EVALUATION OF FISHERY TRENDS IN THE JEFFERSON AND UPPER MISSOURI RIVER RELATED TO CHANGES IN STREAMFLOW PATTERN AND HABITAT RESTORATION ACITITIES (1992-2006)

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INTRODUCTION

Evaluation of annual stream flow and fishery trends in the Jefferson River demonstrate that the fishery is influenced by low flow conditions during periods of drought. Population estimates for brown trout in three sections of the river from 1979 to 1997 indicate that the fishery declined during low flow periods, and surveys of other fish species also show that drought conditions impact all fish species resident to the Jefferson River. Monitoring of fish response to tributary enhancement projects from 1986 to 2005 indicate that such projects have significant potential to improve the trout population of the Jefferson River if adequate seasonal flow is maintained in the mainstem Jefferson River.

The Jefferson River is approximately 80 miles in length. The river originates at the confluence of the Big Hole and Beaverhead Rivers near Twin Bridges and joins with the Madison River near Three Forks, Montana. The average width of the Jefferson River is about 197 feet, and the gradient averages 7.3 feet per mile. The river substrate is primarily composed of gravel and cobble, and the river typically meanders throughout a broad floodplain dominated by cottonwood.

Throughout its length, the Jefferson River and associated tributaries are extensively used as a source of irrigation water. Streamflow gaging near the headwaters show a mean annual flow of 2,014 cfs. Mean monthly flow ranges from 856 cfs (August) to 6,050 cfs (June). Base winter flow averages 1,070 cfs. Stream flow gaging reflects the severe summer dewatering of the Jefferson River, and flow depletion is considered one of the primary limiting factors for maintaining a desirable sport fishery for trout. Evaluation of low streamflow and elevated water temperature will be presented in a future report.

Another factor that significantly influences the sport fishery is the relative scarcity of healthy tributaries providing cold, clean water to the mainstem Jefferson River. The shortage of healthy tributaries results if few locations for successful trout spawning and juvenile trout rearing areas needed to provide recruitment of new fish to the system.

Since mainstem flow depletion and a shortage of quality tributaries are believed to be the primary limiting factors for the Jefferson and Upper Missouri River trout fisheries, these aspects of the fishery and the associated habitat are the primary topics of investigation in this evaluation.

CATCH-PER-UNIT-EFFORT ELECTROFISHING

Electrofishing surveys were conducted in several trout spawning tributaries of the Missouri River and Jefferson River from 1992 through 2006. A single pass using a backpack electrofishing unit during the late summer or fall provides a relative index of the number of juvenile trout residing in each tributary. The technique does not provide an estimate of total numbers of fish, but can provide general trends in response to changes in habitat, flow, and species composition.

Significant changes in fish numbers resulting from habitat enhancement can be detected using this technique, and tables showing trends of brown trout and rainbow trout are presented in this summary. Based on general observations in several streams over a number of years, it appears

that catch rates of 0 to 1.0 juvenile fish per 100 seconds indicates low spawning/rearing success. Catch rates of 1.0 to 3.0 fish per 100 seconds indicates moderate spawning/rearing success, and catch rates exceeding 3.0 fish per 100 seconds indicates that significant spawning and rearing occurred in the stream during a specific year.

Table 1. Summary of catch-per-unit-effort (CPUE) electrofishing surveys of juvenile *rainbow trout* in selected spawning tributaries of the Jefferson River and Missouri River. The CPUE value for each stream represents the number of age 0 *rainbow trout* (<120 mm) captured per 100 seconds of electrofishing during the period, 1992 to 2006.

Creek Name	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06
Willow Springs	1.5	---	2.4	5.0	---	---	6.1	9.1	---	9.8	4.3	1.8	3.1	6.3	--
Hells Canyon	5.6	---	---	3.0	3.8	4.0	2.6	1.6	---	3.3	4.7	6.2	5.5	7.2	3.0
Parson's Slough												0.0	1.6	0.2	9.4
Sappington Spring															2.4
Antelope Creek													0.2		0.2
Hamilton Spring														0.1	0
Beaver Creek	0.3	---	---	5.8	2.2	6.7	2.5	2.1	---	3.5	---	---	1.2		
Deep Creek	0.8	---	---	1.8	0.8	---	3.9	3.0	---	0.0	0.3	---	0.6		
Dry Creek	---	---	---	2.2	---	---	3.6	0.0	---	0.0	---	---	2.5		
Magpie Creek	---	---	---	4.7	2.6	---	---	---	--	---	0.1	---	0.16	0	9.8
Confederate Creek	7.4	4.4	---	6.6	3.8	2.6	2.8	3.0	---	11.4	2.1	2.6	3.0	0.3	0.4
Marsh Creek				1.1				0.2				0.0			0.1

Table 2. Summary of catch-per-unit-effort (CPUE) electrofishing surveys of juvenile *brown trout* in selected spawning tributaries of the Jefferson River and Missouri River. The CPUE value for each stream represents the number of *brown trout* (<130 mm) captured per 100 seconds of electrofishing during the period, 1992 to 2005.

Creek Name	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06
Willow Springs	1.5	---	1.3	0.9	---	---	2.5	0.5	---	3.2	0.6	0.5	0.4	0.1	--
Hells Canyon	3.4	---	---	1.4	0.5	0.7	0.7	1.8	---	0.6	2.4	0.4	0.6	2.0	2.4
Parson's Slough												0.08	1.2	0.4	0.3
Sappington Spring															3.1
Antelope Creek													1.3		1.5
Hamilton Spring														0.1	0.1
Beaver Creek	0.2	---	---	0.0	0.5	0.04	0.07	0.0	---	0.2	---	---	0.9		
Deep Creek	3.6	---	---	0.3	0.3	---	0.3	1.4	---	0.0	0.3	---	0.7		
Dry Creek	---	0.0	0.0	---	---	0.0	0.0	0.0	---	0.0	0.0	---	0.0		
Magpie Creek	---	---	0.0	---	0.0	---	---	---	--	---	0.0	---	0.0	0.0	0.0
Confederate Creek	3.9	3.5	---	0.2	0.06	0.1	0.3	0.6	---	0.0	0.8	0.1	0.0	0.2	0.2
Marsh Creek				0.1		0.1		1.8				0.9			0.1

TABLE SUMMARY

Jefferson River Tributaries

Willow Springs: No rainbow trout spawning occurred prior to 1990. Fry production after habitat improvement and imprinting was significantly improved by the project, and an increase in the number of rainbow trout residing in the Jefferson River near Willow Springs was observed throughout the 1990's. A population estimate section was established near Willow Springs in 2000, and the number of rainbow trout in this section is increasing in recent years despite severe drought conditions. Increased juvenile production of trout due to habitat improvements in Willow Springs and the nearby Parson's Slough may account for the recent increases in rainbow trout (Figure 1.). Redd counts for rainbow trout spawning in Willow Springs is also available (Figure 2). The abundance of age 0 rainbow trout frequently exceeds 3.0 fish per 100 seconds, which is among the highest density of all tributaries surveyed. Initial habitat improvement took place in 1987 and additional improvements were made in April 2005. No rainbow trout were observed in this tributary in the mid-1980's, and the first spawning took place in 1991 (three years after imprinting rainbow trout from Hell's Canyon Creek.

Hells Canyon: Flow information also available for Hells Canyon Creek. Water lease requirements have been met since project was implemented in 1996. Rainbow trout fry numbers have maintained a level near the long-term average despite Whirling Disease and the severe drought of 2000-2006. The water lease has maintained sufficient flow in the stream to allow

rearing of large numbers of young rainbow trout as shown by the catch-per-unit-effort table. Installation of a fish screen has prevented the loss of thousands of juvenile trout each year. Information on this evaluation is presented in the water leasing report.

Parson's Slough: Habitat improvement (private funding in 2004) and imprinting rainbow trout eggs resulted in the first juvenile rainbow trout observed in this spring creek in 2004. Very successful imprinting of rainbow trout eggs from Willow Springs in 2006 resulted in one of the highest catch rates of juvenile rainbow trout observed in any tributary surveyed in the Missouri River and Jefferson River. Additional habitat improvement is planned for Parson's Slough using funds from FFIP and other sources.

Sappington Spring: This small (<5 cfs) spring was constructed during fall 2005 to provide spawning and rearing habitat for brown and rainbow trout resident to the Jefferson River. One brown trout redd was observed soon after construction in 2005 and 5 redds have been observed in 2006 (spawning season ongoing). No rainbow trout redds were observed in spring 2006. Rainbow trout eggs from Willow Springs were imprinted in 2006, and moderate abundance of juvenile brown and rainbow trout was observed in the fall CPUE survey (Tables 1 and 2).

Antelope Creek: Elimination of the irrigation canal and habitat enhancement were implemented in fall/winter of 2005. Five brown trout redds were observed in the project area in 2006. CPUE survey results before and after the project showed similar numbers of brown and rainbow trout after the first year of project completion (Table 1 and 2).

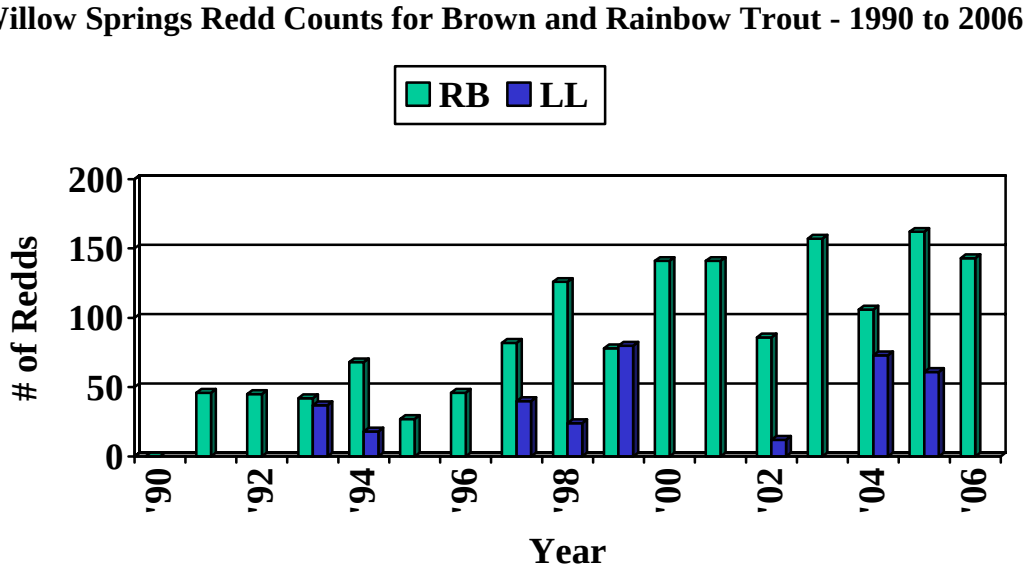


Figure 1. Brown and rainbow trout redd counts in Willow Springs from 1990 to 2006.

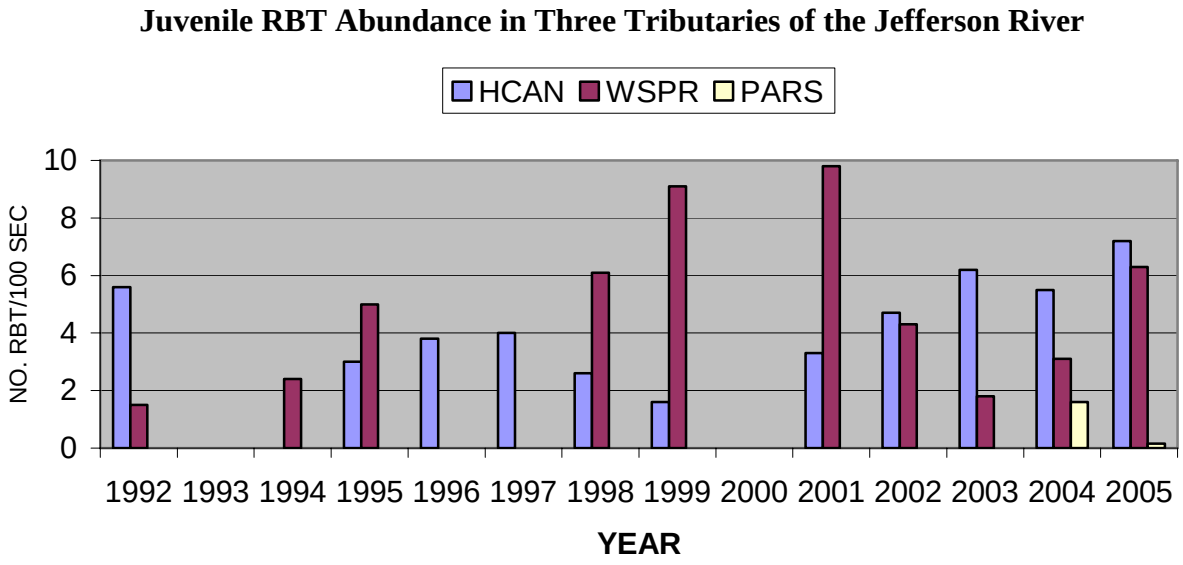


Figure 2. Juvenile rainbow trout Catch-per-Unit-Effort trends for three tributaries to the Jefferson River (HCAN=Hells Canyon Creek, WSPR=Willow Springs, PARS=Parson's Slough).

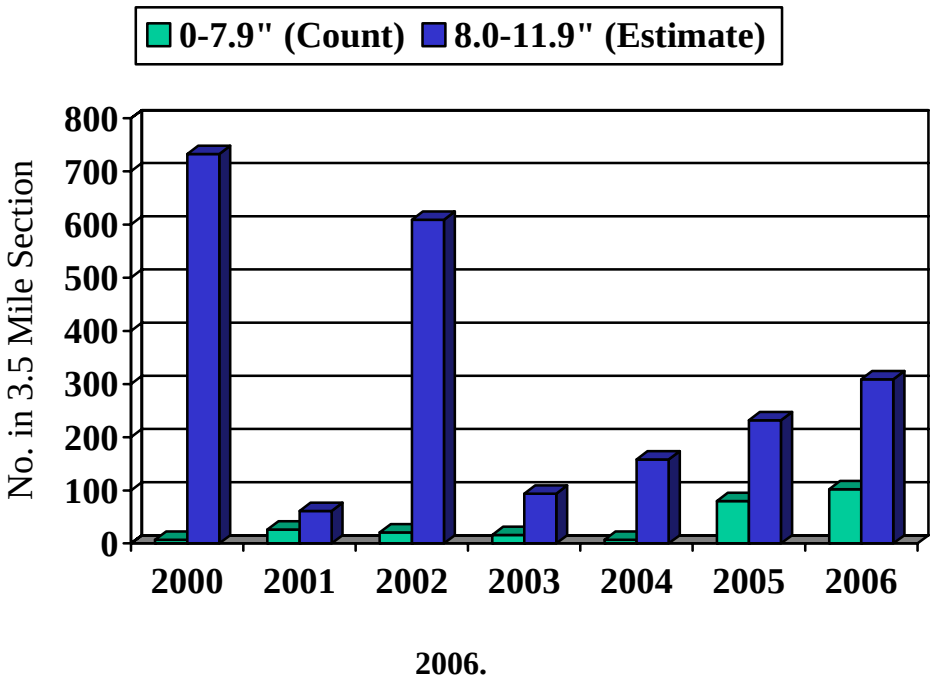


Figure 3. Rainbow trout abundance in the Waterloo Section of the Jefferson River during springtime electrofishing. Yearling rainbow trout (0 to 7.9 inches) represent the total number captured during the survey and age II trout (8 to 11.9 inches) represent the estimated number using Mark/Recapture techniques. Rainbow trout over 12 inches were not included due to bias resulting from spawning movements.

Missouri River/Canyon Ferry Reservoir Tributaries
Catch rates of juvenile trout were also monitored for several tributaries in the Missouri River/Canyon Ferry Reservoir complex to evaluate spawning and rearing success. See Tables 1 and 2 to review trends in abundance. The most extensive fishery monitoring of Missouri River tributaries was conducted in Deep Creek and these results are presented in more detail in a later section.

Beaver Creek**:** Severe flow limitations have reduced rainbow fry abundance during drought (no habitat or flow improvement has been conducted). The CPUE tables show catch rates of less than 1 trout per 100 seconds of sampling during most years.

Deep Creek: Fry migration and adult spawning surveys have also been conducted (see a more detailed evaluation of Deep Creek in this report). Low streamflow has reduced rainbow trout fry abundance compared to the mid-1990's, and effects of Whirling Disease also appear to impact spawning success based on the declining trend in CPUE Table 1 and the frequent observations of fish with deformities.

Dry Creek: Juvenile rainbow trout are completely absent during some years, and at moderate levels during other years. Supplemental water delivered for egg incubation has variable success in this stream. Streamflow is very low during fall and winter and brown trout generally do not spawn successfully.

Magpie Creek: Rainbow spawners pass upstream of the fish ladder in most years. Abundance of juvenile rainbow trout above the ladder is much reduced from levels observed in the mid-1990's and no rainbow trout were observed in 2005. Surprisingly, an extremely high number of juvenile rainbow trout were observed above the fish ladder in 2006, indicating favorable fish passage and high spawning success (Table 1).

Confederate Creek: Juvenile rainbow trout abundance has maintained a level near the long-term average in recent years, despite the severe drought. Brown trout abundance has declined in recent years and virtually no brown trout redds have been observed in this stream in the past five years.

Marsh Creek: Juvenile brown and rainbow trout abundance has remained low throughout the years of sampling. No habitat improvement has been conducted in this stream, but future potential exists to provide spawning and rearing for trout due to a spawning run that occasional enters the system.

Other Future Fisheries Improvement Program Projects
Habitat Enhancement Efforts on the following projects have limited or ongoing fisheries monitoring results and information was not included in the CPUE tables of this report.

Missouri River (Brian Rogers): The river has abandoned the side channel where bank stabilization/revegetation was conducted. No fishery benefits observed and no bank erosion has progressed.

Jack Creek: No biological sampling was conducted in 2006 after two forks of Jack Creek were connected by diverting toxic mine waste in 2005. Future sampling will be conducted to determine benefits to previously isolated populations of westslope cutthroat trout.

Sappington Springs: Not completed. Probable construction in 2005 after water right questions are resolved.

Boulder River Fish Ladder: Brown trout spawners have migrated upstream of the Shaw diversion in 2003 and 2004 after installing a fish ladder. Migration of spawning fish above the diversion is confirmed by observing redds and large spawning adults assumed to be residents of the Jefferson River. The ladder has required maintenance and cleaning of debris and sediment prior to the spawning season.

Creeklyn Ditch/Jefferson Canal: Canal-Seal was applied in both canals during 2002 and 2003 using FFIP funds. Numerous synoptic flow measurements were taken and it appeared that about 6 cfs in Jefferson Canal was conserved in 2002 during mid-summer totaling about 1000 AF of water savings. Creeklyn Ditch had a canal malfunction due to highway construction and funds were returned to FWP. In 2003, improved application of canal seal in Jefferson Canal resulted in a water savings of about 9cfs. Synoptic flow measurements in Creeklyn Ditch showed no quantifiable water savings in 2003. An engineering study conducted by Joe Van Mullem on the use of Canal-Seal estimates a cost of $445 per mile in the Jefferson Valley. Based on a potential water savings of 15% during Canal-Seal application, the unit cost for water saved is $40.49 per acre-foot.

Jefferson River (Kerno Overflow): A fish passage barrier was placed on this overflow from Parrot Ditch prior to rainbow trout spawning in April 2004. The number of rainbow trout rescued from the canal in July 2004 (9 fish) was significantly less than the number of fish rescued in July 2003, which is prior to the installation of the fish passage barrier.

DEEP CREEK MONITORING

Deep Creek monitoring associated with habitat enhancement is conducted to evaluate fish response to restoring fish passage into the stream in 1991 and reducing sediment delivery to the stream by revegetating eroding stream banks in 1996 and 1997. Counting trout redds, estimating number of spawning rainbow trout entering the stream, and estimating juvenile fish production by operating a screw trap are the primary tools for evaluating fishery response to habitat improvements in Deep Creek.

Redd Counts

Both spring and fall redd counts were conducted to monitor rainbow and brown trout spawning in Deep Creek. Spring redd counts were conducted in April and May and fall redd counts were conducted in November. Spring redd counts were conducted in the lower 2 miles of Deep Creek between 1991 and 1993. Results show a high degree of spawning activity by rainbow trout below the Broadwater-Missouri Ditch Siphon (Table 3). In addition spawning rainbow trout from the Missouri River have been seen over 20 miles upstream from the mouth of Deep Creek spawning in small tributaries where spawning habitat is excellent. Routine redd counts of

rainbow trout were discontinued after 1993 because of the operation of the spawning weir from 1993 through 2005, which provides more reliable estimates of rainbow trout spawning use.

Table 3. Summary of spring (rainbow trout) redd surveys Deep Creek 1991-1993

Year	Location of count	Period of counts	Number of Counts	# Redds observed
1991	Mouth-Broadwater Missouri siphon	23 April-7 May	1	118
1992	Mouth-Lightning Barn Lane	27 March-13 May	1	190
1993	Mouth-Carson Lane	2 April	1	23

Brown trout spawning activity can be divided into two reaches of Deep Creek. The first reach extends from the mouth of Deep Creek to the Montana Ditch siphon. The other reach lies between the Clopton Lane Bridge and the Highway 12 bridge. These reaches are defined primarily by groundwater influence, which is attractive to spawning brown trout. Deep Creek receives groundwater inflows from the Montana Ditch below the siphon, which makes the area attractive to brown trout spawners. No groundwater influence is evident for several miles above the siphon making this area less attractive for brown trout spawning. Groundwater influences are also present between Clopton Lane and the Highway 12 bridge and therefore attract brown trout spawners.

A minimal amount of brown trout spawning occurs between the mouth of Deep Creek up to the Montana Ditch Crossing. Brown trout spawning below the trap site are primarily migratory fish from the Missouri River or Canyon Ferry and generally produce less than 5 redds per year. Other factors that may influence low spawning effort in this reach include high sediment loads and the low abundance of brown trout in the Missouri River and Canyon Ferry. Most brown trout spawning takes place between Clopton Lane and the Highway 12 bridge where groundwater influences occur.

Brown trout redd surveys were conducted in November (Table 4). Most spawning activity was observed in the upper reaches of the Clopton – Highway 12 survey area and above impassable beaver dams. In addition all spawners observed ranged in length from 11-14 inches. It is very likely that virtually all spawners observed were brown trout resident to Deep Creek and not adfluvial brown trout from the Missouri River.

The number of brown trout redds peaked in 1999 and appears to have declined in recent years (Table 4). This decline may be due to a reduction in brown trout abundance associated with the recent drought, or may be related the extensive beaver complex that has developed in the area, which has created backwater habitat less suitable for spawning. As of 2005, there were 44 beaver dams in the survey reach, compared to only 6 beaver dams observed in 1991 and 24 beaver dams in 1999.

Table 4. Summary of fall (brown trout) redd surveys Deep Creek 1991-2005

Year	Location of count	Period of counts	Number of Counts	# Redds observed
1991	Clopton Lane Highway 12	18 Nov.-12 Dec.	1	75
1999	Clopton Lane-Highway 12	Nov. 30	1	206
2001	Clopton Lane-Highway 12	Nov 15-16	1	151
2004	Clopton Lane-Hwy 12	Nov 19, 23, 29	1	97
2005	Clopton Lane-Hwy 12	Nov 29, 30	1	90

Screw Trap

A screw trap was deployed in Deep Creek just below the trap site during spring of 2001; however, insufficient flows and stream depths prevented the trap from operating properly. Low flows precluded screw trap deployment in 2002 as well. The trap was operated for the first time in Deep Creek during the spring of 2003. This was possible due to a more normal flow regime during the spring.

The screw trap was operated from April 4 to June 27, 2003. The trapping was not possible before or after these dates due to low stream flow. The screw trap was checked 5-6 times per week and proved effective at capturing rainbow, brown trout and mountain whitefish during periods of high flow. All salmonids were marked with either an adipose clip or an upper caudal fin clip to and released upstream in order to calculate trap efficiency. Trap efficiency allowed a calculation of total migrant fish passing the trap.

Juvenile brown trout have been periodically captured in the adult trap it is thought that some brown trout follow rainbow spawners upstream, presumably to feed on eggs. Brown trout and rainbow trout are known to have resident populations in Deep Creek. Therefore it is unknown if all juvenile brown trout and rainbow trout captured were downstream migrants. All mountain whitefish captured were young of the year and therefore were assumed to be migratory.

In order to assess if captured trout were upstream migrants or residents; fish greater than 90mm total length (TL) were tagged with a visible implant (VI) tag. Each tag bears a unique code and allowed unique identification of each fish. . After tagging fish were released upstream of the trap to calculate trap efficiency. Once a tagged fish was recaptured it was released downstream of the trap. Fish released downstream of the trap and recaptured at a later date were assumed to be upstream migrants or resident fish.

A total of 206 brown trout and 98 rainbow trout were tagged with VI tags and released above the trap. Recaptures of tagged fish totaled 26 and 7 for brown trout and rainbow trout respectively. Only 2 brown trout were caught for third time after being released below the trap.

Sizes of recaptured brown trout were 141 and 148 mm TL. This data shows that brown trout greater than 140 mm TL are capable of ascending Deep Creek during high flows. Because rainbow trout are strong swimmers it can be assumed that rainbow trout of similar size are also

capable of swimming upstream during high flows. However the very low numbers of fish captured after being released below the trap suggests that very few rainbow and brown trout are upstream migrants. The assumption that all salmonids captured were migratory likely leads to a slightly high estimate since some fish were captured after being released from below the trap (Table 5).

Table 5. Screw Trap Migratory juvenile salmonid estimates

Species	Total captured	Recaptures	Estimate of Downstream Migrants*
Rainbow Trout	129	15	1057
Brown Trout	317	60	1617
Mtn. Whitefish	166	16	1328

* Slightly high estimate assumes all fish captured were migratory.

The screw trap was operated daily from late May to early July during 2004 and 2005. The trap was operated in a similar manner to the effort in 2003, when significant effort was made to estimate efficiency of the trap by marking fish and evaluating recapture rates. Efficiency estimates using methods employed in 2003 were not calculated in 2004 and 2005, and it is assumed that efficiency was similar to that observed during 2003.

The number of juvenile brown trout (age I and age II fish ranged from about 60 mm to 170 mm total length) was relatively consistent during the three years ranging from 176 to 360 individual fish per year (Table 6). The number of juvenile rainbow trout (age 0, age I, and age II fish ranged from about 25mm to 180 mm total length) ranged from 45 to 218 fish per year. The trap was operated from late May through early July during 2004 and 2005.

Although trap efficiency was not estimated during 2004 and 2005 it is assumed that the trap was effective at capturing at least 10% of migrating fish, and at most, 30% of migrating fish based on Mark-Recapture estimates conducted in 2003.

Table 6. Comparison of brown and rainbow trout catch in the Deep Creek Screw Trap during 2003, 2004 and 2005.

Year	# Brown Trout	# Rainbow Trout	Est. # Brown Tr.	Est. # Rainbow Tr.
2003	317	129	1617	1057
2004	360	45	1080 to 3600*	135 to 450*
2005	176	218	528 to 1760*	654 to 2180*

*Estimate based on 10% to 30% range of trapping efficiency.

Electrofishing

Electrofishing was intended to estimate the numbers of juveniles that did not migrate during the first year of life. Electrofishing in Deep Creek was conducted in late summer and fall at various locations in Deep Creek. This monitoring was intended to evaluate trends of juvenile fish abundance, and was not expected to determine actual numbers of rearing fry. Results of electrofishing monitoring show the presence of rearing rainbow trout and brown trout in Deep Creek at moderate to low abundance. Not surprisingly, abundance of brown trout fry was

greatest in the areas of highest redd production, below the Montana Ditch and above Clopton Lane. Rainbow trout fry were found in highest densities in the same areas as brown trout.

Adult Rainbow Trout Trapping

A permanent concrete weir has been used to trap spawning rainbow trout from 1993 through 2005. Data collected at this trap is very useful for evaluating benefits of the siphon installation for brown and rainbow trout. Although trapping of adult rainbow and brown trout was not prescribed in the preliminary evaluation plan, this technique was used to determine the numbers of spawning rainbow and brown trout entering Deep Creek from the Missouri River or Canyon Ferry. Data collected on spawning rainbow trout and brown trout is a reliable indicator of total spawning effort for a given year. This information can then be used to estimate the number of females entering the stream, the number of eggs deposited, and determine the potential rainbow trout and brown trout fry production from Deep Creek. Rainbow trapping data also provides information on the relative contribution of hatchery origin and wild fish in the spawning run (Figure 5).

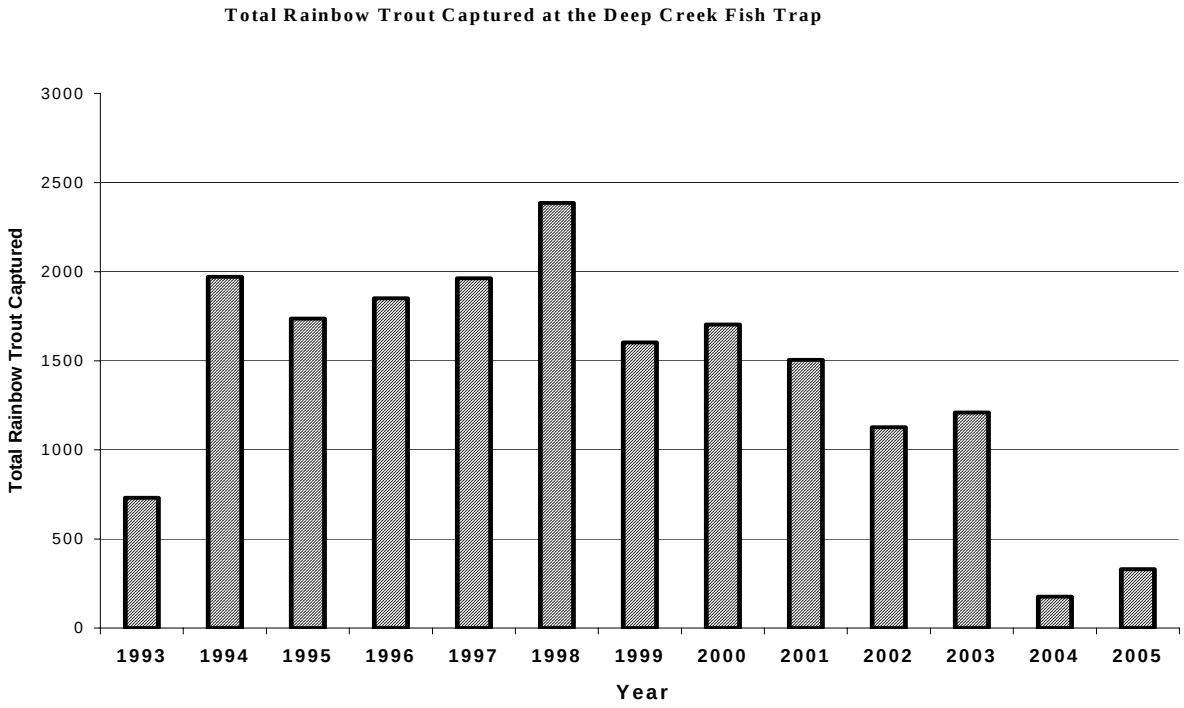
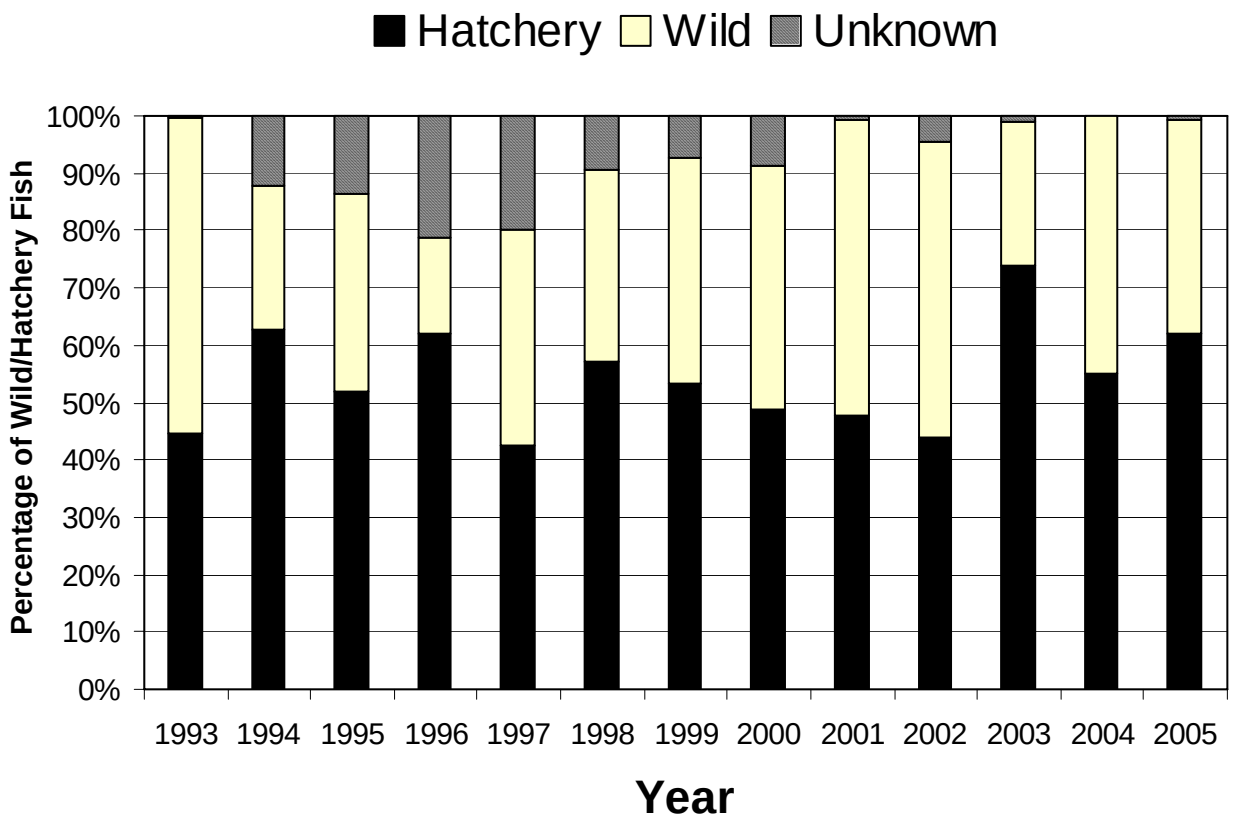


Figure 4. Rainbow trout captured at the Deep Creek fish trap, 1993 – 2005.

High flows during 1993, 1996 and 1997 forced trapping to cease in early May. Data indicate that rainbow trout generally move upstream to spawn during periods of rising flows; therefore, total numbers of rainbow trout using Deep Creek are likely to be higher than reported for these years. Conversely, 1998-2005 represents years of lower flows and the trap was operated the entire spawning season. It is likely that in excess of 90% of all rainbow trout ascending Deep Creek were captured during these years.

Figure 5. Percentage of wild and hatchery origin spawning rainbow captured at Deep Creek Trap from 1993 to 2005.



Total numbers of rainbow trout captured at the weir ranged from 176-2,386 per year during the 1993-2005 period (Figure 4). Total female rainbow captured during the period ranged from 93-1139. Each female was assumed to produce 1804 eggs with 10% survival to outmigration. If these assumptions are correct, between 16,777-205,475 fry were produced annually in Deep Creek between 1993 and 2005. Fry trapping prior to 2003 did not generally indicate that large numbers of fry were produced, and operation of the screw trap from 2003 through 2005, which improved our ability to capture fish of all sizes, also did not indicated that large numbers of rainbow trout fry or subadults were migrating from Deep Creek to the Missouri River. Juvenile fish production from Deep Creek is significantly less that would be expected from the number of spawning rainbow trout entering the system.

The success of previous spawning efforts can also be inferred by examining the origin of rainbow trout spawners at the Deep Creek spawning trap. The return of rainbow trout to the Deep Creek spawning trap is evidence that a wild, naturally reproducing population is established. It is also known that hatchery rainbow trout stocked into Canyon Ferry Reservoir use Deep Creek for spawning, based on extensive marking of hatchery fish and eroded dorsal fins commonly observed on hatchery fish captured at the trap.

Numbers of rainbow trout of wild origin ranged from 79 to 775 and averaged 33 % of the total rainbow trout captured annually in Deep Creek over the 1993-2005 period (Figure 6). Since hatchery fish typically represent a significant percentage of the spawning population, the number of rainbow trout entering Deep Creek to spawn is significantly influenced by the success of hatchery stocking at Canyon Ferry Lake, which is not related to Toston Mitigation activities and tends to confound monitoring results of the Deep Creek project.

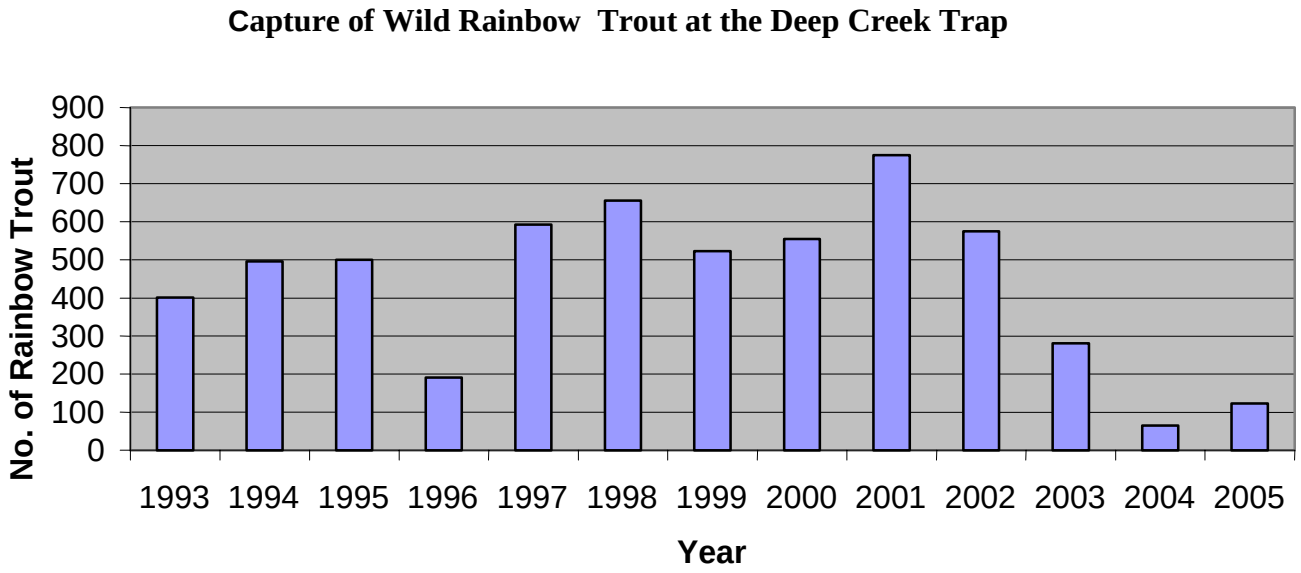


Figure 6. Number of wild rainbow trout captured at the Deep Creek trap, 1993 – 2005.

Another confounding factor is the effects of drought on spawning migrations into Deep Creek. The significant decrease in the number of rainbow trout entering Deep Creek for spawning in 2004 and 2005 was likely influenced by the relatively low flows observed during the April spawning period. Fewer spawning fish likely entered the stream during 2004 and 2005 due to reduced attracting flows needed to draw fish during the peak of the spawning season.

Finally, frequent observations of rainbow trout head and spinal deformities in the past 4 years at the spawning trap and the juvenile fish trap are indicative of clinical signs of the effects of whirling disease in Deep Creek. Whirling disease was first discovered in the Missouri River (and associated tributaries) between Toston Dam and Canyon Ferry in 1997, and the disease was first observed in Deep Creek in 1999. The extent rainbow trout mortality due to this recent occurrence of whirling disease is not known, but it has significant potential to decrease juvenile production.

Brown trout spawning was monitored with the weir during the late summer and fall from 1992-1996. The total numbers of adult brown trout ascending Deep Creek was very low throughout the period; a total of 45 adult brown trout were caught between 1992-1994. Adult brown trout captured at the weir totaled 78 in 1995 but only 5 were captured in 1996. Trapping was discontinued in 1996 because it was evident that very few brown trout ascended the stream to spawn.