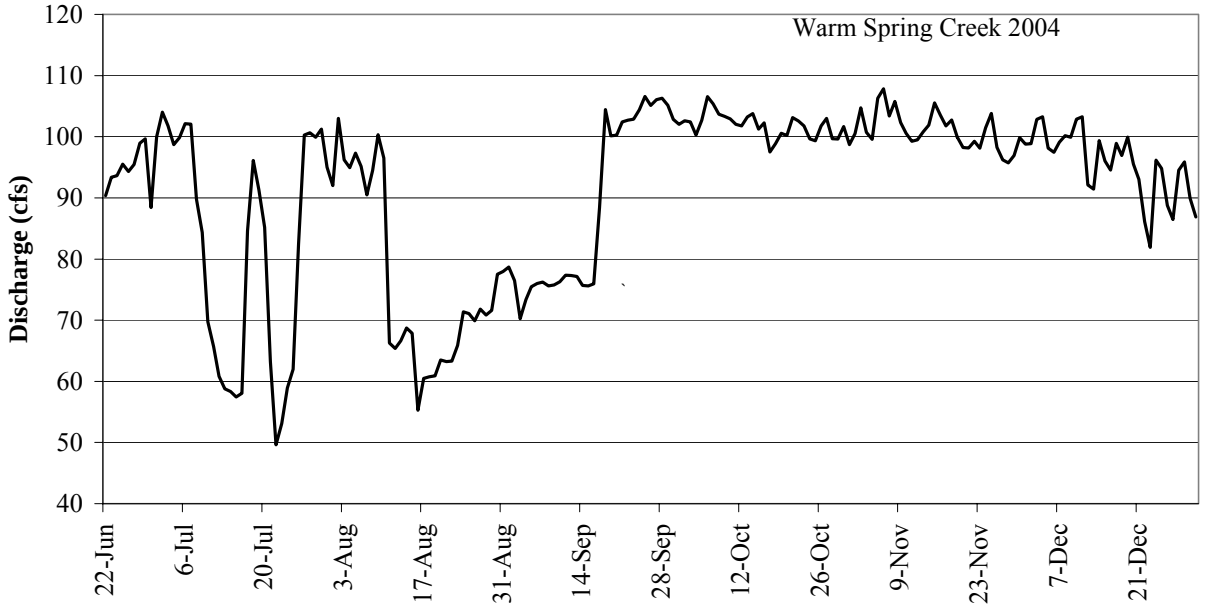

Figure 29. Warm Spring Creek discharge about 0.2 mile downstream of Meadow Creek (river mile 19.8).

Musselshell drainage

South Fork Flatwillow Creek – Brook trout *(Salvelinus fontinalis)* numbers were low in the two sampled sections. There were only 6 brook trout captured at the upper site (Table 10). A total of 26 were captured at the lower site, but mean total length was only 3.1 inches. The lower site has typically had low brook trout populations during the last decade (Tews et al. 1999, Tews et al. 2001). In contrast, a site located just above the upper site had excellent populations in 2000, of 96 ≥4 inches per 1000 ft.

Whitetail Creek – This water was sampled to compare brook trout populations within and above a fenced enclosure. Brook trout was the only species sampled. Brook trout populations were dense in both sections but the population estimate was higher upstream of the enclosure (Table 17). Size structure was similar in both sections. The mean total length was 5.4 inches for brook trout ≥4 inches in both sections the largest fish was 7.8 inches long in each section (Table 10).

Table 17. Depletion removal estimates for brook trout ≥4 inches conducted on 10/25/2004 on two 295 ft sections of Whitetail Creek.

Section	#/1000 ft (95% CI)	Average total length (inches)	Probability of capture
In enclosure	251 (241 – 268)	5.4	3- pass
150 ft above enclosure	305 (295 – 324)	5.4	0.935

Habitat Protection

In the Lewistown area, 25 Natural Streambed and Land Preservation Act "310" permits and four "124" permits were processed during 2004.

Principal Fish Species Involved

Arctic grayling	*Thymallus arcticus*
Black crappie	*Pomoxis nigromaculatus*
Bluegill	*Lepomis macrochirus*
Blue sucker	*Cycleptus elongatus*
Brook trout	*Salvelinus fontinalis*
Brown trout	*Salmo trutta*
Burbot	*Lota lota*
Common carp	*Cyprinus carpio*
Channel catfish	*Ictalurus punctatus*
Emerald shiner	*Notropis atherinoides*
Flathead chub	*Platygobio gracilis*
Goldeye	*Hiodon alosoides*
Largemouth bass	*Micropterus salmoides*
Longnose sucker	*Catostomus Catostomus*
Mountain sucker	*Catostomus platyrhynchus*
Mottled sculpin	*Cottus bairdi*
Mountain whitefish	*Prosopium williamsoni*
Northern pike	*Esox lucius*
Northern redbelly dace.	*Phoxinus eos*
Rainbow trout	*Oncorhynchus mykiss*
River carpsucker	*Carpiodes carpio*
Sauger	*Sander canadense*
Spottail Shiner	*Notropis hudsonius*
Shorthead redhorse	*Moxostoma macrolepidotum*
Stonecat	*Noturus flavus*
Walleye	*Sander vitreus*
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*
White sucker	*Catostomus commersoni*
Yellowstone cutthroat trout	*Oncorhynchus clarki bouvieri*
Yellow perch	*Perca flavescens*

Code Numbers of Waters Referred to in this Report:

16-310	Big Spring Creek, Sec 2
16-0780	Big Casino Creek
16-900	Cottonwood Creek
16-1340	East Fork Big Spring Creek
16-1640	Hansen Creek
16-1800	Judith River, Section 1
16-1820	Judith River, Section 2
16-1965	Little Casino Creek
16-3520	South Fork Judith
16-3920	Warm Spring Creek
16-4300	Ackley Lake
16-4260	Upper Carter Pond
16-4261	Lower Carter Pond
16-4461	Benes Pond #3 (Nelson)
16-4628	Big Casino Reservoir
16-4950	East Fork Spring Creek Reservoir
16-5535	Hanson Creek Reservoir
16-6070	Jakes Reservoir
16-6705	Frog Pond, Lower
16-7920	Rhoda Lake
16-8657	Frog Pond, Upper
18-2475	Whisker Reservoir
18-5610	South Fork Flatwillow Creek
18-6780	Whitetail Creek
18-7750	Bair Reservoir
18-7560	Drag Creek Reservoir
18-7565	Dry Blood Reservoir
18-8380	Martinsdale Reservoir
18-9500	Yellow Water Lake
18-8700	Payola Reservoir
18-8720	Petrolia Reservoir
18-9150	South Fork Dry Blood Reservoir
18-9481	Wolf Coulee #2 (Lower Wolf Coulee)

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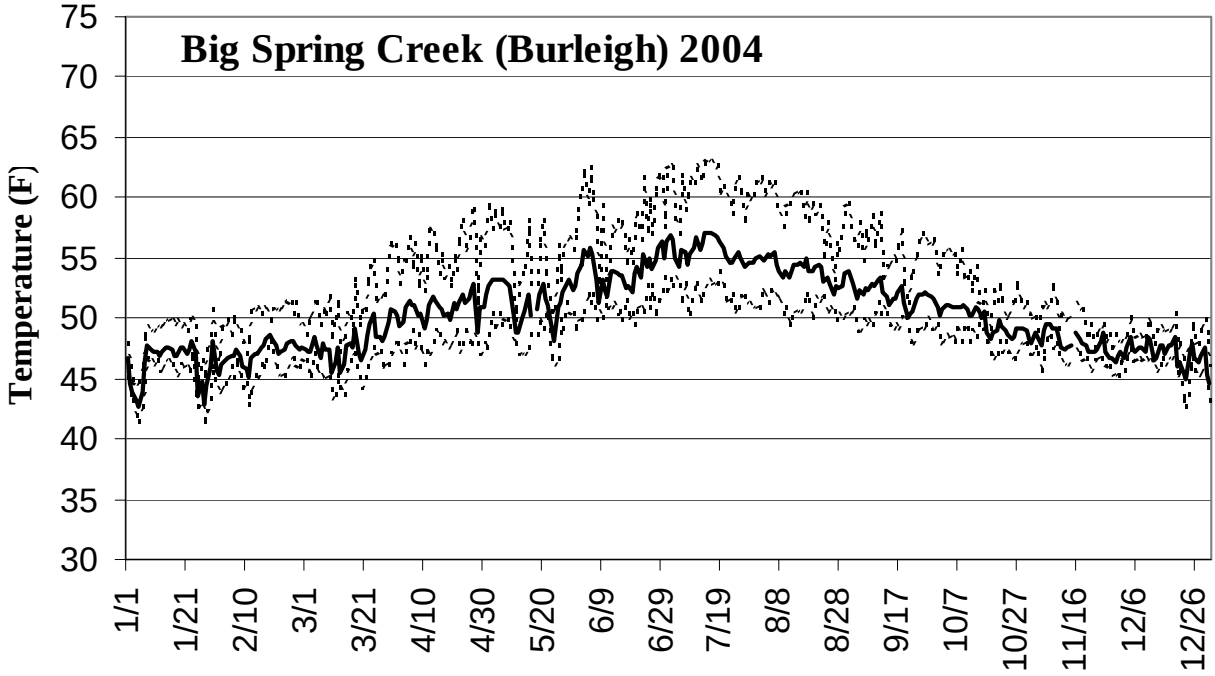
Appendix 1. Total length at age from walleye and yellow perch spines collected at Big Casino Reservoir 2001- 2004.

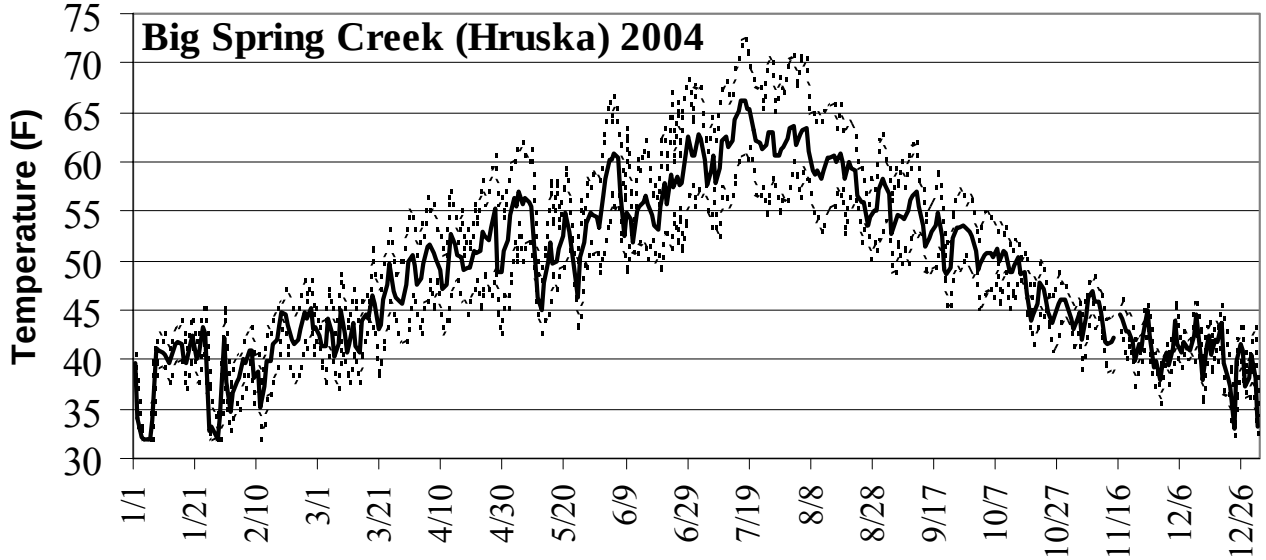
Species	Year collected	Length (inches) N	Min	Max	Mean
Walleye					
			Age 2		
	2001	7	8.5	9.4	8.9
	2002	2	10.2	10.8	10.5
	2003	19	8.6	10.8	9.8
	2004	2	9.1	9.5	9.3
			Age 3		
	2001	18	9.6	10.6	10.0
	2002	5	12.0	12.7	12.4
	2003	21	11.4	13.4	12.6
	2004	16	10	12.7	11.3
			Age 4		
	2001	38	10.7	14.9	11.9
	2002	5	13.0	13.8	13.3
	2003	7	13.4	13.9	13.7
	2004	17	12.1	15.4	13.7
			Age 5+		
	2001	2	17.1	21.1	19.1
	2002	5	13.8	14.9	14.4
	2003	14	14.8	22.0	16.9
	2004	14	12.8	26.1	17.4
Yellow perch			Age 1		
	2003	39	6.7	8.6	8.1
			Age 2		
	2004	9	6.4	7.7	7.0
			Age 3		
	2004	12	7.8	10.7	10.1

Appendix 2. Location of thermographs deployed in the Lewistown vicinity 2004.

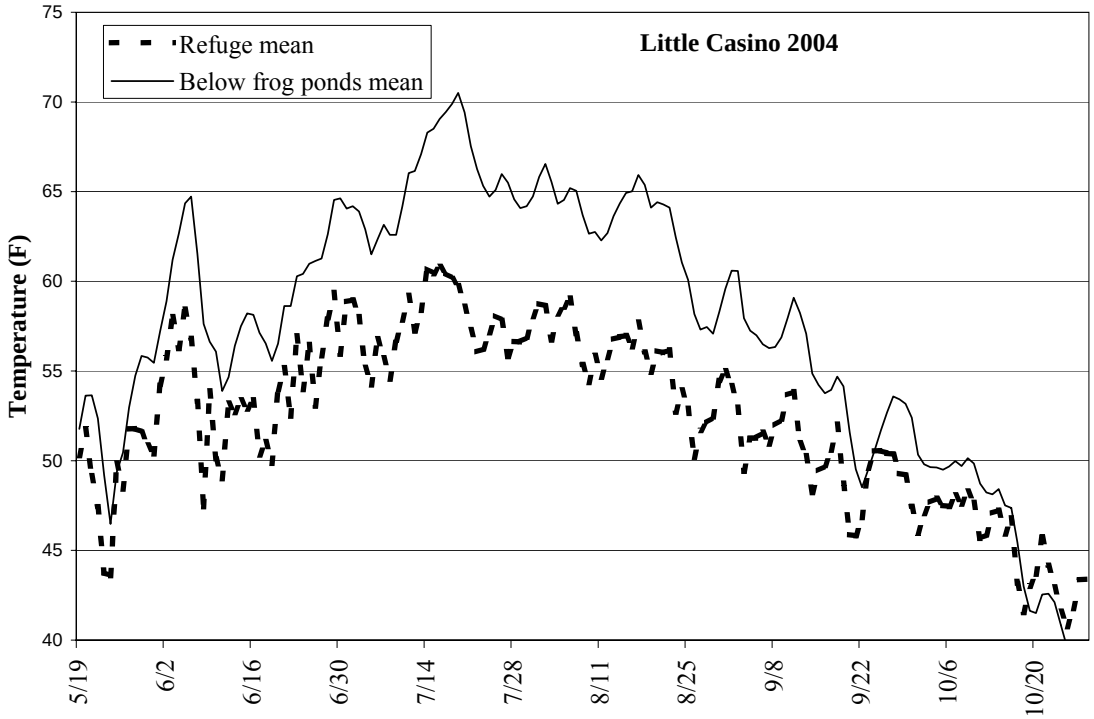
Stream	Location	**Dates**
Big Spring Cr.	Burleigh FAS	Yearlong
Big Spring Cr.	Hruska FAS	Yearlong
Judith R., S. Fk.	Below Big Hill Cr.	6/11/2004-9/7/2004
Judith R., S. Fk.	Below Russian Cr.	6/11/2004-9/7/2004
Judith R., S. Fk.	Below Bluff Mountain Cr.	6/11/2004-9/7/2004
Judith R., S. Fk.	Below Dry Pole	6/11/2004-9/7/2004
Little Casino Cr.	Below ponds	5/19/2004-10/27/2004
Little Casino Cr.	Above ponds	5/19/2004-10/28/2004
N. Fork Running Wolf Cr.		6/29/2004-10/12/2004
S. Fk. Bonanza Cr.	0.5 miles below USFS road	7/7/2004-9/27/2004

Appendix 3. Temperature measurements taken from Big Spring Creek and Little Casino Creek, tributary to Big Spring Creek in 2004.





Appendix 3. Continued.



Appendix 4. Mean Wr of rainbow trout by size group and year in the Burleigh section of Big Spring Creek.

	Size Group (in)									
Year	6 -6.99	7-7.99	8-8.9	9-9.9	10-10.9	11-11.9	12-12.9	13-13.9	14-14.9	15-15.9
1967	100.2	96.1	91.3	95.5	91.1	86.6	87.8	82.5	99.4	75.4
1968	120.8	130.3	110.8	105.6	101.8	98.7	94.4	88.8	87.0	85.7
1974	112.4	111.6	110.7	108.7	102.5	101.1	99.9	97.2	93.7	96.2
1976	91.4	97.0	96.5	98.3	95.0	90.7	92.8	87.3	88.0	83.7
1977	98.9	103.6	94.2	94.4	93.1	90.4	86.8	88.1	82.1	84.9
1978	101.1	105.2	106.1	96.2	91.9	95.3	90.1	87.7	89.4	93.8
1979	92.8	97.9	100.9	90.6	96.0	91.0	91.8	88.3	85.8	87.4
1980	94.0	105.9	108.3	106.8	103.8	99.0	98.2	98.0	96.4	92.9
1981	90.1	92.4	94.8	93.9	92.0	88.0	89.1	89.0	90.6	87.6
1982	97.6	102.6	102.1	102.1	98.4	97.8	91.8	88.7	89.7	84.2
1983	103.8	95.1	111.0	102.0	104.4	99.6	96.1	96.8	92.2	87.6
1984	107.8	98.8	108.6	108.6	104.4	99.4	99.0	95.7	94.5	92.3
1986	114.0	117.4	114.8	110.4	106.1	103.6	101.3	98.4	95.6	92.0
1988	106.1	101.8	103.0	108.4	103.3	100.5	96.8	93.5	89.5	88.4
1990	96.3	100.5	102.4	104.4	106.9	99.5	93.8	91.0	89.5	91.4
1992	111.7	104.6	130.4	94.3	115.4	105.6	104.7	100.9	100.4	104.2
1994	108.8	103.1	100.0	101.3	99.1	94.8	93.2	87.0	85.7	86.4
1995	119.8	113.5	122.1	105.0	108.2	101.1	93.4	90.3	86.7	85.0
1996	87.2	95.7	94.8	99.6	97.5	93.3	92.7	89.1	82.2	79.8
1997	107.4	120.5	113.8	106.3	97.5	91.9	89.0	89.2	86.3	83.8
1998	91.9	95.8	90.8	92.4	90.4	87.4	81.5	80.9	76.5	86.9
1999	102.7	101.6	97.8	94.9	92.7	90.2	89.0	85.6	80.5	82.0
2000	95.0	92.0	116.0	99.2	95.3	99.3	95.8	91.0	87.3	85.7
2001	95.3	100.7	98.7	95.7	95.1	95.8	90.8	88.4	86.6	81.9
2002	107.7	106.0	98.9	101.1	97.0	128.1	91.3	89.4	86.4	84.0
2003	90.8	98.2	99.0	98.6	91.5	95.7	86.5	84.2	81.5	77.0
2004	91.6	102.0	98.1	91.9	101.6	89.9	91.5	86.3	79.2	80.6
Mean	101.4	103.3	104.3	100.2	99.0	96.8	92.9	90.1	88.2	86.7
Mean 95 -04	98.9	102.6	103.0	98.5	96.7	97.3	90.2	87.4	83.3	82.7

Appendix 5. Mean Wr of rainbow trout by size group and year in the Brewery Flats section of Big Spring Creek.

	Size Group (in)								
Year	6 -6.99	7-7.99	8-8.9	9-9.9	10-10.9	11-11.9	12-12.9	13-13.9	14-14.9
1982	98.1	100.9	98.8	96.8	94.6	91.6	87.2	85.6	88.1
1995	116.8	123.1	110.3	114.2	105.9	102.4	95.4	85.7	85.6
1996	100.2	101.9	104.9	101.0	96.5	94.8	89.5	85.2	78.4
1997	95.8	100.3	104.1	102.3	94.3	90.4	89.4	82.4	76.5
1998	94.5	103.7	101.3	100.9	92.7	90.1	84.2	86.7	82.5
1999	103.7	97.6	99.4	97.8	93.4	90.9	88.3	81.0	84.7
2000	100.9	102.8	105.5	101.8	98.8	96.8	94.4	89.8	88.6
2001	103.3	96.9	101.1	101.7	95.2	93.9	89.9	87.7	86.9
2002	127.0	122.9	116.0	108.2	107.3	102.2	98.5	98.6	96.8
2003	108.1	107.7	100.0	103.6	97.9	94.4	89.5	87.7	87.1
2004	106.6	102.0	99.7	97.0	96.9	93.1	89.4	82.9	84.5
Mean 95-04	105.7	105.9	104.2	102.9	97.9	94.9	90.8	86.8	85.2

Appendix 6. Mean Wr of rainbow trout by size group and year in the Carroll Trail section of Big Spring Creek.

	Size Group									
Year	6 -6.99	7-7.99	8-8.9	9-9.9	10-10.9	11-11.9	12-12.9	13-13.9	14-14.9	15-15.9
1967	107.0	106.0	101.6	97.9	96.7	92.3	89.4	88.9	90.9	80.4
1968	97.6	111.4	104.6	101.3	96.7	96.9	92.7	92.5	88.8	85.5
1974	101.6	107.5	107.6	103.9	101.4	96.4	93.9	94.2	91.2	78.2
1976	103.6	106.2	104.5	102.5	100.3	98.3	98.7	97.2	99.7	97.1
1977	107.5	103.2	104.9	102.1	100.5	97.4	96.4	96.1	95.6	93.3
1978	100.8	98.5	98.4	95.3	95.4	93.0	91.8	92.8	89.6	84.0
1979	111.2	113.8	109.3	110.7	106.9	104.7	102.0	101.6	104.4	97.4
1980	113.3	110.6	107.0	108.5	109.5	106.7	104.1	103.8	103.0	105.0
1981	105.6	103.7	103.5	102.4	101.3	99.6	95.1	96.2	93.8	92.7
1983	121.6	115.1	111.3	109.7	106.3	102.5	101.1	99.7	98.4	98.4
1984	114.9	112.5	109.5	107.7	104.1	101.5	99.8	99.1	98.6	97.3
1986	104.8	107.3	105.5	100.7	101.3	96.8	95.6	91.9	91.4	83.6
1988	107.5	106.8	106.5	106.8	103.4	98.5	95.9	91.1	90.8	83.9
1990	110.8	111.8	113.6	108.3	103.7	99.1	98.6	98.5	95.4	93.5
1992	112.3	143.5	122.8	119.9	114.6	113.3	113.0	111.2	111.1	109.9
1994	106.9	106.6	107.6	108.1	105.1	104.4	100.6	97.2	94.0	95.9
1995	125.0	128.2	121.9	112.6	110.4	103.1	100.8	96.3	90.1	90.0
1996	96.4	119.8	105.8	108.0	104.7	104.3	102.6	99.6	100.4	94.7
1997	110.8	109.8	106.2	103.3	104.1	100.1	98.8	95.6	95.7	87.3
1998	94.4	99.3	102.7	100.3	98.5	96.8	95.1	93.3	93.2	90.2
1999	107.2	99.2	101.8	98.5	101.1	96.0	94.9	92.4	89.8	89.0
2000	99.0	101.1	105.3	103.4	101.5	102.6	102.3	101.1	101.1	101.9
2001	110.4	116.4	107.0	111.2	99.3	98.0	98.5	96.5	95.4	94.3
2002	124.3	101.7	108.7	105.8	105.1	102.2	101.7	97.4	96.0	94.5
2003	105.7	107.4	107.5	105.3	103.6	99.6	99.8	98.0	92.2	90.0
2004	107.7	103.0	102.6	101.5	96.5	94.7	95.9	94.9	91.3	88.0
Mean	108.0	109.6	107.2	105.2	102.8	100.0	98.4	96.8	95.5	92.2
Mean 95 -04	108.1	108.6	106.9	105.0	102.5	99.7	99.0	96.5	95.0	92.0

Appendix 7. Mean Wr of brown trout by size group and year in the Burleigh section of Big Spring Creek.

	Size group					
Year	12-12.9	13-13.9	14-14.9	15-15.9	16-16.9	17-17.9
1967	95.7	96.4	91.5	96.2	90.1	89.4
1968	93.6	92.7	91.1	84.7	89.2	84.8
1974		106.9	98.6	97.9	100.4	95.9
1976	100.2	99.7	93.7	90.8	94.7	92.3
1977	99.2	99.7	96.5	99.7	94.7	91.0
1978	102.8	89.4	102.1	97.3	97.0	94.3
1979		100.3	101.3	102.9	113.2	117.1
1980			104.8	107.1	101.1	100.8
1981		111.9	114.2	99.4	105.0	112.7
1982			107.6	106.4	86.8	91.2
1983	103.9	112.7	102.6	109.4	100.2	97.6
1984	111.8	83.8	103.4	108.2	100.2	111.2
1986	109.6	103.8	104.8	112.2	101.3	98.0
1988	106.2	99.9	100.3	101.9	90.5	97.1
1990		101.3	111.2	102.6	98.2	102.5
1992		104.4	107.7	107.0	101.1	108.1
1994	101.2	96.6	102.1	95.2	93.2	89.3
1995	103.2	98.3	99.2	97.9	96.4	85.1
1996	106.7	87.8	95.0	90.4	88.6	74.9
1997	89.7	107.1	94.3	97.9	83.4	86.1
1998	96.4	88.2	87.9	91.4	84.0	88.0
1999	86.8	98.3	95.6	92.6	89.8	91.5
2000	109.2	94.6		97.8	95.0	98.8
2001	114.1	100.0	101.4	100.2	90.6	92.8
2002		102.8	97.8	101.1	95.9	94.1
2003		102.4	96.1	96.0	92.8	89.3
2004		112.3	98.5	95.8	95.6	89.2
Mean	101.8	99.7	100.0	99.3	95.2	94.9
Mean 95-04	100.9	99.2	96.8	96.1	91.2	89.0

Appendix 8. Mean Wr of brown trout by size group and year in the Brewery Flats Section

Year	Size group						
	10-10.9	11-11.9	12-12.9	13-13.9	14-14.9	15-15.9	16-16.9
1982		102.4		88.3	100.4	96.9	94.0
1995		106.0	102.7	103.2	102.2	99.2	90.9
1996		98.1	90.1	93.5	90.8	85.8	81.5
1997		93.4	93.7	92.3	89.2	84.6	78.6
1998		105.7	99.0	89.7	95.8	94.3	94.1
1999		95.5	98.5	103.3	90.2	91.2	82.5
2000		95.8	97.9	101.1	99.3	94.2	94.2
2001		94.1	96.9	93.3	88.6	87.1	87.8
2002		106.7	109.2	102.8	97.8	101.1	95.9
2003		96.1	95.9	98.5	96.7	92.6	89.1
2004		94.9	94.9	92.4	89.8	87.0	84.7
Mean 95-04		98.6	97.9	97.0	94.0	91.7	87.9

Appendix 9. Mean Wr of brown trout by size group and year in the Carroll Trail Section.

	Size group									
Year	8-8.9	9-9.9	10-10.9	11-11.9	12-12.9	13-13.9	14-14.9	15-15.9	16-16.9	17-17.9
1967	99.1	95.6	91.1	88.4	91.0	89.2	87.2	89.9	93.9	93.0
1968	94.2	93.7	93.6	89.9	92.8	89.9	89.8	90.9	94.5	99.0
1974	108.6	101.5	98.3	90.7	96.3	95.4	91.4	93.8	88.8	95.1
1976	103.7	101.3	98.8	103.1	100.1	96.4	96.6	93.8	89.9	88.7
1977	100.2	100.6	100.7	100.7	96.0	100.1	100.5	102.2	97.3	98.4
1978	92.2	91.5	95.4	91.3	91.5	91.3	90.3	92.4	95.2	97.6
1979	106.2	105.9	103.2	102.0	102.8	98.1	95.4	94.3	92.2	105.9
1980	96.2	105.6	102.7	104.4	104.5	104.5	102.0	103.5	99.7	101.4
1981	97.5	100.4	98.2	98.8	97.4	97.1	96.4	93.4	93.1	92.9
1983	93.9	102.1	102.5	107.0	102.9	105.1	103.5	103.8	104.1	102.2
1984	104.4	106.0	103.6	103.2	103.2	99.2	102.4	97.7	97.4	98.0
1986	101.5	105.3	97.8	99.7	98.4	97.8	92.9	90.2	89.4	85.6
1988	101.6	102.3	100.3	113.0	112.3	97.1	96.6	94.2	92.1	78.9
1990	106.6	105.4	103.4	100.3	101.0	99.7	101.8	98.2	95.1	87.4
1992	112.2	117.0	109.6	111.8	109.7	108.7	108.5	105.9	109.6	101.8
1994	105.3	101.8	103.9	100.2	99.4	97.7	94.9	94.7	91.7	90.0
1995	117.0	112.2	106.4	108.5	102.6	101.7	100.6	94.3	96.1	94.9
1996	106.4	102.0	105.4	100.5	98.0	95.8	94.1	89.1	99.5	101.7
1997	103.6	109.4	106.8	97.0	100.5	95.0	90.3	86.5	87.8	87.8
1998	95.5	91.6	105.3	85.3	94.6	89.7	88.9	86.8	90.4	79.4
1999	94.4	100.3	96.4	97.1	93.7	88.9	85.4	86.3	88.0	80.2
2000	94.5	99.8	98.4	96.5	97.1	96.2	93.2	90.9	93.1	86.4
2001	103.0	100.3	98.7	96.5	96.0	94.5	91.3	91.9	85.7	91.5
2002	102.7	103.7	102.4	99.1	99.9	96.1	93.6	89.9	89.0	88.6
2003	100.9	104.0	99.5	97.9	95.9	94.5	91.8	86.7	88.7	85.6
2004	99.1	95.6	95.5	92.0	93.2	93.8	96.7	89.6	82.6	88.4
Mean	101.6	102.1	100.7	99.0	98.9	96.7	95.2	93.5	93.3	92.3
Mean 95-04	101.7	101.9	101.5	97.0	97.2	94.6	92.6	89.2	90.1	88.5

Appendix 10. Habitat measurements take before and 4 years after restoration on the Brewery Flats section of Big Spring Creek.

Pre-restoration 1999

Habitat Class	Habitat type	% Habitat Type	% Stable Bank	% Undercut Bank	Avg. Width (ft)	Avg. Depth (ft)	Max. Depth (ft)	Avg. Velocity (ft/s)
FAST	Low Gradient Riffle (LGR)	12.8	0.0	84	46.5	0.81	1.3	2.6 (2.5-2.6)
	Run (RUN)	78.3	18.0	62	33.6	1.48	3.3	1.8 (0.8-3.1)
	Weighted Mean		15.7	64.8	35.3	1.40		1.9 (0.8-3.1)
SLOW	Scour Lateral Bedrock Pool (SLR)	8.4	18.0	40	34.2	2.03	5.0*	1.3 (1.1-1.4)
	Scour Plunge Culvert Pool (SPC)	0.6	10.0	75	37.5	1.80	2.5	1.0 (1.0-1.0)
	Weighted Mean		15.4	51.6	35.3	1.95		1.2 (1.0-1.4)
	Total Weighted Means		15.6	63.2	35.3	1.41		1.8 (0.8-3.1)

* Max. depth estimated

Appendix 10 Continued.

Post-restoration, 2005.

Habitat Class	Habitat type	% Habitat Type	% Stable Bank	% Undercut Bank	Avg. Width (ft.)	Avg. Depth (ft.)	Max. Depth (ft.)	Avg. Velocity (ft/s)
FAST	Glide (GLD)	26.9	79.4	14.8	35.8	1.28	2.5	2.0 (1.5-2.6)
	Low Gradient Riffle (LGR)	12.8	92.6	5.0	32.4	1.00	1.4	2.3 (2.3-2.3)
	Run (RUN)	23.9	79.7	34.3	34.5	1.23	2.0	1.9 (1.3-2.5)
	Weighted Mean		80.6	22.2	35.0	1.24		2.0 (1.3-2.6)
SLOW	Scour Lateral Meander Pool (SLM)	34.9	83.1	32.8	37.3	1.69	6.6	1.4 (0.8-1.9)
	Scour Mid Boulder Pool (SMB)	1.5	88.8	45.9	35.4	1.54	4.6	1.3 (1.3-1.3)
	Weighted Mean		83.5	33.7	37.2	1.68		1.4 (0.8-1.9)
	Total Weighted Means		83.1	28.9	36.6	1.49		1.7 (0.8-2.6)

Appendix 11. Discharge measurements taken at the Reed and Bowels FAS 2001 – 2004.

Date	Discharge CFS
12/4/2001	108.1
3/13/2003	167.5
8/7/2003	65.8
3/18/2004	135
5/6/2004	79.3
5/24/2004	154
6/11/2004	209
7/30/2004	62.5
11/30/2004	115.9

Appendix 12. Physical measurements accompanying larval fish samples collected with round nets in the Judith River, 2004.

Station	Number Samples	Average Net Velocity (ft/s)	Average Net Volume (ft^3/s)	Average Time (minutes)	Average Temperature (°F)	Average Secchi (ft)
PN Ranch	57	1.37 (0.11-3.08)	4,967 (236-11710)	28.1 (7-37)	62 (54-80)	1.9 (0.2-5.9)
Anderson Bridge	52	1.27 (0.02-3.04)	4,506 (65-11578)	28.5 (15-36)	65 (55-80)	2.0 (0.4-5.0)
Total	109	1.32 (0.02-3.08)	4,745 (65-11710)	28.3 (7-37)	64 (54-80)	2.0 (0.2-5.9)