An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin: Phase II

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INTRODUCTION

Fish habitat protection and restoration are both key components to managing and maintaining quality populations of stream-dwelling salmonids. A large-scale effort to restore and protect fish habitat is currently underway in the Upper Clark Fork River Basin (UCFRB). This effort was spearheaded by litigation between the State of Montana and the Atlantic Richfield Company (ARCO) regarding damages to the natural resources of the UCFRB caused by historic mining activities in the drainage. Recent developments in this litigation has led to a consent decree between the State of Montana and ARCO, which includes a substantial monetary settlement aimed at remediation and restoration of fisheries resources in the UCFRB.

While fish habitat restoration and protection are valuable tools for managing fish populations, these efforts need to be prioritized to ensure that they are: 1) focused in areas that will provide the most benefit to the target fisheries and 2) focused on addressing factors that currently limit fish populations. This is particularly true in the UCFRB, as a substantial amount of money will be available to complete habitat restoration and protection efforts in the future. A lack of prioritization of these efforts could lead to the use of a substantial amount of monetary resources without maximizing the protection and enhancement of target fish populations.

As part of its restoration planning process for the Clark Fork River restoration damage claim, the State of Montana considered alternatives involving restoration work on the tributaries that would best help the Clark Fork River fishery reach baseline conditions. Based on its evaluation of existing information on tributary fisheries, however, the State concluded that there was insufficient information to conduct such a prioritization. Thus in 2007, the State, through a Memorandum of Understanding between Fish, Wildlife and Parks and the Natural Resource Damage Program, began a phased tributary restoration prioritization effort. Through discussions of this effort, three goals were established for prioritizing tributaries to the Clark Fork River. These goals were to:

1) Restore the Clark Fork River fishery to levels similar to other area rivers.
2) Maintain and enhance viable native trout populations throughout the UCFRB
3) Replace lost angling opportunity in the Clark Fork River by enhancing tributary fisheries.

In order to complete a tributary prioritization, a fish distribution study needed to be completed in tributaries to the Upper Clark Fork River. This step was identified as critical, as the knowledge of what species are present, their relative abundance, and their distribution within these drainages, is all necessary information needed to begin prioritization. While fish distribution data existed for some tributaries in the Upper Clark Fork drainage, a substantial number of streams had not been previously sampled, or where data had been collected, it was quite dated.

In addition to fish distribution data, riparian and fish habitat assessment data were also collected as part of the phased tributary restoration prioritization effort. This data was largely collected as a secondary effort in an attempt to document current habitat conditions at the sample locations, as well as to highlight potential habitat deficiencies at these sites. This effort however, was not aimed at identifying all potential impacts to riparian and fish habitat in the sample drainages, and was limited in its spatial scope (see methods).

This report represents an annual progress report for the second year's (2008) effort to collect fish distribution and riparian assessment data throughout the Upper Clark Fork drainage.

METHODS

Stream Selection

Streams chosen for sampling during this study were selected largely by size and presumed importance (or potential importance) to mainstem Clark Fork River trout recruitment. Larger tributaries and drainage networks were prioritized because these systems generally produce larger and greater numbers of fish, which in turn, increase potential trout recruitment to the Clark Fork River.

Another important factor considered during stream selection was the known or presumed presence of bull trout *Salvelinus confluentus* and/or westslope cutthroat trout *Oncorhynchus clarki lewisi* in a stream or watershed. Bull trout are listed as a Threatened Species under the Endangered Species Act, while westslope cutthroat trout are listed as a Species of Special Concern by the State of Montana, and as a Sensitive Species by the US Forest Service. Both are important indicator species of stream health, and westslope cutthroat trout provide a unique native species angling opportunity in the UCFRB. Finally, drainages that appeared to have possible restoration potential based on available literature and discussions with other land management agencies (i.e. Forest Service) and watershed groups were also considered during the stream selection process.

Sample Reach Selection

Sample reaches were selected by examining topographic maps and aerial photographs of each selected stream in conjunction with reviewing recent data and literature that was available for each stream. Streams were stratified by multiple factors including channel type, gradient, and noticeable changes in riparian condition in an effort to describe the range of habitat conditions and, hopefully, fishery conditions present in each selected stream. Multiple reaches were generally delineated for each stream. Sample sites were also purposefully spaced longitudinally with enough distance between sites to reflect likely changes in species composition, as it was assumed that both habitat and the location of the section within the drainage likely would affect species composition.

Because many sample reaches were located on private land, cooperation by landowners was critical to gaining access to many sampling locations. Fortunately, a majority of land owners were willing to grant access for these sampling efforts. However, permission was denied by a few landowners, some of which owned relatively large portions of target drainages. In these situations, reaches that were relatively close in location (longitudinally) and maintained similar channel types and habitat were selected.

Fish Sampling

Electrofishing was used to sample fish at all sample sites. The focus of electrofishing was primarily to assess species composition and general abundance at a broad scale. For this reason, single-pass, catch-per-unit-effort (CPUE) electrofishing was used as the standard procedure. Single-pass surveys were able to be done quickly and provided information on species composition, size (and indirectly age structure), and a rough measure of abundance. Single-pass surveys did not however, provide a precise abundance estimate of fish in a given reach, and should not be viewed as such. To get an abundance estimate with an associated standard error, it is necessary to obtain a measure of capture efficiency using multiple-pass electrofishing techniques (i.e. depletion and mark-and-recapture). Due to time constraints, it was not possible to do this at all sample sites and the time saved by not conducting these estimates at every site allowed crews to complete more single-pass surveys in a greater number of streams and sample reaches. We did, however, conduct multiple-pass mark-recapture estimates at a few sites. These population estimates were calculated using the partial log-likelihood algorithm provided by Montana Fish, Wildlife and Parks' FA+ fisheries analysis software.

For small streams (i.e. streams less than approximately 15' in width), a backpack electrofishing unit (Smith-Root LR-24) was used to sample fish in 100 m reaches. At these sites, a block net was placed at the lower end of the reach to increase capture efficiency. Electrofishing was completed in a downstream direction towards the block net, except at sites where high turbidity created poor visibility. In these instances, electrofishing was completed in an upstream direction. In larger streams (i.e. streams greater than approximately 15' in width), an electrofishing tote barge system (Smith-Root SR-6 w/ 2.5 GPP) was used for fish sampling. This system was more efficient at capturing fish due to its increased power output. Reaches where the tote barge system was used were significantly longer than the standard 100 m reaches sampled in smaller streams. Warm Springs Creek (near Anaconda) was the only stream sampled with the tote barge in 2008. No block nets were used in the 1000 m section that was sampled.

At each sample reach, all captured fish were identified to species, weighed, measured and released. Genetic samples were collected in drainages and sections suspected to contain pure westslope cutthroat trout. Genetic samples were also collected from suspected bull trout / brook trout *Salvelinus fontinalis* hybrids to confirm hybridization. All fish data were collected on standard Montana Fish, Wildlife & Parks (MFWP) electrofishing data sheets using MFWP species abbreviations. These abbreviations were also used in the tables presented in the results section of this report. Below is a key for interpreting these abbreviations.

WCT = westslope cutthroat trout
BULL = bull trout
LL = brown trout (*Salmo trutta*)
RB = rainbow trout (*Oncorhynchus mykiss*)
EB = brook trout
MWF = mountain whitefish
EBxBULL = brook trout / bull trout hybrid
ONC = *Oncorhynchus* unidentified- used at sites with rainbow trout and westslope cutthroat trout or potential hybrids between these species.

TRT = unidentified trout
LN_SU= longnose sucker
LN_DC= longnose dace

It is important to note that sampling fish in short, delineated reaches represents a snapshot in time and space. It is likely that species distribution and abundance may change in a sample reach given different conditions (i.e. flow conditions, season, etc). This is always a drawback of intensively sampling short reaches. However, this method also allowed fish sampling to be completed in multiple drainages during the field season rather than only a few.

Riparian Assessments

Riparian assessments were conducted at each delineated reach where fish sampling occurred. These assessments were completed to identify possible relationships between the observed riparian condition and the existing fishery, as well as help identify areas for potential restoration or protection. Riparian assessments were completed using a modified version of the USDA Natural Resources Conservation Service (NRCS) Montana Riparian Assessment Methodology (including the supplemental attributes) (Appendix C). The methodology was modified to include a scored component that evaluated the relative condition of fish habitat in each survey reach largely based on available cover. A majority of the overall assessment survey consisted of a visual examination of stream and riparian character and condition. The only quantitative measurements collected at each site during these assessments were bankfull width and bankfull depth. All other portions of the assessment, including Rosgen channel type classification, were based on visual observations and estimates.

The NRCS Montana Riparian Assessment Methodology provides a rapid, qualitative evaluation of riparian condition by defining the stability and sustainability of current physical and ecological processes observed in a stream reach. It is not designed to give a quantitative or comprehensive analysis of these processes however. Specific habitat problems identified during these surveys may need to be further evaluated using more specific assessment techniques, which were not completed during these initial surveys.

Additionally, due to time constraints, riparian assessments conducted during this sampling effort occurred only at fish sampling reaches, and not throughout the entirety of each watershed. Thus, it is doubtful that we observed all of the factors affecting riparian health in each stream basin sampled, and subsequently, it must be assumed that not all potential habitat restoration and protection projects were observed during these sampling efforts.

Water Temperature

Stream temperature was monitored in many (but not all) of the streams sampled in 2008. Temperature monitoring consisted of the deployment of one or more thermographs (ONSET Computer Corp, Model: HOBO Water Temp Pro V2) in the target drainages. In streams where only one thermograph was deployed, the thermographs were generally placed near the mouth of the stream. In streams where multiple thermographs were deployed, the thermographs were generally distributed throughout the watershed with one being deployed near the mouth.

Thermographs were set to measure temperature every half hour or hour. In some locations on private land, deployment was delayed until landowner permission was granted. At deployment sites where the stream was later found to be intermittent, thermographs were either moved to other sites in the drainage or to other drainages where temperature data was deemed useful.

Data Summary

All data collected during these sampling efforts were summarized for each sampled stream reach and were organized by stream and drainage. Each sample section was identified by a river mile (RM) that marks the top of the survey site. River miles were measured beginning at the mouth of each stream and were obtained using a geographic information system (GIS).

Fishery data was summarized by species and included the number of fish captured at each site, catch-per-unit-effort (standardized to number of fish per 100m of channel), mean and range of fish lengths, and percent of species composition. A table displaying this information was created for each sampled stream. Additionally length-frequency histograms were also produced for each sample reach when two or more fish of a given species were present in the reach. These data are provided as an appendix (Appendix A). Only trout species were considered in these data summary efforts although observations of others species were noted in some of the tables and write-ups.

Riparian assessment data were separated into three distinct categories, which included geomorphology (NRCS Montana Riparian Assessment Methodology, questions 1-3 and 10), vegetation (NRCS Montana Riparian Assessment Methodology, questions 4-9), and fish habitat (Fish Habitat Assessment Worksheet, question 1). These categories were created to allow readers to better comprehend the results of the riparian assessment surveys and to better define habitat deficiencies at survey sites. Total scores from each category, as well as a total overall riparian assessment score, were summarized in tables created for each sample stream.

Water temperature data (where available) was summarized by the maximum daily temperature recorded at each site, as well as the number of days maximum daily temperature rose above 15º C and 20º C. At sites where thermographs were deployed late, these summary statistics are not comparable to other sites due to the reduced number of days of operation. Charts displaying mean and max daily temperature during the period of record are provided as an appendix (Appendix B).

Rock Creek Drainage

Gilbert Creek

Although no fisheries survey was conducted on Gilbert Creek, a thermograph was placed in the creek on July 8, 2008 at approximately river mile (RM) 0.2. The temperature did not exceed 15°C at any point during 2008. A maximum recorded temperature of 13.3°C was observed on August 18, 2008.

Brewster Creek

Brewster Creek is a tributary to Rock Creek that enters the drainage at approximately river mile 9.3. The lower mile of Brewster Creek flows through private land, while the majority of the upper creek is on National Forest. The primary land uses observed in the Brewster Creek drainage were historic logging and mining, primarily in the upper portion of the drainage.

Two sections were electrofished on Brewster Creek during September 2008 (Figure 1). The upper section (RM 3.0) was located on National Forest land above the mouth of North Fork Brewster Creek. A total of 33 westslope cutthroat trout were captured (Table 1, Appendix A) and these fish ranged in size from 59-211 mm. No other salmonids were sampled at this site. At the lower site (RM 1.4), a total of 25 westslope cutthroat trout, 28 brook trout and one brown trout were captured (Table 1, Appendix A). Westslope cutthroat trout comprised 46% of the total fish sampled while brook trout and brown trout comprised 52% and 2% of the fish sampled, respectively.

Table 1. Electrofishing data collected in two sections of Brewster Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 3.0	WCT	33	33	106	59-211	100
RM 1.4	WCT	25	25	161	31-284	46
	LL	1	1	154	154	2
	EB	28	28	121	51-210	52

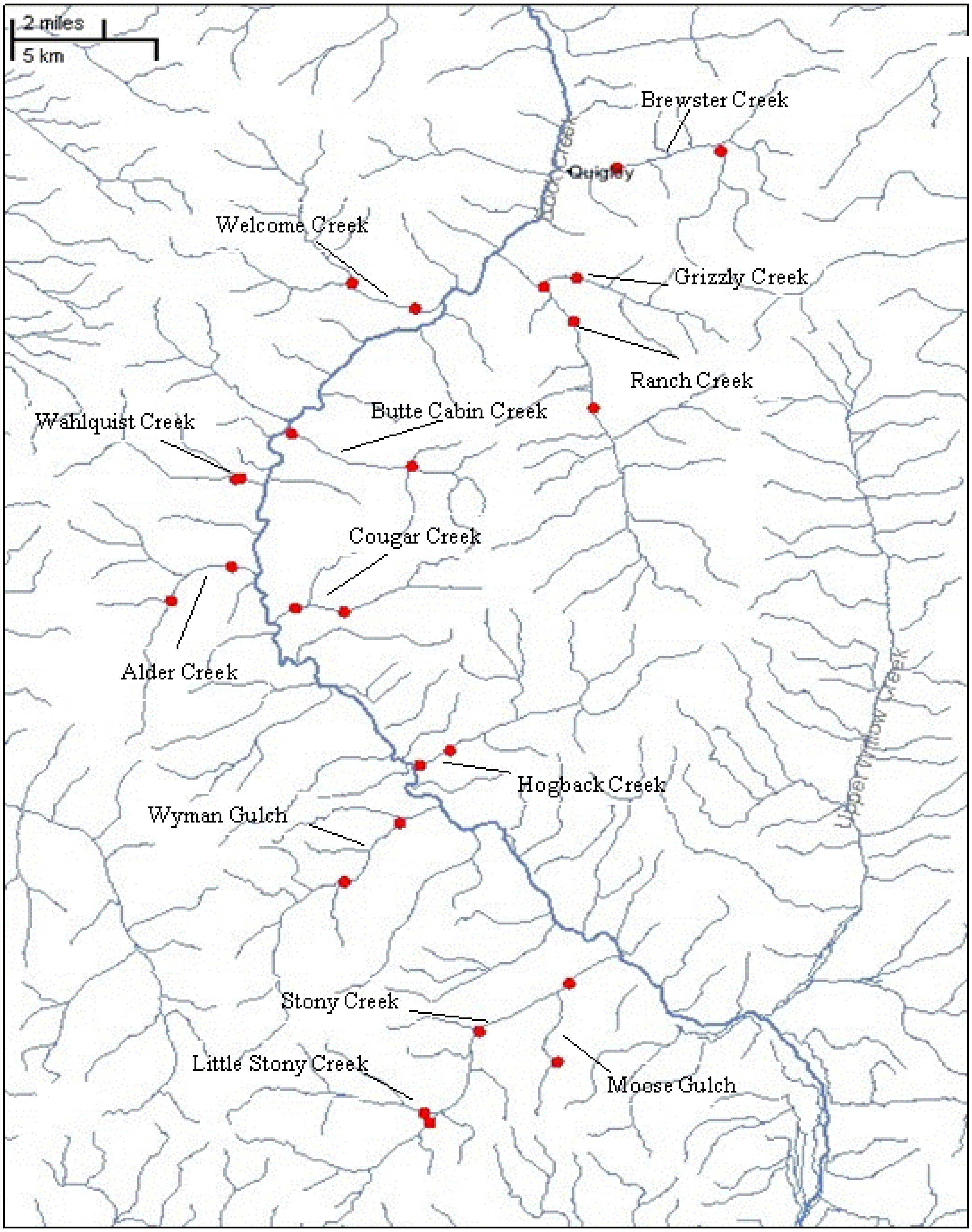


Figure 1. Map of the Lower Rock Creek drainage showing electrofishing sections completed in 2008.

A riparian assessment was conducted at both electrofishing sections on Brewster Creek (Table 2). At the upper site, the riparian vegetation was primarily Alder and Douglas-fir and the channel type was classified a B. The fish habitat was excellent throughout the reach and the only point that was deducted was due to the presence of an occasional disturbance-induced plant species. At the lower site, Brewster Creek was classified as a C channel and the riparian community consisted of alder, ponderosa pine, and Douglas fir. Fish habitat was again rated as "excellent" in this portion of Brewster Creek (Table 2). The only point deducted at this site was due to the presence of Canada thistle. At both sites, fine sediments were present in the substrate, but this was suspected to come from an upstream source (possibly mining), not channel instability within the reach.

Table 2. Riparian assessment results for two sites sampled on Brewster Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 3.0	30/30 (100%)	29/30 (97%)	10/10 (100%)	69/70 (99%)
RM 1.4	30/30 (100%)	29/30 (97%)	10/10 (100%)	69/70 (99%)

Ranch Creek

Ranch Creek is a tributary to Rock Creek that enters the drainage at approximately river mile 11.5. Most of the lower portion of Ranch Creek runs through private land with the exception of the Forest Service campground located near the confluence of Grizzly Creek. Land use in the lower portion of the drainage is light agricultural use primarily in the form of horse pastures along with private residences.

Three sections were electrofished on Ranch Creek during August 2008 (Figure 1). The upper section (RM 4.3) was located just upstream of Elkhorn Creek. At this site, native fish made up 74% of the species composition with a total of 25 westslope cutthroat trout and four bull trout captured (Table 3, Appendix A). Non-native brown trout and brook trout were also captured, with three brown trout and seven brook trout comprising 26% of the fish sampled. The middle site was located in a horse pasture on private land at river mile 2.4. At this site, 24 westslope cutthroat trout and eight bull trout were captured comprising 50% and 17% of the total fish sampled (Table 3). Brown and brook trout were also sampled at this site with a total of seven brown trout and nine brook trout captured. At the lowest site, bull trout were absent from the sample and the 13 westslope cutthroat captured were the only native salmonids sampled. Four brown trout and 10 brook trout were also captured at this site representing 15% and 37% of the total fish sampled.

Table 3. Electrofishing data collected in three sections of Ranch Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 4.6	WCT	25	25	181	66-249	64
	BULL	4	4	190	103-344	10
	LL	3	3	179	165-189	8
	EB	7	7	126	83-181	18
RM 2.4	WCT	24	24	143	59-280	50
	BULL	8	8	120	53-191	17
	LL	7	7	197	91-325	15
	EB	9	9	118	77-176	19
RM 1.3	WCT	13	13	143	70-222	48
	LL	4	4	222	146-270	15
	EB	10	10	148	83-215	37

A riparian assessment was conducted at all three electrofishing sections on Ranch Creek. At the upper site (RM 4.6), Ranch Creek was classified as a B channel type and the woody riparian vegetation consisted of alder, Douglas fir, and spruce (Table 4). Fish habitat at this site was excellent due to abundant large woody debris (LWD) and deep pools. The woody riparian vegetation was thick in this reach providing good stream bank stability and excellent stream shading. The middle site was located at RM 2.4 and maintained significantly poorer fish habitat than the upper site (49/70, 70%) (Table 4). This site was currently being used as a horse pasture, which was the primary cause of habitat degradation. Riparian grazing at this site appeared to be limiting the recruitment of woody riparian vegetation with primarily older age classes of woody vegetation present. The impact of riparian grazing was particularly evident in the floodplain, which was essentially comprised of only shallow-rooted grass species. Riparian grazing also appeared to have caused some channel over-widening, bank erosion, and reduced large woody debris in the channel however fish habitat was still considered good due to the resiliency of this B channel to disturbance. Several noxious weeds and disturbance-induced plants were common as well. Habitat conditions at the lower site (RM 1.3) improved due to a lower width to depth ratio and a lack of riparian grazing (Table 4). Unfortunately, reed canary grass was the most common vegetation found in the riparian area at this site. The presence of this undesirable species was likely limiting the recruitment of desirable woody species, which in turn appeared to be reducing stream shading, bank stability, and large woody debris recruitment.

Table 4. Riparian assessment results for three sites sampled on Ranch Creek in 2007.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 4.6	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)
RM 2.4	23/30 (77%)	19/30 (63%)	7/10 (70%)	49/70 (70%)
RM 1.3	30/30 (100%)	24/30 (80%)	7/10 (70%)	61/70 (87%)

A thermograph was placed near the campground on Ranch Creek at approximately river mile 1.1 on July 3, 2008. Water temperatures did not exceed 15°C during the 2008 summer, and the maximum recorded temperature of 12.7°C was observed on July 26, 2008 (Appendix B).

Grizzly Creek
Grizzly Creek is a tributary to Ranch Creek that enters the drainage at approximately river mile 1.2. Grizzly Creek lies entirely within roadless National Forest land. A recreational trail follows Grizzly Creek for most of its length and no additional land use was observed in the drainage.

One section was electrofished on Grizzly Creek in August 2008 (Figure 1). Westslope cutthroat trout were the only fish species captured with a total of 15 fish sampled. These fish averaged 100 mm TL and ranged in size from 57-145 mm (Table 5, Appendix A).

Table 5. Electrofishing data collected from one section sampled on Grizzly Creek in 2007.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 0.9	WCT	15	15	100	57-145	100

A riparian assessment was conducted at the electrofishing section on Grizzly Creek (Table 6). Grizzly Creek in this reach was classified as a B channel and received a score of 70/70 (100%) (Table 6). The riparian vegetation at this site was quite dense and consisted primarily of alder and willow. The width to depth ratio was well within the range typical of a healthy B channel type and both LWD and deep pools were abundant in the reach.

Table 6. Riparian assessment results for one site sampled on Grizzly Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.9	30/30(100%)	30/30(100%)	10/10(100%)	70/70(100%)

Welcome Creek
Welcome Creek is a tributary to Rock Creek that enters the drainage at approximately river mile 13.9. The creek lies entirely within the Welcome Creek Wilderness on Lolo National Forest land. Several historic mines exist on the upper portion of the drainage, which is the only noticeable historic land use in the drainage. During the summer of 2007, the Welcome Creek drainage experienced extensive wildfires, and much of the drainage's riparian vegetation was affected by this event.

Two sections were electrofished on Welcome Creek during August 2008 (Figure 1). The upper section was located just above the confluence of Cinnabar Creek (RM 2.4). The only fish captured at this site were native species, with a total of 17 westslope cutthroat trout and six bull trout being captured (Table 7, Appendix A). At the lower section (RM 0.8), species composition changed considerably. At this site, a total of 13 westslope cutthroat trout and 5 bull trout were captured comprising 34% and 13% of the fish sampled (Table 7). Nonnative salmonids maintained a similar abundance at this site with a total of 15 brown trout and five rainbow trout captured comprising 39% and 13% of the total fish sampled at this site (Table 7).

Table 7. Electrofishing data collected in two sections of Welcome Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 2.4	WCT	17	17	214	88-203	74
	BULL	6	6	131	61-225	26
RM 0.8	WCT	13	13	135	74-232	34
	BULL	5	5	174	114-233	13
	LL	15	15	148	93-229	39
	RB	5	5	196	173-220	13

A riparian assessment was conducted at both electrofishing sections on Welcome Creek. In the upper section, Welcome Creek was classified as a B channel type and received a score of 70/70 (100%) (Table 8). The riparian vegetation at this site was primarily Douglas-fir, alder, and red-osier dogwood and these species were all quite abundant. The fish habitat was excellent with good bank stability, abundant large woody debris, and boulder formed plunge pools throughout the reach. At the lower site, Welcome Creek was classified as a C_b channel and received a score of 67/70 (96%) (Table 8). The reduced assessment score at this site was due to the presence of disturbance-induced plants and functionality of the floodplain due to fire damage. While the stream channel in this reach remained in good shape due to a boulder-dominated nature of the channel, the floodplain consisted mainly of loose, sooty soil, which may cause the floodplain to be less stable during flood events. Overall, the fish habitat in this reach was still classified as "excellent."

Table 8. Riparian assessment results for two sites sampled on Welcome Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 2.4	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)
RM 0.8	28/30 (93%)	39/30 (97%)	10/10 (100%)	67/70 (96%)

A thermograph was placed near the mouth of Welcome Creek at approximately RM 0.1 on July 3, 2008 (Appendix B). Water temperatures did not exceed 15°C during 2008 and the maximum recorded temperature of 11.8°C was observed on August 18, 2008.

Butte Cabin Creek

Butte Cabin Creek is a tributary to Rock Creek that enters the drainage at approximately river mile 18.9. Butte Cabin Creek lies mainly within a roadless portion of the Lolo National Forest. The lower 0.1 mile of Butte Cabin Creek is bordered by a road which leads to a gravel pit utilized by Forest Service road crews. Beyond this point, the only access to the drainage is provided by a National Forest trail.

Two sections were electrofished on Butte Cabin Creek during July 2008 (Figure 1). At the upper site (RM 3.0), a total of three westslope cutthroat trout were captured and no other fish species were captured (Table 9, Appendix A). At the lower section (RM 0.2), species diversity changed considerably. Again, three westslope cutthroat trout were captured along with one bull trout; however 20 brown trout and 12 rainbow trout were also captured. This increase in non-native fish is likely due to the proximity of the sampling section to mainstem Rock Creek. A brown trout redd survey was conducted in mid-November and it was determined that brown trout spawning is occurring in the lower portion of the creek.

Table 9. Electrofishing data collected in two sections of Butte Cabin Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 3.0	WCT	3	3	154	135-173	100
RM 0.2	WCT	3	3	156	125-187	8
	BULL	1	1	270	270	3
	LL	20	20	88	59-122	56
	RB	12	12	85	51-128	33

A riparian assessment was conducted at both electrofishing sections on Butte Cabin Creek. Butte Cabin Creek was classified as a B-channel type and received a perfect 70/70 (100%) at both sites (Table 10). The riparian vegetation was thick at both sites and consisted primarily of alder and Douglas-fir. The abundant woody riparian vegetation at both sites provided excellent bank stability, stream shading and abundant large woody debris.

Table 10. Riparian assessment results for two sites sampled on Butte Cabin Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 3.0	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)
RM 0.2	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)

A thermograph was placed in the lower portion on Butte Cabin Creek at approximately river mile 0.1 on July 3, 2008. Water temperatures did not exceed 15°C during 2008 and the maximum recorded temperature of 10.4°C occurred on August 17, 2008 (Appendix B).

Wahlquist Creek

Wahlquist Creek is a tributary to Rock Creek that enters the drainage at approximately river mile 20.6. Wahlquist Creek lies mainly on National Forest land, however approximately 0.25 miles of the lower drainage flow through private land. There is a primitive trail which follows Wahlquist Creek for about 0.35 miles. The upper portion of the Wahlquist drainage has a series of National Forest Roads that are accessible from the Bitterroot Valley.

Two sections were electrofished on Wahlquist Creek in July 2008 (Figure 1). In the upper section (RM 0.8), no fish were captured (Table 11). Wahlquist Creek in this portion of the drainage is very high gradient and provides minimal habitat for stream dwelling salmonids. A series of smaller waterfalls were observed downstream of this section, which may have prevented historic colonization by westslope cutthroat trout into this portion of the drainage, although most of these falls were not greater than four feet in height. At the lower site located at river mile 0.6, Walhquist Creek is much lower gradient and a total of seven westslope cutthroat trout were captured (Table 11). Interestingly, these fish were primarily larger fish with a length range of 136 to 175 mm TL (Table 11, Appendix A).

Table 11. Electrofishing data collected in two sections of Wahlquist Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 0.7	NO FISH	NO FISH	-	-	-	-
RM 0.6	WCT	7	7	156	136-175	100

A riparian assessment was conducted at both electrofishing sections in the Wahlquist drainage. At the upper site, the creek was an A channel type and scored a 66/66 (100%) (Table 12). This habitat was in excellent condition with dense riparian vegetation consisting of primarily of alder and spruce. However, the gradient in this reach of the creek was quite high which is suspected to preclude westslope cutthroat trout from inhabiting this reach. At the lower site, the gradient leveled out and the creek was classified as a B channel. The creek again displayed excellent fish habitat and scored a perfect 68/68 (100%). The riparian vegetation in this reach was quite dense and consisted of alder and spruce. The width to depth ratio was excellent in the reach and large woody debris and deep pools were abundant.

Table 12. Riparian assessment results for two sites sampled on Wahlquist Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.7	30/30 (100%)	26/26 (100%)	10/10 (100%)	66/66 (100%)
RM 0.6	30/30 (100%)	28/28 (97%)	10/10 (100%)	68/68 (100%)

A thermograph was placed in the lower portion on Wahlquist Creek at approximately river mile 0.1 on July 22, 2008 (Appendix B). Water temperatures did not exceed 15°C during the entire 2008 summer and the maximum temperature of 11.1°C was observed on August 18, 2008.

Alder Creek

Alder Creek is a tributary to Rock Creek that enters the drainage at approximately river mile 23.5. The Alder Creek drainage has a small road system that is accessed from the Bitterroot River Valley. A trail follows Alder Creek for most of its length, however, access to the trail requires fording mainstem Rock Creek at the Bitterroot Flats Campground.

Two sections were electrofished on Alder Creek during September 2008 (Figure 1). In the upper section (RM 2.4), 19 westslope cutthroat trout and one bull trout were captured (Table 13, Appendix A). At the lower section (RM 0.7), species composition was similar with 32 westslope cutthroat trout two bull trout being captured. Interestingly, bull trout captured in both reaches were relatively large juveniles and likely represent older age classes of juveniles (age 3 or 4) (Table 13).

Table 13. Electrofishing data collected in two sections of Alder Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 2.4	WCT	19	19	132	61-237	95
	BULL	1	1	148	148	5
RM 0.7	WCT	32	32	135	72-208	94
	BULL	2	2	160	150-169	6

A riparian assessment was conducted at both electrofishing sections on Alder Creek in 2008 (Table 14). At the upper site, the creek was classified as a B channel type and riparian vegetation consisted of alder, red-osier dogwood, and spruce. The habitat in the reach was considered excellent and the only reduction in assessment score was due to browse observed on woody riparian vegetation, which was likely caused by moose. Upstream of this site, Alder Creek appears to have burned in the 2007 wildfires; however, the extent of the damage was not investigated. At the lower site, Alder Creek exhibited excellent habitat with dense riparian vegetation providing stable banks, abundant LWD, and excellent stream shading (Table 14). The riparian vegetation consisted of primarily alder and spruce and the channel was classified as a C_b channel type in this reach.

Table 14. Riparian assessment results for two sites sampled on Alder Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 2.4	30/30 (100%)	28/30 (93%)	10/10 (100%)	68/70 (97%)
RM 0.7	28/28 (100%)	30/30 (100%)	10/10 (100%)	68/68 (100%)

Cougar Creek

Cougar Creek is a tributary to Rock Creek that enters the drainage at approximately river mile 25.0. Except for the lower 0.1 mile near Rock Creek Road, Cougar Creek flows entirely through roadless National Forest land. During the summer of 2008, the Lolo National Forest replaced an old culvert with an improved bridge crossing where the Rock Creek road crosses Cougar Creek. The goal of this project was to improve fish passage and to reduce the likelihood of failure at this crossing. Land use on Cougar Creek appears to be limited to roadless recreation, although use appears light outside of the campground just off of Rock Creek Road.

Two sections were electrofished on Cougar Creek during September 2008 (Figure 1). At the upper section (river mile 1.7), only one bull trout was captured with no other fish species being captured (Table 15, Appendix A). Interestingly, no fish were captured during sampling efforts in the lower section (RM 0.6). The creek was observed at several other sites below the lowest section (RM 0.6) and a few of the larger pools were electrofished to investigate presence/absence of fish. A few small bull trout were observed in some of the pools that were electrofished, but densities were still quite low. Interestingly, a large bull trout redd was also observed at approximately river mile 0.35.

Cougar Creek was also quickly sampled (a standard 100 m reach was not established) near the campground at approximately RM 0.1 and both brown and rainbow trout were observed at this site. The presence of brown and rainbow trout at this site is likely due to its close proximity to Rock Creek. It is unclear why this drainage does not maintain higher densities of fish and why westslope cutthroat trout were not observed in the drainage. It is also unclear why the distribution of bull trout appears erratic. Further investigations into the distribution and abundance of fish in the Cougar Creek drainage are warranted.

Table 15. Electrofishing data collected in two sections of Cougar Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.7	BULL	1	1	189	189	100
RM 0.6	NO FISH	-	-	-	-	-

A riparian assessment was conducted at both electrofishing sections on Cougar Creek. At both sites, the creek was classified as a B channel type and the riparian habitat at both sites was in excellent condition (Table 16). At the upper site, the riparian vegetation was primarily spruce and alder while the lower site consisted of a mix of spruce, red osier dogwood, lodge pole pine, and willow. Fish habitat was created mainly by large woody debris and boulder pocket water/plunge pools and fish habitat was classified as “excellent” at both sites (Table 16).

Table 16. Riparian assessment results for two sites sampled on Cougar Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.7	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)
RM 0.6	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)

Hogback Creek

Hogback Creek is a tributary to Rock Creek and enters the drainage at approximately river mile 30.7. A majority of the Hogback Creek drainage is within roadless National Forest land. In the lower portion of the Hogback Creek drainage, there is a historic cabin that is maintained by the Lolo National Forest and available for public use. Above this site, Hogback Creek is accessible only by trail.

Two sections were electrofished on Hogback Creek during July 2008 (Figure 1). At the upper electrofishing section (RM 1.0), 18 westslope cutthroat trout were captured along with one bull trout and one brook trout (Table 17, Appendix A). At the lower section (RM 0.2), a slightly higher proportion of non-native fish were sampled. Sixteen westslope cutthroat trout and one bull trout were captured in this section while the non-native fish captured at this site consisted of two brown trout, two brook trout, and one probable rainbow trout x westslope cutthroat trout hybrid. This increase in non-native fish was likely due to the closer proximity of the sampling section to mainstem Rock Creek.

Table 17. Electrofishing data collected in two sections of Hogback Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.0	WCT	18	18	167	82-294	90
	BULL	1	1	205	205	5
	EB	1	1	240	240	5
RM 0.2	WCT	16	16	136	60-284	72
	BULL	1	1	228	228	5
	LL	2	2	125	113-136	9
	EB	2	2	144	85-202	9
	RBxWCT	1*	1	372	372	5

A riparian assessment was conducted at both electrofishing sections on Hogback Creek. At the upper site, Hogback Creek was classified as a B channel type and the woody riparian vegetation consisted of primarily alder and willows. The fish habitat was excellent in this reach and the only deduction in points was due to the presence of disturbance-induced plants and Canada thistle (Table 18). At the lower site, Hogback Creek scored a 69/70 (99%) (Table 18). The only observable signs of degraded habitat were the presence of undesirable plants in the reach, probably as a result of disturbance caused by use at the near-by cabin. This section of creek was also classified a B channel and the woody riparian vegetative community consisted of primarily alder and willows. Fish habitat was rated high at this site due to abundant riparian vegetation providing stream shading, stable banks, and abundant pools (Table 18).

Table 18. Riparian assessment results for two sites sampled on Hogback Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.0	30/30 (100%)	28/30 (93%)	10/10 (100%)	68/70 (97%)
RM 0.2	30/30 (100%)	29/30 (97%)	10/10 (100%)	69/70 (99%)

A thermograph was placed in the lower portion on Hogback Creek at approximately river mile 0.1 on July 3, 2008 (Appendix B). Water temperatures did not exceed 10°C during the entire 2008 summer, and the maximum recorded temperature of 9.8°C was observed on August 17, 2008.

Wyman Gulch

Wyman Gulch is a tributary to Rock Creek and enters the drainage at approximately river mile 32.2. The creek lies entirely on roadless National Forest land. A trail follows the creek for most of its length, and is accessible by fording the mainstem Rock Creek. During the summer of 2007, the drainage was burned heavily by wildfires.

Two sections were electrofished on Wyman Gulch during August 2008 (Figure 1). In the upper section (RM 3.0), a total of 16 westslope cutthroat trout were captured with a mean length of 170 mm (Table 19, Appendix A). In the lower section (RM 1.0), species composition changed substantially. In this section, native species comprised 92% of the species composition with a total of 20 westslope cutthroat trout and six bull trout being captured. Non-native species, on the other hand, comprised approximately 8% of the species composition with one brown trout and one brook trout being captured at this site.

Table 19. Electrofishing data collected in two sections of Wyman Gulch in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 3.0	WCT	16	16	170	75-201	100
RM 1.0	WCT	20	20	107	34-242	71
	BULL	6	6	104	67-144	21
	LL	1	1	240	240	4
	EB	1	1	241	241	4

A riparian assessment was conducted at both electrofishing sections on Wyman Gulch. At the upper site, the creek was classified as a C channel type and the woody riparian vegetation consisted of Douglas fir and spruce. Some habitat degradation was observed at this site, all of which was related to the severe fires, which burned a large portion of the drainage in 2007 (Table 20). Nearly all the riparian vegetation in this reach was burned except for a few small alders. This resulted in an un-shaded stream with abundant fine sediment and some bank erosion. At the lower site, Wyman Gulch was classified as a B channel type and the woody riparian vegetation consisted of Douglas fir, spruce and alder. The fire damage was as extensive as was observed at the upper site, however due to the boulder-dominated nature of this B channel, fish habitat was less impacted by the wildfires (Table 20). Stream shading remained a concern, but the stream banks were stable and fine sediment was not as abundant as observed at the upstream site. The floodplain was damaged by fire and the introduction of fine sediment from the floodplain will likely occur during high flow events.

Table 20. Riparian assessment results for two sites sampled on Wyman Gulch in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 3.0	28/30 (93%)	24/30 (80%)	7/10 (70%)	59/70 (84%)
RM 1.0	28/30 (93%)	10/10 (100%)	10/10 (100%)	48/50 (96%)

A thermograph was placed in the lower portion on Wyman Gulch at approximately river mile 0.1 on July 3, 2008 (Appendix B). The temperature exceeded 15°C on three days during the 2008 summer, with the maximum recorded temperature of 15.3°C occurring on July 16, 2008. The likely cause of Wyman Gulch being the only tributary of Rock Creek with a temperature exceeding 15°C is the lack of shading by woody riparian vegetation due to the extensive fire damage from the 2007 wildfires.

Stony Creek

Stony Creek is a tributary to Rock Creek and enters the drainage at approximately river mile 38.4. Approximately one mile of the lower portion of Stony Creek flows through private land, while the remainder of the creek flows through National Forest land. Forest Road 241 follows the creek for approximately the lower five miles and the remainder of the drainage is roadless.

Three sections were electrofished on Stony Creek during July and August 2008 (Figure 1). The upper section (river mile 6.2) was located approximately ½ mile above the trailhead on National Forest land. At this site, only native fish were captured with a total of three westslope cutthroat trout and five bull trout being sampled (Table 21, Appendix A). At the middle site (RM 3.6), located just above the mouth of Camp Creek, again only native species were captured (Table 21). At this site, a total 42 westslope cutthroat trout and 16 bull trout were captured. At the lowest site (RM 1.3), a total of six non-native brown trout were captured, comprising 37% of the fish sampled while a total of ten bull trout and eight westslope cutthroat were captured, comprising 26% and 15% of the fish captured (Table 21, Appendix A). The remainder of the fish captured at this site were suspected to be rainbow/westslope cutthroat trout hybrids, although genetic testing would be required to confirm that these fish were indeed hybrids.

Table 21. Electrofishing data collected in three sections of Stony Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 6.2	WCT	3	3	123	49-176	38
	BULL	5	5	140	80-174	63
RM 3.6	WCT	42	42	136	28-270	72
	BULL	16	16	130	53-215	28
RM 1.3	WCT	8	8	120	80-191	26
	BULL	10	10	182	100-263	32
	LL	6	6	149	42-270	19
	RBxWCT*	7	7	164	84-284	23

* pending results of genetic analysis

A riparian assessment was conducted at all three electrofishing sections on Stony Creek. At the upper site, the Stony Creek was classified as an A channel and the woody riparian vegetation consisted of lodgepole pine and spruce (Table 22). Fish habitat at this site was excellent due to abundant large woody debris and deep pools. At the middle site (RM 3.6), the site was classified as a B channel and again was in excellent condition. Similar to the upper site, abundant large woody debris and deep pools were found throughout the reach. At the lowest site, Stony Creek was classified as a B_c channel type and again demonstrated excellent fish habitat. The only degradation observed at this site was the presence of noxious weeds (Canada thistle, spotted knapweed) and disturbance induced undesirable plant species (Table 22).

Table 22. Riparian assessment results for three sites sampled on Stony Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 6.2	30/30 (100%)	28/28 (100%)	10/10 (100%)	68/68 (100%)
RM 3.6	30/30 (100%)	28/28 (100%)	10/10 (100%)	68/68 (100%)
RM 1.3	30/30 (100%)	30/28 (93%)	10/7 (70%)	68/70 (97%)

A thermograph was placed in the lower portion of Stony Creek at approximately river mile 0.1 on July 2, 2008 (Appendix B). However, this thermograph was found partially out of water on August 20, 2008. Because it is unknown when this thermograph emerged from the water, all data before August 20, 2008 were excluded from our report. After this date, the maximum recorded temperature of 13.2°C occurred on August 25, 2008.

Moose Gulch

Moose Gulch is a tributary to Stony Creek and enters the drainage at approximately river mile 1.6. Moose Gulch flows entirely through National Forest land. The lower portion of the drainage is accessible via a spur road off the main Stony Creek Road while the upper portion of the drainage is accessible via FR 5012.

One section was electrofished on the upper portion of Moose Gulch in August 2008 (Figure 1). No fish were captured at this site (Table 23). A second section was attempted the mouth, however it was found to be dry. It appears that this portion of Moose Gulch is intermittent and only flows during high water conditions.

Table 23. Electrofishing data collected in one section of Moose Gulch in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.9	NO FISH	NO FISH	-	-	-	-

A riparian assessment was conducted at the electrofishing section on upper Moose Gulch (Table 24). Moose Gulch in this reach was classified as a B-channel with the riparian vegetation consisting of Douglas-fir, lodgepole pine, and spruce. The creek in this reach maintained excellent fish habitat with abundant large woody debris and quality pool habitat. The only degradation observed was relatively heavy browse on the riparian vegetation, likely caused by big game inhabiting the drainage.

Table 24. Riparian assessment results for one site sampled on Moose Gulch in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.9	30/30(100%)	27/28(96%)	10/10(100%)	67/68(99%)

Little Stony Creek

Little Stony Creek is a tributary to Stony Creek and enters the drainage at approximately RM 5.8. Little Stony Creek lies entirely on roadless National Forest lands, with a lightly used trail providing the only access to the drainage. One section was electrofished on Little Stony Creek in July 2008 (Figure 1). Three westslope cutthroat trout and seven bull trout were captured in this reach (Table 25).

Table 25. Electrofishing data collected in one section of Little Stony Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 0.3	WCT	3	3	73	60-96	30
	BULL	7	7	134	90-190	70

A riparian assessment was conducted at the electrofishing site on Little Stony Creek (Table 26). Little Stony Creek was classified as an A/B channel in this reach and the riparian vegetation consisted of alder, lodgepole, and spruce. Fish habitat was excellent due to abundant woody riparian vegetation, deep pools, and large woody debris.

Table 26. Riparian assessment results from one site sampled on Little Stony Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.3	30/30(100%)	28/28(100%)	10/10(100%)	68/68(100%)

West Fork Rock Creek Drainage

West Fork Rock Creek

West Fork Rock Creek is a tributary to mainstem Rock Creek and forms mainstem Rock Creek at its confluence with Middle Fork Rock Creek at approximately RM 51.3. West Fork Rock Creek originates in the Sapphire Mountains on the Beaverhead-Deerlodge National Forest with a majority of the upper portion of the drainage being located within National Forest lands. For a majority of its length, West Fork Rock Creek is followed by Montana Highway 38 (Skalkaho Highway). In the lower portion of the drainage, land ownership is a mix of Forest Service, State of Montana, and private land ownership. Grazing occurs on private lands as well as National Forest and State of Montana lands through grazing allotments, although some of the grazing allotments in the upper portion of the drainage have been recently removed (Steve Gerdes, Beaverhead-Deerlodge National Forest, pers. comm.). Past logging is still evident in portions of the drainage.

Four sections were electrofished on West Fork Rock Creek during July and August of 2008 (Table 27, Figure 2). The upper section was located on National Forest land above the mouth of Bowles Creek at approximately river mile 21.1. At this site, 14 westslope cutthroat trout and four bull trout were captured comprising 78% and 22% of the fish community, respectively (Table 27, Appendix A). The next site downstream was located about 1.5 miles above the confluence with Sand Basin Creek (RM 16.2) (Figure 2). Fish species composition at this site remained entirely of native fish and mountain whitefish were also captured at this site (Table 27, Appendix A). Westslope cutthroat trout were again the most abundant species with a total of 21 fish captured while a total of four bull trout and seven mountain whitefish were also captured. The next site downstream was located at river mile 6.4, just above the mouth of Coal Gulch. At this site, a total of 47 westslope cutthroat and 11 bull trout were captured comprising 80% and 18% of the fish sampled while one brown trout was also sampled comprising 2% of the fish sampled (Table 27, Appendix A). Other species sampled at this site include mountain whitefish and longnose suckers. The final electrofishing section was completed on a section of land owned by the State of Montana and located at river mile 1.7. Fish densities appeared to be quite low at this site with a total of only four westslope cutthroat trout and three brown trout being sampled in this section (Table 27, Appendix A). Other species captured included longnose suckers and longnose dace.

Table 27. Electrofishing data collected in four sections of West Fork Rock Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 21.1	WCT	14	14	139	58-230	78
	BULL	4	4	194	142-272	22
RM 16.2	WCT	21	21	134	54-244	84
	BULL	4	4	162	151-193	16
	MWF	7	7	123	86-269	-
RM 6.4	WCT	47	47	171	75-254	80
	BULL	11	11	157	85-245	18
	LL	1	1	153	153	2
	MWF	1	1	184	184	-
	LN_SU	5	5	191	170-221	-
RM 1.7	WCT	4	4	172	97-248	57
	LL	3	3	232	188-260	43
	LN_SU	4	4	146	115-169	-
	LN_DC	6	6	128	66-157	-

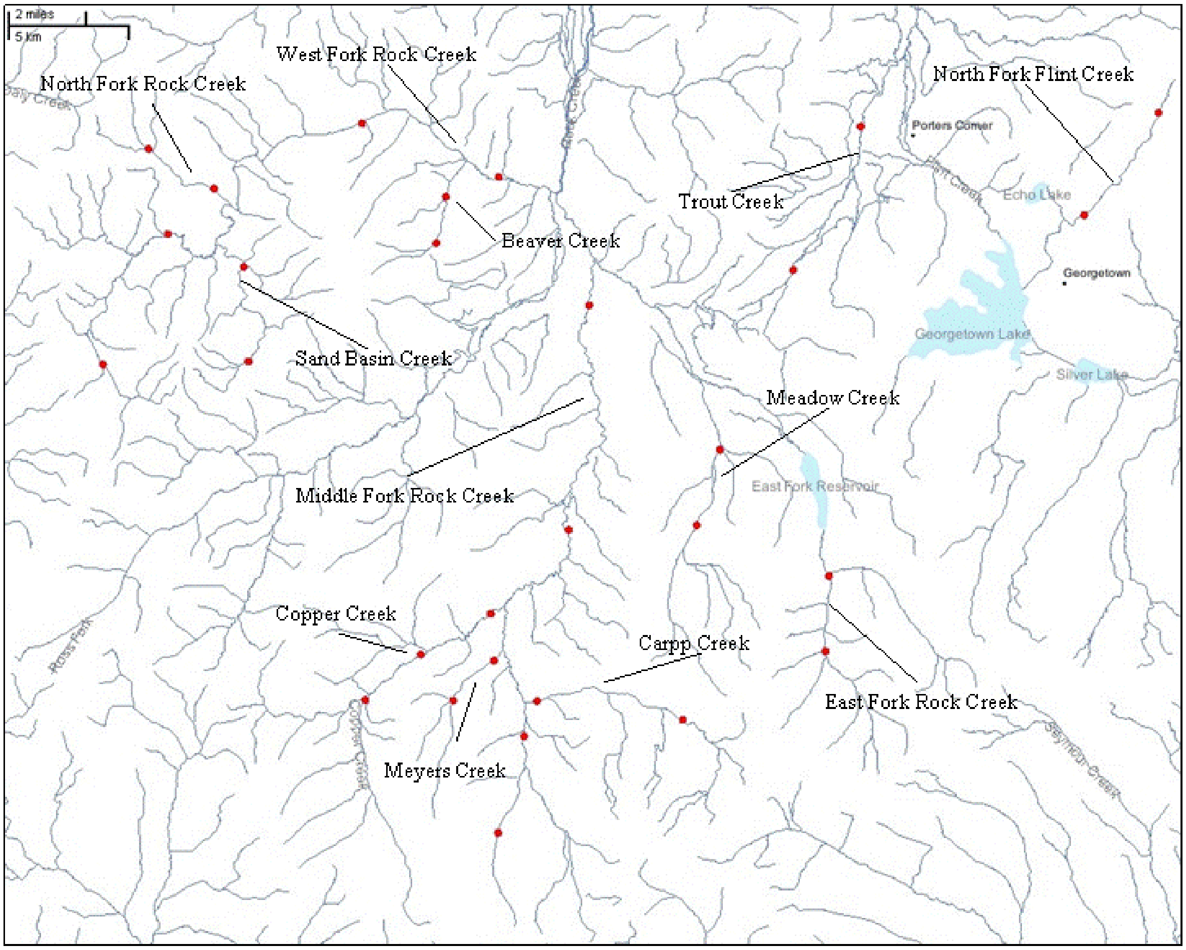


Figure 2- Map of the Upper Rock Creek drainage showing electrofishing sections completed in 2008.

Riparian assessments were completed at all of the electrofishing sections sampled in the West Fork Rock Creek drainage in 2008. Some habitat degradation was observed at the site located at river mile 21.1 including relatively low densities of riparian vegetation, large woody debris, and deep pools as well as a slightly incised channel which may not allow the stream properly access its floodplain (Table 28). The creek appeared to have a B_c channel type, but due to the channel incision, it resembled an E channel. Bank erosion was observed in several portions of the reach. Similar habitat degradation was observed at the site located at river mile 16.6. This reach was classified as a B channel type and the riparian vegetation consisted of sedges, spruce, lodgepole pine and willows. The density of woody riparian vegetation in this reach appeared reduced and recruitment of these species also appeared to be somewhat limited. These impacts on woody riparian vegetation appeared to be affecting channel stability with bank erosion and channel over-widening evident in the reach (Table 28). It appears that at both river mile 21.1 and 16.6, previous cattle grazing may have caused the observed habitat degradation, however, it also appears that changes in grazing management in this reach may be allowing these reaches to recover from these past impacts.

The riparian assessment conducted at the electrofishing section located just above Coal Gulch (RM 6.4) indicated that fish habitat in this reach was excellent (Table 28). West Fork Rock

Creek in this section was classified as a boulder-dominated B_c channel, with abundant woody riparian vegetation, large woody debris, and deep pools which yielded an excellent fish habitat score (Table 28). In the lowest section located at RM 1.7, riparian habitat and channel conditions were found to be fair (51/70 overall score) (Table 28). At this site, cattle grazing appeared to be having significant impacts on the riparian habitat. This reach was classified as a B_c channel type and despite the resiliency of this channel type to grazing, the channel was over-widened with relatively simple fish habitat observed throughout the reach. The abundance of riparian vegetation, particularly willows, appeared to be reduced due to the impact of riparian grazing. The relatively high width to depth ratio and reduced woody riparian vegetation appeared to be having impacts on fish habitat as water temperatures were quite high (16.8° C) on the day of the survey and periphyton was abundant throughout the reach. The abundance of salmonids appeared to be significantly reduced compared to other reaches of West Fork Rock Creek, which is likely indicative of the fish habitat in this reach.

Table 28. Riparian assessment results for four sites sampled on West Fork Rock Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 21.1	23/30 (77%)	26/30 (87%)	7/10 (70%)	56/70 (80%)
RM 16.2	21/30 (70%)	26/30 (87%)	7/10 (70%)	54/70 (77%)
RM 6.4	30/30 (100%)	29/30 (97%)	10/10 (100%)	69/70 (99%)
RM 1.7	25/30 (83%)	23/30 (77%)	3/10 (30%)	51/70 (73%)

A thermograph was placed in the lower portion of the West Fork Rock Creek at approximately river mile 0.2 on July 2, 2008. However, this thermograph was found partially out of water on September 10, 2008. Because it is unknown when this thermograph emerged from the water, all data before September 10, 2008 were excluded from this report. After September 10, a maximum recorded temperature of 13.6°C was observed on both September 15 and September 19, 2008. These water temperatures are lower than would have been observed in July and August.

Beaver Creek

Beaver Creek is a tributary to the West Fork Rock Creek and enters the drainage at approximately river mile 2.8. Beaver Creek lies almost entirely on National Forest land with the exception of the lowest portion of the drainage, which flows through private land. Forest roads are found throughout the drainage and land uses that were observed included both cattle grazing and historic logging.

Two sections were electrofished on Beaver Creek during July 2008 (Figure 2). The upper section (RM 3.7) was located on National Forest land just above the FR 5068 crossing. No fish were captured at this site (Table 29, Appendix A). At the lower site RM 1.1), a total of 14 westslope cutthroat trout were captured with no other species of fish being observed (Table 29).

Table 29. Electrofishing data collected in two sections of Beaver Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 2.4	NO FISH	-	-	-	-	-
RM 1.1	WCT	14	14	97	50-141	100

A riparian assessment was conducted at both electrofishing sections on Beaver Creek (Table 30). At the upper site, the creek was classified A/B channel type and demonstrated excellent riparian habitat (Table 30). No degradation of either the riparian vegetation or stream channel was observed at this site. At the lower site (RM 1.1), the riparian habitat was still found to be quite good, but some degradation was observed (Table 30). This site was located on National Forest lands and was being managed as an active grazing allotment. Grazing in the riparian area appeared to be impacting willow regeneration and noxious weeds, such as Canada thistle, were present in the reach. However, fish habitat was rated as excellent in this reach, as deep pools and undercut banks were abundant in this E channel (Table 30). Despite the lack of older age classes of willows, younger willows were quite abundant in this reach.

Table 30. Riparian assessment results for two sites sampled on Beaver Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 2.4	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)
RM 1.1	30/30 (100%)	26/30 (87%)	10/10 (100%)	66/70 (94%)

North Fork Rock Creek

North Fork Rock Creek is a tributary to West Fork Rock Creek and enters the drainage at approximately river mile 12.4. The North Fork Rock Creek flows through National Forest land and is followed for its entire length by Highway 38 (Skalkaho Highway). North Fork Rock Creek's headwaters are located near Skalkaho Pass and flows through Mud Lake, approximately one mile below its headwaters.

Two sections were electrofished on the North Fork Rock Creek during July 2008 (Figure 2). The upper section (RM 2.9) was located just below the Crystal Creek confluence. At this site, 54 westslope cutthroat trout and two bull trout were captured (Table 31, Appendix A). At the lower site (RM 0.7), 22 westslope cutthroat trout and 13 bull trout were captured with again only native fish being observed in this reach.

Table 31. Electrofishing data collected in two sections of North Fork Rock Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 2.9	WCT	54	54	106	49-195	96
	BULL	2	2	101	94-108	4
RM 0.7	WCT	22	22	118	49-231	37
	BULL	13	13	141	71-305	63

A riparian assessment was conducted at both electrofishing sections on North Fork Rock Creek (Table 32). At the upper site, the creek was a B channel type that maintained excellent riparian habitat (Table 32). The quality habitat in this reach was due to the low width to depth ratio and abundant woody riparian vegetation, large woody debris, and deep pools. At the lower site (RM 0.7), approximately half of this reach was classified as a B channel while the other half was classified as a C channel and this portion of the stream again demonstrated excellent riparian habitat (Table 32). Similar to the upstream section, this reach of North Fork Rock Creek maintained a low width to depth ratio and abundant woody riparian vegetation and quality pools. Interestingly, conductivity in both reaches was quite low with readings of 10.1 µS and 12.0 µS in the upper and lower reaches, respectively.

Table 32. Riparian assessment results collected for two sites on North Fork Rock Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 2.9	30/30 (100%)	12/12 (100%)	10/10 (100%)	52/52 (100%)
RM 0.7	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)

Sand Basin Creek

Sand Basin Creek is a tributary to the West Fork Rock Creek and enters the drainage at approximately RM 14.2. Sand Basin Creek lies on National Forest land and is followed for its most of its length by a series of forest roads. Most of the drainage is marshy and low gradient and sand is the dominant substrate found in this creek. Past grazing of National Forest Lands in this drainage was apparent, but no active grazing was observed in 2008.

Two sections were electrofished on Sand Basin Creek during July 2008 (Figure 2). The upper section (RM 4.5) was located just below the confluence of a small tributary. At this site, 30 westslope cutthroat trout and four bull trout were captured (Table 33, Appendix A). At the lower site (RM 1.2), only westslope cutthroat trout were captured with a total of 41 being sampled.

Table 33. Electrofishing data collected in two sections of Sand Basin Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 4.5	WCT	30	30	100	45-187	88
	BULL	4	4	79	63-95	12
RM 1.2	WCT	41	41	113	49-226	100

A riparian assessment was conducted at both electrofishing sections on Sand Basin Creek (Table 34). At the upper site, the creek was classified as a B channel type and the habitat was found to be in good condition (Table 34). The only habitat deficiencies observed was a minimal number of young woody riparian species, which may be due to past fire activity or historic grazing. At the lower site (RM 1.2), Sand Basin Creek was classified as an E channel type and still maintained good habitat, although some deficiencies were noted (Table 34). Both woody riparian vegetation and large woody debris appeared to be slightly less dense than expected for this site. Past grazing in this reach may have played a role in the minor habitat degradation that was observed.

Table 34. Riparian assessment results collected for two sites on North Fork Rock Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 4.5	30/30 (100%)	28/30 (93%)	10/10 (100%)	68/70 (97%)
RM 1.2	28/30 (93%)	27/30 (90%)	7/10 (70%)	62/70 (89%)

Middle Fork Rock Creek Drainage

Middle Fork Rock Creek

Middle Fork Rock Creek along with West Fork Rock Creek combine to form Rock Creek at their confluence just above Skalkaho Bridge at approximately river mile 51.4. The Middle Fork Rock Creek drainage begins in the Anaconda-Pintler Wilderness area and thus the upper portion of the drainage exhibits excellent fish habitat. Below the wilderness boundary, land ownership remains National Forest, however additional land uses were observed in this reach including cattle grazing and historic logging. In the lower portion of the drainage, land ownership is primarily private with cattle ranching being the primary land use.

In August and September 2008, four sections of Middle Fork Rock Creek were electrofished (Figure 2). The upper site was located at river mile 21.5, approximately one mile above the trailhead into the Anaconda-Pintler Wilderness area. Westslope cutthroat trout and bull trout were the only fish species captured with a total of 13 westslope cutthroat trout and nine bull trout being sampled (Table 35, Appendix A). The next site downstream was located approximately one mile above Carpp Creek at RM 18.5. Again, westslope cutthroat trout and bull trout were the primary fish species sampled with a total of 16 and 14 captured, respectively. One brook trout, measuring 136 mm, was also sampled. One relatively large (555 mm) bull trout was captured in this section and this fish was likely a migratory fish from Rock Creek that had entered the drainage to spawn (Table 35).

The next section downstream was located within a US Forest Service restoration project at river mile 11.0 (Table 35). At this site, a 200 meter section was sampled and a two-pass depletion estimate was conducted to provide baseline monitoring for the restoration project. Half of the fish sampled (50%) were native species, while the other half were non-native brown and brook trout. Forty eight westslope cutthroat trout and seven bull trout were captured in total in this reach while 27 brown trout and 27 brook trout were also captured. Four mountain whitefish were also sampled at this site. At the lowest site (RM 3.5), 13 brown trout were captured, compared with just 11 westslope cutthroat trout and three bull trout. One brook trout, one mountain whitefish, and one longnose dace were also sampled. Electrofishing efficiency in this reach was quite low due to the size of the stream and the use of only one backpack electrofisher for sampling. Effective sampling (i.e. relatively high capture probabilities) in this reach would likely require the use of two backpack electrofishers or a mobile anode electrofishing unit. Additional electrofishing data was collected on mainstem Middle Fork Rock Creek in 2007 and this data was summarized in ***An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin*** (2008).

Table 35. Electrofishing data collected in four sections of Middle Fork Rock Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 21.5	WCT	13	13	120	58-237	72
	BULL	5	5	150	145-157	28
RM 18.5	WCT	16	16	149	65-280	52
	BULL	14	14	148	46-555	45
	EB	1	1	136	136	3
RM 11.0	WCT	48	24	158	81-385	44
	BULL	7	3	158	60-210	6
	LL	27	13	168	100-330	25
	EB	27	13	116	44-229	25
	MWF	4	2	224	46-290	-
RM 3.5	WCT	11	11	170	48-357	39
	BULL	3	3	194	167-242	11
	LL	13	13	152	65-310	46
	EB	1	1	175	175	4
	MWF	1	1	80	80	-
	LN DC	1	1	151	151	-

A riparian assessment was conducted at each site sampled in 2008 (Table 36). At the upper site, the creek was classified as a B channel in a lodgepole pine/spruce forest and the habitat was found to be excellent. This site is located within the Anaconda-Pintlar Wilderness and large woody debris and deep pools were abundant. Spawning habitat was present in the reach and quality juvenile rearing habitat was abundant. At the next site downstream (RM 18.5), the creek was classified as a B_c channel and the habitat appeared to be in good condition. Some habitat deficiencies were observed in the reach including relatively low densities middle and older age classes of willows and some bank instability. Large woody debris was also somewhat limited in the reach. It was apparent that cattle grazing had occurred at this site in the past and was the likely reason for the degradation observed however, fish habitat in the reach was still classified as “good” (Table 36).

The next site downstream in the drainage is located at river mile 11.0, near the lower end up Forest Service ownership in the drainage. The stream channel at this site was classified at a B_c channel type and the riparian vegetation consisted of spruce, lodgepole pine, and alder (Table 36). Historically, cattle grazing had occurred at this site as part of a National Forest grazing allotment and habitat degradation was observed. The primary degradation observed included channel over-widening, reduced densities or younger and middle age classes of woody riparian vegetation, a general lack of willow and alders in the reach, and a minimal amount of large woody debris in the channel. In recent years, the Beaverhead-Deerlodge National Forest had excluded this portion of Middle Fork Rock Creek from grazing. In 2008, the Beaverhead-

Deerlodge National Forest also completed a habitat restoration project aimed at adding large woody debris to the channel to provide fish habitat and bank stability while also promoting the regeneration of willow and alder in the reach. The effectiveness of this project will be monitored into the future through both channel dimension monitoring (cross-sections and longitudinal profiles) and fish abundance monitoring. The lowest section sampled in the Middle Fork drainage is located at river mile 3.5. This section was classified as a B channel type with the channel substrate being dominated by large boulders. The habitat in this section was found to be excellent with abundant woody riparian vegetation and boulder formed pocket pool habitat (Table 36). The only habitat deficiencies observed in this reach were the relatively low abundance of large woody debris along with the presence of weeds and undesirable plant species within the riparian area. Cattle grazing and the associated browse of woody riparian vegetation was observed in the reach, however, cattle use did not appear to be high and the boulder dominated nature of the channel and stream banks appeared to be minimizing the degradation caused by cattle grazing.

Table 36. Riparian assessment results collected for four sites on Middle Fork Rock Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 21.5	30/30 (100%)	26/26 (100%)	10/10 (100%)	66/66 (100%)
RM 18.5	30/30 (100%)	22/28 (79%)	7/10 (70%)	59/68 (87%)
RM 11.0	25/30 (83%)	24/30 (80%)	7/10 (70%)	56/70 (80%)
RM 3.5	30/30 (100%)	15/18 (83%)	10/10 (100%)	55/58 (95%)

A thermograph was placed in the lower portion of the Middle Fork Rock Creek at approximately river mile 0.1 on July 2, 2008 (Appendix B). However, this thermograph was found partially out of water on September 10, 2008. Because it is unknown when this thermograph emerged from the water, all data before September 10, 2008 were excluded from this report. After September 10, the maximum recorded temperature of 13.6°C was observed on September 19, 2008.

Meyers Creek

Meyers Creek is a tributary to Middle Fork Rock Creek and enters the drainage at approximately river mile 16.0. Meyers Creek lies entirely on National Forest land and can be accessed on its upper reaches by walking the gated Forest Road 5057. Cattle grazing was observed near the confluence with Middle Fork Rock Creek and historic logging was observed in the upper portions of the drainage.

Two sections were electrofished on Meyers Creek during July 2008 (Figure 2). The upper section (RM 1.9) was located just below the confluence of a small, unnamed tributary. At this site, four westslope cutthroat trout, two bull trout, 36 brook trout, and one probable bull trout x brook trout hybrid were captured (Table 37, Appendix A). The bull trout x brook trout hybrid will be submitted for genetic analysis to confirm that it is a hybrid. At the lower site (RM 0.4), bull trout were the most abundant fish species with a total of seven captured, comprised 37% of the species composition. Six cutthroat trout and six brook trout were also captured, comprising 32% of the fish composition each.

Table 37. Electrofishing data collected in two sections of Meyers Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.9	WCT	4	4	129	85-172	9
	BULL	2	2	126	103-168	5
	EB	36	36	108	32-186	84
	BULLxEB*	1	1	103	103	2
RM 0.4	WCT	6	6	106	50-155	32
	BULL	7	7	90	63-138	37
	EB	6	6	111	66-155	32

* Pending results of genetic analysis

A riparian assessment was conducted at both electrofishing sections on Meyers Creek in 2008 (Table 38). At the upper site, the creek was a B channel type that demonstrated excellent habitat (Table 38). At this site, riparian vegetation was abundant including lodgepole pine, spruce, and sedges with the woody species providing an excellent source of large woody debris recruitment. At the lower site (RM 0.4), the creek was characterized as a B channel type and the riparian vegetation was primarily Douglas fir and spruce (Table 38). At this site, Meyers Creek had an appropriate width to depth ratio and abundant large woody/boulders created deep scour pools. Dense woody riparian vegetation in the reach provided good bank stability and quality spawning habitat was also observed. Near its confluence with the Middle Fork, Meyers Creek was currently being grazed and some habitat degradation was observed in this reach including bank erosion and a reduction of woody riparian vegetation.

Table 38. Riparian assessment results collected for two sites on Meyers Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.9	30/30 (100%)	28/28 (100%)	10/10 (70%)	68/68 (100%)
RM 0.4	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)

Copper Creek

Copper Creek is a tributary to Middle Fork Rock Creek, which enters the drainage at approximately river mile 14.7. Copper Creek lies entirely on National Forest land and minimal land use impacts were observed in the drainage, particularly in the upper portion of the drainage, which is roadless.

Three sections were electrofished on Copper Creek in 2008 (Figure 2). The upper section was located just below the confluence of Lutz Creek at RM 4.8 (Table 39, Appendix A). At this site, 22 westslope cutthroat trout and two bull trout were captured comprising 59% and 5% of the fish sampled, respectively. Brook trout were also sampled in this reach with a total of 13 captured, comprising 35% of the fish sampled. The middle section was located just above the confluence with Green Canyon Creek and native species comprised less than 50% of the fish population in this reach (RM 1.9). At this site, 21 westslope cutthroat trout and three bull trout were captured, comprising 43% and 6% of the species composition, while a total of 25 brook trout were sampled, comprising 51% of the species composition. The lowest site was located just upstream of the Forest Service bridge across Copper Creek at river mile 0.4 (Table 39). At this site, a total of 33 westslope cutthroat trout and 17 bull trout were sampled, comprising 26% and 13% of the fish captured. Other species sampled at this site included brook trout, brown trout, and a bull trout x brook trout hybrid with a total of 77 brook trout and one brown trout being captured. Brook trout comprised 60% of the fish sampled at this site. A fin clip was collected for the bull trout x brook trout hybrid and will be submitted for genetic analysis to confirm that this fish is a hybrid.

Table 39. Electrofishing data collected in three sections of Copper Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 4.8	WCT	22	22	150	59-260	59
	BULL	2	2	154	110-198	5
	EB	13	13	128	85-212	35
RM 1.9	WCT	21	21	158	65-275	43
	BULL	3	3	188	134-221	6
	EB	25	25	107	35-235	51
RM 0.4	WCT	33	33	146	67-267	26
	BULL	17	17	139	98-530	13
	LL	1	1	156	156	1
	EB	77	77	120	37-252	60
	BULLxEB*	1	1	177	177	1

* pending results of genetic analysis

A riparian assessment was conducted at each of the three electrofishing sections on Copper Creek in 2008 (Table 40). At the upper site, the creek was classified as a B channel, although it was located just downstream of a C channel reach. All aspects of the riparian habitat were in good shape at this section, and fish habitat was rated as excellent (Table 40). Large woody debris was common, woody riparian vegetation was abundant and the reach demonstrated an excellent width to depth ratio. At the middle site, the creek still maintained quality habitat, however some minor deficiencies were noted (Table 40). At this site, the creek was classified as a C_b channel type and fish habitat was rated as excellent, as pools were abundant and width to depth ratio was low. Also, spawning habitat was abundant throughout the reach. The deficiencies of this section included the presence of some bank erosion, a slightly lower density of willows than expected for this reach, and the presence of disturbance-induced plants and noxious weeds. The cause of the slight habitat degradation observed at this site was unknown, but may have been due to past grazing. At the lowest site, Copper Creek was classified as a C_b channel type and the riparian habitat was found to be in excellent condition (Table 40). The riparian vegetation in this reach consisted of willows, sedges and lodgepole pine. Fish habitat was rated as excellent due to the abundant woody riparian vegetation, good width to depth ratio, and abundant pools.

Table 40. Riparian assessment results collected for three sites on Copper Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 4.8	30/30 (100%)	18/18 (100%)	10/10 (100%)	58/58 (100%)
RM 1.9	27/30 (90%)	26/30 (87%)	10/10 (100%)	63/70 (90%)
RM 0.4	30/30 (100%)	29/30 (97%)	10/10 (100%)	69/70 (99%)

A thermograph was placed in the lower portion of Copper Creek at approximately river mile 0.1 on July 2, 2008 (Appendix B). However, this thermograph was found partially out of water on September 10, 2008. Because it is unknown when this thermograph emerged from the water, all data before September 10, 2008 were excluded from our report. After this date, a maximum recorded temperature of 11.4°C was observed on September 19, 2008.

Carpp Creek

Carpp Creek is a tributary to Middle Fork Rock Creek and enters the drainage at approximately river mile 17.6. Carpp Creek flows entirely through National Forest lands. Approximately one mile upstream from the mouth, Carpp Creek serves as a boundary for the Anaconda-Pintler Wilderness Area with land to the south classified as wilderness. Carpp Creek is accessible on its lower end via Moose Lake Road and approximately four miles upstream via FR 5141. Land use is minimal in the drainage due to a majority of the drainage being located within wilderness.

Carpp Creek was electrofished at two sites during July 2008 (Figure 2). The upper site was located just above the trailhead at the end of FR 5121 (RM 4.4) (Table 41, Appendix A). In this section, seven westslope cutthroat trout and one bull trout were captured. The lower site was located at approximately river mile 0.3. In this section, only two westslope cutthroat trout were captured, while eight bull trout and seven brook trout were also captured. Water levels were still relatively high in Carpp Creek during these electrofishing surveys making netting somewhat difficult, particularly in the lower section. Due to the high water conditions, it is suspected that several fish were missed which may have affected the CPUE (Table 41).

Table 41. Electrofishing data collected in two sections of Carpp Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 4.4	WCT	7	7	134	96-185	88
	BULL	1	1	85	85	12
RM 0.3	WCT	2	2	114	55-173	12
	BULL	8	8	125	99-150	47
	EB	7	7	161	130-247	41

A riparian assessment was conducted at each site on Carpp Creek in 2008 (Table 42). At both sites, the riparian habitat conditions were excellent (Table 42). At the upper site the creek was classified as a C channel, although the section was located just above the start of a B channel. All aspects of the stream at this site were in good condition and fish habitat was rated as excellent. Woody riparian vegetation and large woody debris were abundant and deep pools were common. Excellent spawning habitat was common in the reach. However, this spawning habitat may not be currently used by migratory bull trout due to a large logjam located downstream of the site that may be serving as an upstream migration barrier (Steve Gerdes, Beaverhead-Deerlodge National Forest, pers. comm.). Unfortunately, this logjam was not observed during these surveys. At the lower site, the stream was classified as a B channel and the riparian vegetation at this site consisted of alder, spruce, and lodgepole pine. At this site, habitat was created primarily by the abundant large boulders and plunge pools with deep pools being observed throughout the reach. Large woody debris and woody riparian vegetation were also abundant throughout the reach (Table 42). Interestingly, this reach appeared to have significantly more water than the upstream site.

Table 42. Riparian assessment results collected from two sites on Carpp Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 4.4	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)
RM 0.3	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)

A thermograph was placed in the lower portion of Carpp Creek at approximately RM 0.1 on July 2, 2008 (Appendix B). Water temperatures did not exceed 15°C during 2008 and the maximum recorded temperature of 12.1°C was observed on August 7, 2008.

East Fork Rock Creek Drainage

East Fork Rock Creek

East Fork Rock Creek is a tributary of Middle Fork Rock Creek, which enters the drainage at approximately river mile 2.1. East Fork Rock Creek begins in the Anaconda-Pintler Wilderness Area and is fed by several tributaries before leaving the wilderness and entering East Fork Reservoir at approximately river mile 8.5. The primary purpose of the reservoir is to capture and store spring high flows and deliver this water to the Flint Creek valley for irrigation. The main diversion into the Flint Creek Canal is located just below the dam at approximately river mile 8.2. During summer irrigation season, a majority of the East Fork Rock Creek flow is diverted into this canal (canal capacity is 200 cfs). This water travels to approximately 2.5 miles to where it is siphoned from the west side of the valley to the east side of the valley and eventually gains the necessary elevation to enter the Trout Creek drainage. This water is then delivered to the Flint Creek valley via Trout Creek. Releases from the dam are quite high during the irrigation season (May-October- up to 200 cfs) and low during the remainder of the year with discharge from the dam commonly being less than 1 cfs from November through April.

Two sections were electrofished on East Fork Rock Creek during July 2008 (Figure 2). Both sites were located above the reservoir and within the wilderness boundary. Additional data for the lower portion of East Fork Rock Creek (below the dam) are presented in Lindstrom et al. (2008). The upper site was located just upstream of Spruce Creek approximately 3.0 miles above the reservoir (RM 14.3). At this site, bull trout were the only fish captured (Table 43, Appendix A). A total of nine bull trout were captured and these fish had a mean length of 109 mm (Table 43). The lower site sampled was located just above Page Creek (RM 12.2), which marks the downstream boundary of the Anaconda Pintler Wilderness. At this site, both westslope cutthroat trout and bull trout were captured (Table 43). Ten cutthroat trout were captured with a mean length of 148 mm and a range of 56-375 mm. The largest fish was believed to be a hatchery fish stocked into East Fork Reservoir due to its large size and apparent fin erosion, typical of fish reared in hatchery raceways. In addition to westslope cutthroat trout, a total of 18 bull trout were also captured in this reach (Table 43). Additional electrofishing data for the lower portion of East Fork Rock Creek (below the dam) was collected in 2007 and the results of this survey work are summarized in ***An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin*** (2008).

Table 43. Electrofishing data collected in two sections of East Fork Rock Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 14.3	BULL	9	9	109	66-157	100
RM 12.2	WCT	10	10	148	56-375	36
	BULL	18	18	127	36-296	64

Riparian assessments were completed at each of the electrofishing sections on the East Fork Rock Creek in 2008 (Table 44). Riparian habitat conditions were found to be excellent at both sites, which was expected considering these sites are located within the Anaconda-Pintler Wilderness. At the upper site, East Fork Rock Creek was classified as a B channel and the riparian plant community consisted of spruce, ponderosa pine, and willows. Fish habitat was classified as "excellent" with abundant woody riparian vegetation and large woody debris observed throughout the reach as well as a low width to depth ratio. Spawning habitat was somewhat limited in the reach, but the habitat that is available is commonly used for spawning by bull trout. At the lower site, the creek was classified as a B_c channel type and the riparian habitat in this reach was again excellent. Habitat components differed slightly from the upper section as more habitat was created by large woody debris. The width to depth ratio was low in this reach and woody riparian vegetation was abundant. Spawning habitat at this site appeared to be quite good, however redd surveys indicate that typically more spawning occurs in reaches upstream of this site.

Bull trout spawning is observed annually in redd surveys conducted in the East Fork Rock Creek drainage. However, a large proportion of the spawning appears to be occurring just upstream of East Fork Reservoir below an intermittent reach of East Fork Rock Creek. Annually, many redds are observed in this marginal habitat that is seasonally inundated by East Fork Reservoir. This inundation causes significant deposition of fine sediment and thus appears to provide poor spawning habitat for bull trout. The large amount of bull trout spawning that is occurring in this sub-optimal habitat appears to be caused by the intermittency of East Fork Rock Creek just upstream of this reach, which is apparently reducing access of adult bull trout to the upper portion of the East Fork Rock Creek drainage. While it is unclear whether the intermittent flows above the reservoir are natural or human caused, further investigations into potential improvement of flow through the intermittent reach are likely warranted. Providing access for additional spawners to the upper portion of the East Fork drainage could potentially increase recruitment of fish to the population and insure the overall viability of this population.

Table 44. Riparian assessment results collected for two sites on East Fork Rock Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 14.3	30/30 (100%)	30/30 (100%)	10/10 (100%)	70/70 (100%)
RM 12.2	30/30 (100%)	28/28 (100%)	10/10 (100%)	68/68 (100%)

Three thermographs were placed in the East Fork Rock Creek during July 2008 (Appendix B). One was placed at approximate RM 3.0 on July 11, 2008. The temperature exceeded 15°C on 48 days during the 2008 summer and a maximum recorded temperature of 18.6°C was observed on August 18, 2008. Another thermograph was also placed on the same property in East Fork Rock Creek just below Meadow Creek at approximately RM 4.9 on July 11, 2008. At this site, the temperature exceeded 15°C on 18 days during the 2008 summer and a maximum recorded temperature of 16.2°C was observed on July 28, 2008. This data indicates that there is a significant increase in stream temperatures over the length of this property. A riparian fencing project is currently under way on this property to aid in re-establishing a healthy riparian community in this reach and will hopefully improve the thermal regime of this reach of East Fork Rock Creek.

A third thermograph was also placed in East Fork Rock Creek above the reservoir at approximately river mile 12.0 on July 3, 2008 (Appendix B). However, this thermograph was found partially out of water on September 10, 2008. Analysis of the data shows that this thermograph likely emerged from the water on July 16, 2008. Based on these findings, all data recorded between July 16, 2008 and September 10, 2008 were excluded from this report. During the dates of accurate measurements, a maximum recorded temperature of 8.4°C was observed on July 10, 2008.

Meadow Creek

Meadow Creek is a tributary to East Fork Rock Creek, which enters the drainage at approximately RM 4.6. Land ownership on Meadow Creek is primarily Forest Service with the exception of a small parcel of private land in the lower portion of the drainage.

Grazing allotments appeared to be active in the upper portion of the Meadow Creek drainage and historic mines are apparently present in the headwaters of the drainage, according to the Beaverhead-Deerlodge National Forest map.

Two sections of Meadow Creek were electrofished in September 2008 (Table Y). At the upper site (RM 4.1), 37 westslope cutthroat trout were captured, comprising 73% of the fish sampled while14 brook trout were captured, comprising 27% of the fish sampled (Table 45, Appendix A). At the lower site (RM 2.0), several other fish species were also observed (Table 45). Westslope cutthroat trout were the most abundant fish sampled with a total of 33 captured, comprising 50% of the fish sampled followed by brook trout with a total of 29 captured, comprising 44% of the fish sampled. Bull trout and brown trout were also present with one of each species being captured. Two suspected bull trout x brook trout hybrids were also sampled and genetic samples from these individuals will be submitted to confirm this identification. Additional electrofishing data for the lower portion of Meadow Creek was collected in 2007 and the results of this survey work were summarized in ***An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin*** (2008).

Table 45. Electrofishing data collected in two sections of Meadow Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 4.1	WCT	37	37	119	55-224	73
	EB	14	14	95	37-190	27
RM 2.0	WCT	33	33	189	104-290	50
	BULL	1	1	221	221	2
	LL	1	1	216	216	2
	EB	29	29	130	66-267	44
	BULLxEB*	2	2	189	124-254	3

* pending results of genetic analysis

A riparian assessment was conducted at each of the electrofishing sections on Meadow Creek (Table 46). In the upper section, an active grazing allotment was observed and some habitat degradation was noted. Meadow Creek at this site was classified as a B channel with woody riparian vegetation consisting of Douglas Fir, spruce, willows and alders. Cattle hoof shear was observed on the stream banks of this site and the channel was found to be somewhat over-widened. Woody riparian vegetation recruitment appeared to be limited in the reach due to browsing by cattle and fine sediment was also present throughout the reach. However, this reach of Meadow Creek was still classified as "good" fish habitat based on pools, large woody debris, and undercut banks still being present in the reach and providing fish habitat. The lower reach of Meadow Creek was classified as a C_b channel type and the overall condition of the riparian habitat was quite good. Woody riparian vegetation along with sedges were abundant throughout the reach, providing excellent bank stability. The woody vegetation observed at this site consisted of primarily willow and lodgepole pine. Fish habitat in this reach was also rated as excellent due to under-cut banks and the presence of deep pools throughout the reach.

Table 46. Riparian assessment results collected for two sites on Meadow Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 4.1	23/30 (77%)	24/30 (80%)	7/10 (70%)	54/70 (77%)
RM 2.0	28/30 (93%)	28/28 (100%)	10/10 (100%)	66/68 (97%)

Clark Fork Drainage

Gillespie Creek

Gillespie Creek is a tributary to the Clark Fork River and enters the drainage at approximately river mile 387.6. Land ownership in Gillespie Creek is a mix of Forest Service, Stimson Lumber Company, and private lands. The primary land uses in the drainage are timber harvest and grazing. A perched culvert, which serves as a fish passage barrier, is located on Forest Road 354 at approximately river mile 1.0. This culvert is located on a section of land owned by Stimson Lumber Company.

Three sections were electrofished on Gillespie Creek in August 2008 (Figure 3). The upper section was located near the turnoff for the Gillespie-Welch saddle (RM 3.7) and no fish were captured (Table 47). The second section was located just above the barrier culvert, at approximately river mile 1.5. At this site, a total of 32 westslope cutthroat trout were captured. Below the culvert at river mile 0.6, another electrofishing section was completed and a total of 53 westslope cutthroat trout were captured (Table 47, Appendix A). Fin clips were collected from westslope cutthroat trout captured both above and below the culvert and genetic analyses will be completed to determine whether this barrier is protecting a pure westslope cutthroat trout population.

Table 47. Electrofishing data collected in three sections of Gillespie Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 3.7	NO FISH	-	-	-	-	-
RM 1.5	WCT	32	32	98	66-226	100
RM 0.6	WCT	53	53	110	31-235	100

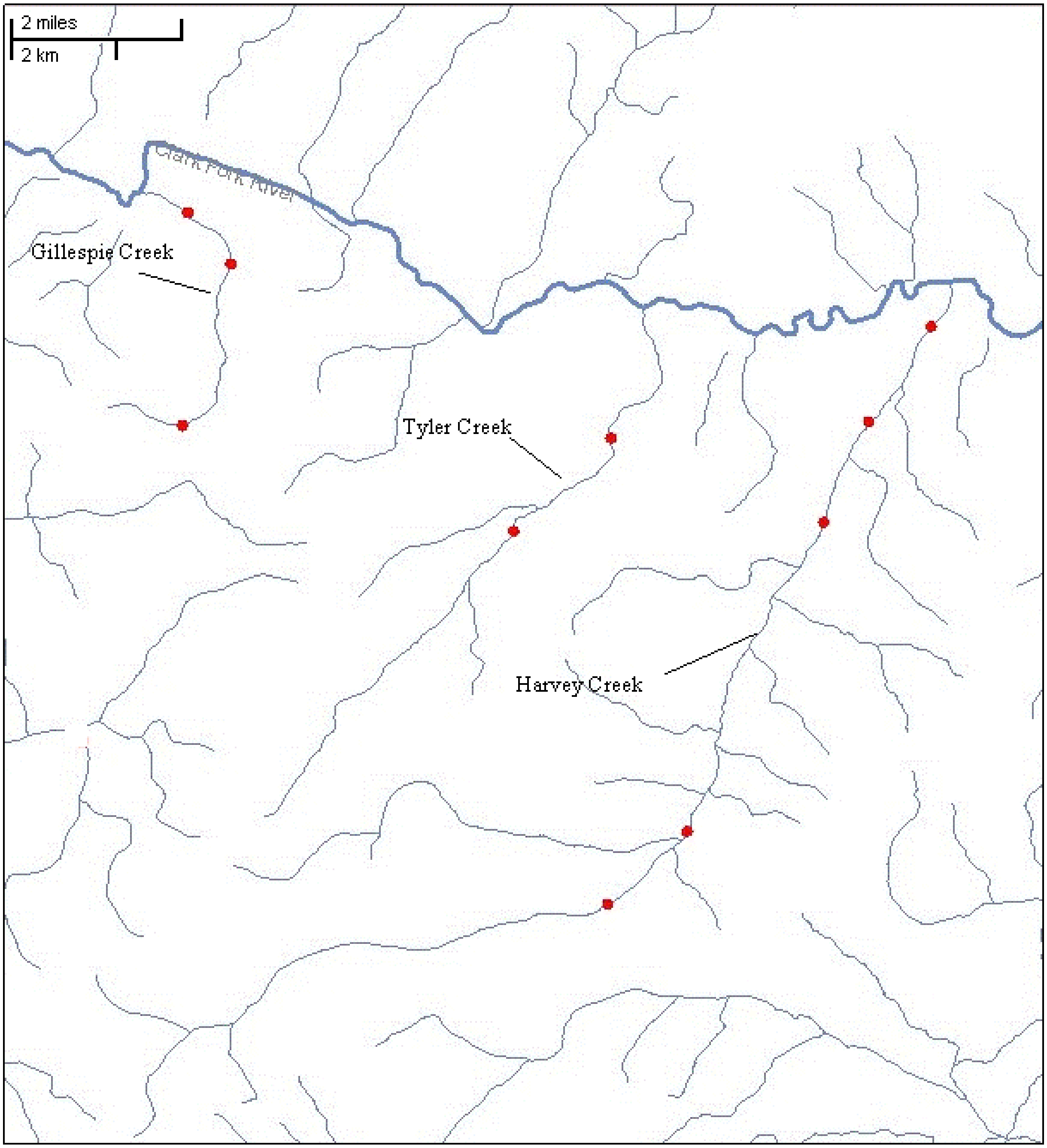


Figure 3. Map of a portion of the Clark Fork drainage showing electrofishing sections completed in 2008.

A riparian assessment was conducted at each of the electrofishing sections on Gillespie Creek in 2008 (Table 48). At the upper site, the creek was classified as a B channel and significant habitat degradation was observed. This degradation included a relatively high width to depth ratio and reduced densities of riparian vegetation. Cattle grazing in the riparian area appeared to be the primary cause for this degradation. Interestingly, the upper portion of the reach appeared to be more impacted than the lower portion. Overall, this reach had very little water due to the small drainage area above this point, which likely limits its fisheries value. At the middle site (RM 1.5), Gillespie Creek was classified as a B channel type and the riparian habitat in this reach was excellent. Woody riparian vegetation was quite thick in this reach and was comprised of alder, red osier dogwood, various willow species and Douglas fir. The reach also maintained abundant large woody debris and an appropriate width to depth ratio. The lowest reach sampled on Gillespie Creek was located at river mile 0.6 and the riparian habitat at this site was slightly degraded. The degradation observed in this reach included both bank erosion and slight down-cutting, particularly in the upper portion of the reach. Woody riparian vegetation was not as thick as was expected for this reach and several noxious weed species were observed in the reach including knapweed and Canada thistle. These impacts appeared to be related to past timber harvest in the drainage. Despite the described degradation, fish habitat in the reach was still considered good with a relatively low width to depth ratio and a reasonable number of pools in the reach (Table 48).

Table 48. Riparian assessment results collected for two sites on Gillespie Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 3.7	23/30 (77%)	23/30 (77%)	7/10 (70%)	53/70 (76%)
RM 1.5	30/30 (100%)	28/30 (93%)	10/10 (100%)	68/70 (97%)
RM 0.6	21/30 (70%)	26/30 (87%)	7/10 (70%)	54/70 (77%)

A thermograph was placed in Gillespie Creek at approximately river mile 0.7 on July 16, 2008 (Appendix B). Water temperatures did not exceed 15°C during 2008 and the maximum recorded temperature of 13.3°C was observed on August 18, 2008.

Tyler Creek

Tyler Creek is a tributary of the Clark Fork River and enters the drainage at approximately river mile 395.8. Land ownership in the drainage is primarily National Forest with some Stimson Lumber Company and private agricultural land in the lower portion of the drainage. The primary land uses in the drainage are timber harvest and cattle grazing. Timber harvest on private timber company lands appears to have been quite extensive historically in the Tyler Creek drainage. In the lower portion of the drainage, a majority of Tyler Creek is diverted into a ditch for irrigation purposes and a defined channel or flow is largely unrecognizable from the diversion to the mouth (Dennis Workman, pers. comm.).

Two sections of Tyler Creek were electrofished in August 2008 (Figure 3). In both sections, westslope cutthroat trout were the only fish species captured. The upper section was located just above the second road crossing over Tyler Creek at river mile 3.7 and a total of 48 westslope cutthroat trout were captured in this section (Table 49, Appendix A). The lower section was located below the lowest road crossing at river mile 1.9. In this section, a total of 84 westslope cutthroat trout were captured (Table 49).

Table 49. Electrofishing data collected in two sections of Tyler Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 3.7	WCT	48	48	118	56-206	100
RM 1.9	WCT	84	84	110	30-225	100

A riparian assessment was conducted at each of the electrofishing sections on Tyler Creek in 2008 (Table 50). At the upper site, the creek was classified as a B channel type and the riparian habitat in this reach appeared to be quite good. The width to depth ratio in reach was low and pools were relatively abundant throughout the reach. The only degradation observed in the reach was the presence of several large stumps from previously harvested trees. Several channel spanning logs also appeared to have been actively cut out of the channel, potentially as a "stream cleaning" project. While several pools were still present in the reach, the removal of this large wood from the channel likely has led to reduced pool formation in the reach. At river mile 1.9, Tyler Creek was classified as a B channel and the riparian habitat appeared to be in excellent condition (Table 50). This reach maintained a low width to depth ratio and woody riparian vegetation was quite dense throughout the reach. Large woody debris and deep pools were also observed throughout the reach. Extensive timber harvest was observed on the terrace above the stream channel, but it appears that the logging operation avoided the Streamside Management Zone, as minimal disturbance to the stream channel was observed.

Table 50. Riparian assessment results collected for two sites on Tyler Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 3.7	30/30 (100%)	26/28 (93%)	7/10 (70%)	63/68 (93%)
RM 1.9	30/30 (100%)	30/30 (63%)	10/10 (70%)	70/70 (100%)

A thermograph was placed in Tyler Creek at approximately river mile 0.2 on July 9, 2008 (Appendix B). The temperature did not exceed 15°C during 2008 and the maximum recorded temperature of 14.2°C was observed on July 26, 2008.

Harvey Creek

Harvey Creek is a tributary to the Clark Fork River and enters the drainage at approximately river mile 400.5. Land ownership in the Harvey Creek drainage is almost entirely National Forest in the upper portion of the drainage. In the lower portion of the Harvey Creek drainage, land ownership consists of National Forest, Stimson Lumber, and private lands. Cattle grazing and timber harvest are the primary land uses in the drainage. A large fish migration barrier exists just upstream from the mouth of Harvey Creek at river mile 0.1.

Five sections were electrofished on Harvey Creek in September 2008 (Figure 3). The upper site was located approximately 0.5 miles above the upper road crossing at river mile 8.8. At this site, 28 cutthroat trout and 11 bull trout were captured (Table 51, Appendix A). Interestingly, bull trout made up the highest proportion of the catch at this site in comparison to other sections sampled in the drainage (Table 51). The next site downstream was located below the mouth of Eightmile Creek at river mile 7.5 and a total of 57 cutthroat trout and six bull trout were captured at this site. The middle sample site was located on Stimson Lumber land approximately 3.3 miles up from the Clark Fork River. At this site, 42 cutthroat trout were captured while only one bull trout was captured.

The next site down was located on private land at approximately river mile 2.0. Sixty westslope cutthroat trout and one bull trout were captured at this site (Table 51). The lowest section sampled was located 0.6 miles above the mouth of Harvey Creek. At this site, no bull trout were sampled, while a total of 20 westslope cutthroat trout were captured. It is not clear why bull trout densities are higher in the upper portions of the drainage, but it may due to increased land use lower in the drainage.

Table 51. Electrofishing data collected in five sections of Harvey Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 8.8	WCT	28	28	160	86-240	72
	BULL	11	11	170	106-295	28
RM 7.5	WCT	57	57	161	30-311	90
	BULL	6	6	121	54-227	10
RM 3.3	WCT	42	42	81	38-283	98
	BULL	1	1	269	269	2
RM 2.0	WCT	60	60	132	45-351	98
	BULL	1	1	270	270	2
RM 0.6	WCT	20	20	93	49-286	100

A riparian assessment was conducted at each of the electrofishing sites on Harvey Creek (Table 52). At the upper site (RM 8.8), the creek was classified as a B channel and the habitat appeared to be in excellent condition (Table 52). At this site, Harvey Creek flows through an alder and spruce dominated canyon and although cattle grazing was evident up to a quarter mile below this reach, no grazing was evident within the canyon reach. The canyon walls provided obvious lateral stability to the channel and subsequent low width to depth ratio and large woody debris and plunge pools were observed throughout the reach. The next site lower in the drainage was located at river mile 7.5, just below the mouth of Eightmile Creek. Harvey Creek in this reach was classified as a C_b channel type and some slight habitat degradation was observed. While woody riparian vegetation was relatively abundant in the reach, the recruitment of young alders was relatively low and the density of adult alders was also relatively low. Noxious weeds (knapweed and Canada thistle) and disturbance-induced plants were also present in the reach in relatively low densities. Overall, habitat in this reach was good with the channel exhibiting a low width to depth ratio and abundant large woody debris and pools.

In the lower three sites, marked differences in habitat conditions were observed, primarily due to increased cattle grazing within riparian areas. At the site located at river mile 3.3, Harvey Creek was classified as a C channel type and habitat degradation was observed (Table 52). Cattle grazing in the riparian area appeared to be relatively high and bank instability in the reach led to significant bank erosion and channel over-widening. The density of woody riparian vegetation was lower than expected and riparian grazing appeared to be limiting the recruitment of several of these species. Large woody debris was absent from the reach and pools were quite infrequent (Table 52). At the site located at river mile 2.0, the channel was classified as a C_b channel type and the habitat in this reach was quite good. This reach of Harvey Creek maintained a low width to depth ratio and both large woody debris and pools were abundant throughout the reach. The only degradation observed at the site was observed in the vegetation category (Table 52). The woody riparian vegetation at this site was composed of alder, willow, ponderosa pine, and juniper and recruitment of particularly alder appeared low in the reach. Also, several noxious weeds and other undesirable plant species were observed in the reach however, the habitat degradation observed at this site was still considered minimal. At the lowest site in the drainage located at river mile 0.6, the stream channel was classified as a C channel and the habitat in this reach appeared to be moderately degraded. The degradation observed was primarily in the vegetation category and was impacted by grazing at the site (Table 52). Woody riparian vegetation was comprised of cottonwood, juniper, and alder and overall, the density of these species appeared to be relatively low. Several sections of the reach had little to no woody vegetation and both noxious weeds and disturbance induced undesirable plants had colonized these areas. The recruitment of woody riparian species also appeared to be limited with a majority of the riparian area being composed of large mature cottonwoods. Despite the observed degradation, the width to depth ratio was still relatively low in the reach and several large pools were still present, thus fish habitat in this reach was rated as "good" (Table 52).

Table 52. Riparian assessment results collected for five sites on Harvey Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 8.8	30/30 (100%)	24/24 (100%)	10/10 (100%)	64/64 (100%)
RM 7.5	30/30 (100%)	24/30 (80%)	10/10 (100%)	64/70 (91%)
RM 3.3	23/30 (77%)	17/30 (57%)	3/10 (30%)	43/70 (61%)
RM 2.0	30/30 (100%)	24/30 (80%)	10/10 (100%)	64/70 (91%)
RM 0.6	28/30 (93%)	16/30 (53%)	7/10 (70%)	51/70 (73%)

A thermograph was placed in Harvey Creek at approximately river mile 0.1 on July 9, 2008 (Appendix B). Water temperatures exceeded 15°C on 48 days during 2008 and the maximum recorded temperature of 19.0°C was observed on July 26, 2008.

Antelope Creek

Although no survey was completed on Antelope Creek, a thermograph was placed in the creek at approximately RM 0.2 on July 9, 2008 (Appendix B). Water temperatures did not exceed 15°C during 2008 and the maximum recorded temperature of 14.7°C was observed on August 18, 2008.

Dunkleberg Creek

Dunkleberg Creek is a tributary to the Clark Fork River and enters the drainage at approximately river mile 427.3. Land ownership in the drainage is primarily Forest Service in the upper portion of the drainage while the lower portion of the drainage is primarily private lands along with some State of Montana school trust lands. The primary land use in the drainage is cattle grazing although some historic logging was also observed.

Two sections were electrofished on Dunkleberg Creek in 2008 (Figure 4). The upper section was located on National Forest land (RM 6.2). At this site, 31 westslope cutthroat trout with a mean length of 127 mm were captured (Table 53, Appendix A). The lower site was located on State of Montana school trust lands at river mile 2.8. Westslope cutthroat trout were the primary species sampled with a total of seven captured, however one brown trout measuring 207 mm was also captured (Table 53).

Table 53. Electrofishing data collected in two sections of Dunkleberg Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 6.2	WCT	31	31	127	58-208	100
RM 2.8	WCT	7	7	176	98-259	88
	LL	1	1	207	207	12

A riparian assessment was conducted at each of the electrofishing sites on Dunkleberg Creek in 2008 (Table 54). At the upper site, the creek was classified as a C channel and the habitat was in relatively good condition with some minor degradation observed. The degradation that was observed was primarily due to reduced densities of woody riparian vegetation throughout the reach and the absence of willows from the reach. Large woody debris was also absent from the reach and deep pools were observed infrequently. This site appeared to have been grazed heavily in the past but was currently recovering from this disturbance. Signs of historic logging in this reach were also observed, which may have impacted fish habitat at this site. At the lower site located at river mile 2.8, significantly more degradation was observed. This site was classified as an E channel type and the woody riparian vegetation in the reach was comprised of alder and juniper. The degradation in this reach was observed primarily in the vegetation category and was due to the low species diversity of woody riparian species observed in the reach and also the abundance of noxious weeds and other disturbance-induced plant species. It is suspected that past grazing impacts led to the conversion of the woody riparian community into an alder and juniper dominated system, as both these species have reduced palpability. Grazing impacts also likely influenced the establishment of knapweed and Canada thistle in this riparian area. Despite the degradation observed in this reach, the fish habitat was still classified as "good" (Table 54). Pools and under-cut banks were observed throughout the reach and large woody debris was abundant. Relatively large amounts of fine sediment were observed in the reach, but were likely introduced from degraded sites located upstream of this section.

Table 54. Riparian assessment results collected for two sites on Dunkleberg Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 6.2	30/30 (100%)	24/30 (80%)	7/10 (70%)	61/70 (87%)
RM 2.8	28/30 (93%)	19/30 (63%)	7/10 (70%)	54/70 (77%)

Lower Willow Creek Drainage

Lower Willow Creek

Although no fisheries survey was completed on Lower Willow Creek during 2008, a thermograph was placed in the creek just below the Lower Willow Dam at approximately river mile 0.2 (Appendix B). During the summer of 2008, water temperatures exceeded 15°C on 35 days and the maximum recorded temperature of 17.5°C was observed on August 10, 2008.

Flint Creek Drainage

Douglas Creek

Douglas Creek is a tributary to Flint Creek and enters the drainage at approximately river mile 10.0. Mainstem Douglas Creek begins with the confluence of the North and Middle Forks of Douglas Creek, and flows for approximately 6.6 miles to its confluence with Flint Creek. Land ownership on Douglas Creek is predominately private with the exception of a small parcel of land owned by the State of Montana. The primary land use is cattle grazing, but historic mining and logging are also present in the drainage. An old reservoir existed at approximately river mile 3.0, but it appears that a new channel of Douglas Creek was constructed to flow around this old reservoir, apparently as part of the past mining reclamation that has occurred in the drainage. It is speculated that this work was completed to prevent Douglas Creek from using its historic channel and floodplain, presumably due to the polluted nature of these soils. A steep culvert was placed on Douglas Creek at the end of the constructed reach to direct flow back into the historic channel below the dam and this structure is currently functioning as a fish passage barrier.

Three sections of Douglas Creek were electrofished during August and September 2008 (Figure 4). The upper section (RM 4.6) was located on state land above the old reservoir. At this site, 20 westslope cutthroat trout and 20 brook trout were captured (Table 55, Appendix A). The next sample site was located in the constructed channel around the old reservoir (RM 2.5). At this site, brook trout comprised 95% of the sample with a total of 39 captured compared to only two westslope cutthroat trout captured in this reach. At the lowest site (RM 0.9), brown trout were the sole fish species sampled with a total of 89 captured.

Table 55. Electrofishing data collected in three sections of Douglas Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 4.6	WCT	20	20	140	61-231	50
	EB	20	20	108	43-208	50
RM 2.5	WCT	2	2	146	112-179	5
	EB	39	39	113	51-273	95
RM 0.9	LL	89	89	97	53-297	100

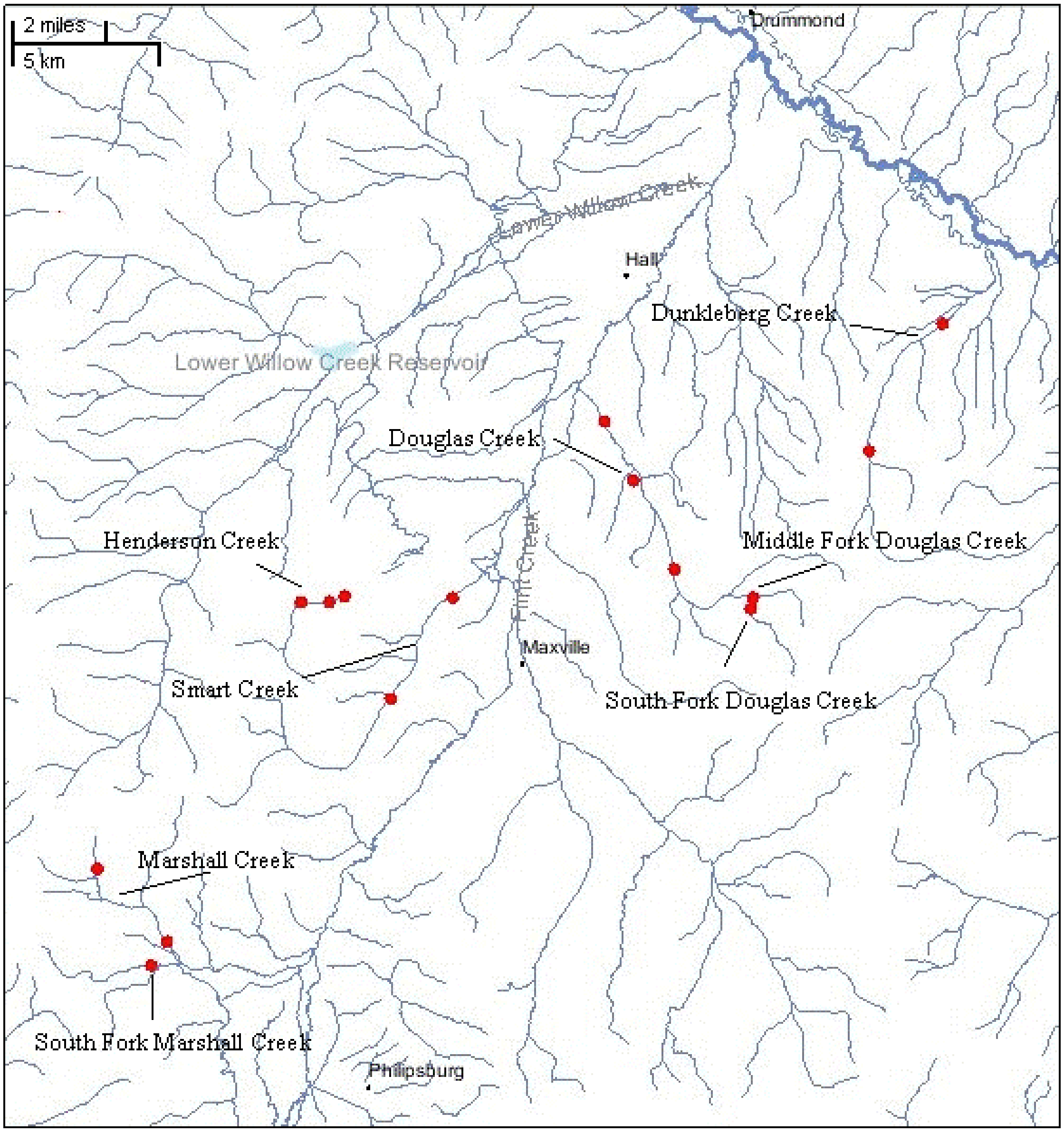


Figure 4. Map of the Lower Flint Creek drainage showing electrofishing sections completed in 2008.

A riparian assessment was conducted at all three electrofishing sites on Douglas Creek in 2008 (Table 56). At the upper site located at river mile 4.6, Douglas Creek was classified as a B_c channel type with the riparian vegetation consisting of alders, lodgepoles, willows, and juniper. Cattle grazing was the primary land use at this site and the degradation that was observed was due to grazing within the riparian area of this reach. Cattle hoof shear was observed throughout the reach and appeared to have caused moderate bank erosion and slight channel over-widening. Disturbance-induced plants and noxious weeds such as spotted knapweed and Canada thistle were common in this reach. Excess fine sediment was also observed and was likely due to both upstream habitat degradation and degradation observed within this reach. Fish habitat was still classified as “good” in the reach due to the relatively stable nature of the channel and the relatively abundant pools, however, the resiliency of B_c channel types to grazing impacts appeared to be the only reason that this reach was not more impacted by the current grazing management.

The next site downstream (RM 2.5) was located in the constructed reach of Douglas Creek adjacent to the old reservoir. This reach appears to be a channel that was constructed to move Douglas Creek away from the reservoir as part of past reclamation efforts. Unfortunately, the habitat in this reach is severely degraded due to current land management and also due to the channelization of this reach during reclamation. The current channel in this reach was classified as a G channel with the primary woody vegetation being alder. This constructed channel is perched above the valley floor and was clearly bermed on both sides during construction to prevent high flows from leaving the constructed channel. Thus, the current channel has no access to its floodplain during high flow events, although some reaches have widened out into an F channel and appear to be creating some floodplain within the berms via bank (berm) erosion. As this channel approaches an equilibrium over time, it may evolve into and incised C channel. This reach is currently grazed quite heavily as cattle hoof shear was observed throughout the reach. Grazing in the riparian area appears to be limiting the recruitment of woody vegetation and has also encouraged the establishment of several noxious weeds and other undesirable plant species, although channel construction may have also led to the establishment of weeds in this reach. Fish habitat in the reach is quite poor as there is minimal woody riparian vegetation to provide shade or large woody debris and very few pools were present throughout the entire reach. The lack of woody riparian vegetation also likely leads to high water temperatures during the summer. Fine sediment is abundant throughout the reach, likely due to degradation observed both within and upstream of this reach. Overall, the health of this reach of Douglas Creek has been severely compromised by the channelization, however it is suspected that removing Douglas Creek from its historic channel through the reservoir has had a positive influence in terms of controlling pollutants contamination.

The lowest reach of Douglas Creek (RM 0.9) was classified as a B_c channel type and the woody riparian vegetation in this reach was comprised primarily of cottonwood, willow, and alder (Table 56). This reach of Douglas Creek has experienced relatively heavy grazing pressure within the riparian area with cattle hoof shear being observed on the stream banks throughout this reach. This grazing pressure appeared to be limiting the recruitment of younger woody riparian vegetation as the riparian community was comprised primarily of mature cottonwoods and willows, although some younger and middle age classes of alder were observed. The density of woody riparian vegetation also appeared to be relatively low in the floodplain outside of the immediate banks, likely due to poor recruitment and competition with noxious weeds and other disturbance-induced plants. Bank erosion was also quite common in this reach and the width to depth ratio appeared to be higher than typical for this channel type. Fish habitat in this reach was considered “fair” based on the previously mentioned degradation and due to fine sediment being quite abundant. The sources of this fine sediment are likely both bank erosion within this reach as well as upstream sources.

Table 56. Riparian assessment results collected for three sites on Douglas Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 4.6	23/30 (77%)	19/30 (63%)	7/10 (70%)	49/70 (70%)
RM 2.5	5/30 (17%)	4/30 (13%)	0/10 (0%)	9/70 (13%)
RM 0.9	17/30 (57%)	17/28 (61%)	3/10 (30%)	37/68 (54%)

Middle Fork Douglas Creek

Middle Fork Douglas Creek is a tributary to Douglas Creek and enters the drainage at approximately river mile 6.3. The confluence of Middle Fork Douglas Creek with North Fork Douglas Creek forms mainstem Douglas Creek. Land ownership in the Middle Fork drainage is comprised of both National Forest and private lands. Land use in the drainage is primarily cattle grazing with historic mines present throughout the drainage.

One section was electrofished on Middle Fork Douglas Creek in August 2008 (RM 0.5) (Figure 4). This section was located on National Forest land just upstream from the confluence of the South Fork Douglas Creek (RM 0.5). Westslope cutthroat trout were the only fish species sampled at this site with a total of 16 captured, maintaining a mean length of 132 mm (Table 57, Appendix A).

Table 57. Electrofishing data collected in one section of Middle Fork Douglas Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 0.5	WCT	16	16	132	89-174	100

A riparian assessment was also completed on the Middle Fork Douglas Creek in 2008 (Table 58). Middle Fork Douglas Creek at this site was classified as a B channel and the woody riparian vegetation at this site consisted of Douglas-fir, alder, and lodgepole pine. Primary land use at this site was cattle grazing via a Forest Service grazing allotment. The stream was well-vegetated in most spots, however some cattle hoof shear and bank erosion was observed. Fine sediment was relatively abundant in the reach and is likely due to both upstream impacts and bank erosion within the sampled reach. Overall, the width to depth ratio in this reach was low and pools were relatively abundant.

Table 58. Riparian assessment results collected for one site on Middle Fork Douglas Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.5	23/30 (77%)	28/30 (93%)	7/10 (70%)	58/70 (83%)

South Fork Douglas Creek

South Fork Douglas Creek is a tributary to Middle Fork Douglas Creek and enters the drainage at approximate RM 0.3. South Fork Douglas Creek flows entirely through National Forest lands and is accessible by Forest Road 1550. A grazing allotment exists on South Fork Douglas Creek and cattle grazing was the primary land use observed in the drainage.

One section was electrofished on the South Fork Douglas Creek in August 2008 (Figure 4). This section was located on National Forest land approximately 0.3 miles upstream from the confluence with Middle Fork Douglas Creek. No fish were captured at this site (Table 59). It is unknown why no fish were captured as no potential migration barriers were observed downstream of this section and westslope cutthroat trout were captured in Middle Fork Douglas Creek.

Table 59. Electrofishing data collected in one section of South Fork Douglas Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 0.3	NO FISH	-	-	-	-	-

A riparian assessment was also completed on the South Fork Douglas Creek in 2008 (Table 60). At this site, South Fork Douglas Creek was classified as a B channel type and the woody riparian vegetation consisted of Douglas-fir and alder. Bank erosion was high due to cattle hoof-shear and woody riparian vegetation was sparse due to poor recruitment and heavy browse on young woody species. However, the creek was a boulder dominated B-channel, and fish habitat remained good due to numerous boulder formed pools. Many springs feed the creek in this reach which likely keeps water temperatures low in the summer.

Table 60. Riparian assessment results collected for one site on South Fork Douglas Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.3	21/30 (70%)	18/30 (60%)	7/10 (70%)	46/70 (66%)

Henderson Creek

Henderson Creek is a tributary to Flint Creek and enters the drainage at approximately river mile 13.0 (Figure 1). Land ownership in the drainage consists of National Forest, BLM, and private lands. Historically, placer mining was a major land use on Henderson Creek as is evident by the abundant tailings found in the drainage. The middle portion of Henderson Creek appears intermittent, with long stretches of this reach so impacted by placer mining that a defined channel was not observed. Several dredge ponds were observed within this middle reach. The lower portion of Henderson Creek flows through private lands used primarily for cattle grazing. Interestingly, Henderson Creek appears to have minimal flow compared to the drainage area that the watershed encompasses. This is true even upstream of the extensive placer mining in the middle portion of the drainage and no irrigation diversions or other factors that could impact instream flows were observed in the drainage.

Two sections of Henderson Creek were electrofished during August 2008 (Figure 4). The upper section was located on BLM administered lands at river mile 5.2. At this site, five westslope cutthroat trout were captured with a mean length of 89 mm (Table 61, Appendix A). At river mile 4.8, the densities of westslope cutthroat trout increased substantially with a total of 43 fish captured with a mean length of 86 mm. No other fish species were captured at either site (Table 61).

Table 61. Electrofishing data collected in two sections of Henderson Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 5.2	WCT	5	5	89	33-171	100
RM 4.8	WCT	43	43	86	31-140	100

A riparian assessment was conducted at both electrofishing sites on Henderson Creek in 2008 (Table 62). At the upper site (RM 5.2), Henderson Creek was classified as an E channel type and willow, spruce and alder were the primary woody riparian species observed. Sedges were also abundant in this reach and appeared to be important for stream bank stability. Cattle grazing appeared abundant on this federal allotment as cattle hoof shear was observed throughout the reach. Some channel incision and bank erosion was observed in the reach and the densities of woody riparian vegetation appeared low, as did recruitment of these species. Fish habitat in the reach was considered "fair" due to the lack of woody riparian vegetation and the lack of quality pool habitat. At the next site downstream (RM 4.8), Henderson Creek was classified as a B channel type and was well vegetated by willows and alder (Table 62). This reach was located directly adjacent to Forest Road 448, which restricted the floodplain on one side and also likely led to the establishment of noxious weeds within the riparian area. Fine sediment appeared abundant in the reach and was likely caused by upstream land use and the encroachment of Forest Road 448. Fish habitat in the reach was rated "good" due to the abundant woody riparian vegetation and the presence of quality pool habitat throughout the reach (Table 62).

Table 62. Riparian assessment results collected for two sites on Henderson Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 5.2	15/30 (50%)	16/30 (53%)	3/10 (30%)	34/70 (49%)
RM 4.8	25/30 (83%)	28/30 (93%)	7/10 (70%)	60/70 (86%)

A thermograph was placed in Henderson Creek at approximately river mile 0.3 on July 3, 2008 (Appendix B). The temperature exceeded 15°C on 81 days during the 2008 summer, including 44 days over 20°C with a maximum recorded temperature of 23.6°C observed on August 6, 2008.

Smart Creek

Smart Creek is a tributary to Henderson Creek, which enters the drainage just above its confluence with Flint Creek at approximately river mile 0.2 (Figure 4). Smart Creek lies within a mix of Forest Service, BLM, and privately owned lands. The main land use observed in the drainage is cattle grazing with grazing allotments existing on federal lands in the drainage.

Two sections were electrofished on Smart Creek in August 2008 (Figure 1). In both sections, westslope cutthroat trout were the sole fish species captured. The upper section was located approximately 0.7 miles above a closure gate on Forest Road 5185 (RM 5.7). At this site, 88 cutthroat trout were captured (Table 62, Appendix A). The lower electrofishing site sampled was located on BLM administered lands at river mile 3.0. In this section, 25 westslope cutthroat trout were captured.

Table 63. Electrofishing data collected in two sections of Smart Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 5.7	WCT	88	88	114	80-208	100
RM 3.0	WCT	25	25	108	81-170	100

A riparian assessment was conducted at both electrofishing sections on Smart Creek in 2008 (Table 64). At the upper site located at river mile 5.7, Smart Creek was classified as a C channel and woody riparian vegetation consisted of willows, alder, and cottonwoods. At this site, cattle grazing was quite heavy and cattle hoof shear was observed throughout the reach. Bank erosion was common in the reach and the channel appeared to be slightly over-widened. Both the density and recruitment of woody riparian vegetation in the reach appeared to be low and browse on the adult woody vegetation was heavy. However, this reach still maintained some quality pool habitat and fish densities were quite high, so the fish habitat was still rated as "good" (Table 64). At the lower site (RM 3.0), Smart Creek was classified as a C channel type and the woody riparian vegetation observed at this site was primarily alders and spruce. The width to depth ratio at this site appeared reasonable however bank erosion was observed throughout the reach. Woody riparian vegetation was relatively abundant at this site, however, the diversity of woody species was low with only alder and spruce observed. Past grazing impacts were evident in the reach, although it appeared that the reach had not been grazed in 2008 at the time of the survey. Noxious weeds and disturbance-induced plants were common, likely indicative of past grazing in this reach. Fish habitat in the reach was classified as "good" due to the low width to depth ratio and abundant pool habitat, but the pools in the reach appeared to be relatively shallow and fine sediment was also common (Table 64).

Table 64. Riparian assessment results collected for two sites on Smart Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 5.7	17/30 (57%)	11/30 (37%)	7/10 (30%)	35/70 (50%)
RM 3.0	23/30 (77%)	18/30 (60%)	7/10 (70%)	48/70 (69%)

Marshall Creek

Marshall Creek is a tributary to Flint Creek and enters the drainage at approximately river mile 27.8 (Figure 1). Land ownership in this drainage is primarily private, although some State of Montana and Forest Service lands are present in the drainage. Cattle grazing was the primary land use observed in the drainage.

Two sections were electrofished on Marshall Creek in August and September 2008 (Figure 4). In the upper section (RM 6.5), westslope cutthroat trout were the only species captured with a total of 20 sampled in this section (Table 65, Appendix A). The other section sampled on Marshall Creek was located on land owned and administered by the State of Montana at river mile 3.9. In this section, a total of 107 brook trout were sampled comprising 88% of the trout captured while 14 westslope cutthroat trout were sampled comprising 12% of the trout captured. Seven longnose suckers were also captured in this reach.

Table 65. Electrofishing data collected in two sections of Marshall Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 6.5	WCT	20	20	93	70-158	100
RM 3.9	WCT	14	14	127	41-216	12
	EB	107	107	87	61-251	88
	LN_SU	7	7	121	95-155	-

A riparian assessment was conducted at each of the electrofishing sections on Marshall Creek in 2008 (Table 66). At the upper site, Marshall Creek was classified as a B channel and the woody riparian vegetation consisted of alder and Douglas fir. Past grazing impacts were evident at this site and these impacts appeared to primarily affect woody vegetation in the reach. Overall, the density of woody vegetation was relatively low and recruitment of these species also appeared minimal. However, the width to depth ratio still appeared to be low and fish habitat was still rated as “good” which likely reflects the resiliency of B channel types to disturbance. The lower site, located at river mile 3.9, was classified as an E channel with the woody riparian vegetation consisting of willows and rose (Table 66). Sedges were also observed and were considered an important species for bank stability in this reach. Cattle grazing within the riparian area on this reach of Marshall Creek appeared to be quite extensive with cattle hoof shear observed on stream banks throughout the reach. The width to depth ratio was slightly higher than expected for a typical E channel, suggesting that the channel is slightly over-widened. The density of woody riparian vegetation appeared to be quite low in this reach and recruitment of these species also appeared to be impacted by grazing. Fine sediment was abundant and likely reflects both the condition of the channel in this reach and upstream land use impacts. Fish habitat was classified as “fair” due to the above impacts as well as the likelihood of high summer stream temperatures based on the low density of woody riparian vegetation (Table 66).

Table 66. Riparian assessment results collected for two sites on Marshall Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 6.5	30/30 (100%)	15/30 (50%)	7/10 (70%)	52/70 (74%)
RM 3.9	23/30 (77%)	15/28 (54%)	3/10 (30%)	41/68 (60%)

A thermograph was placed in Marshall Creek at approximately RM 0.3 on July 3, 2008 (Appendix B). The temperature exceeded 15°C on 57 days during the 2008 summer, including 9 days where temperatures exceeded 20°C. The maximum recorded temperature was 21.2°C and was observed on July 3, 2008.

South Fork Marshall Creek

South Fork Marshall Creek is a tributary to Marshall Creek, which enters the drainage at approximately river mile 4.0. On most maps, this creek is an unnamed tributary of Marshall Creek, however it is referred to as South Fork Marshall Creek in this report. Land ownership in the drainage is primarily private, with the exception of a small parcel of BLM land and the primary land use is private cattle grazing.

One section of South Fork Marshall Creek was electrofished during September 2008 (Figure 4). Westslope cutthroat trout were the only fish species captured and they occurred at very high densities with a total of 94 captured (Table 67). These fish were relatively small with a mean length of 75 mm (Table 67, Appendix A).

Table 67. Electrofishing data collected in one section of South Fork Marshall Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 0.3	WCT	94	94	75	32-187	100

A riparian assessment was conducted at the electrofishing section completed on South Fork Marshall Creek in 2008 (Table 68.) This site was classified as a B channel and the woody riparian vegetation consisted of solely alder. Grazing impacts were evident at this site with cattle hoof shear observed throughout the reach. Bank erosion was observed in the reach and the width to depth ratio appeared high. Overall, the density of woody vegetation in this reach was relatively low and recruitment of these species also appeared minimal. The woody riparian community currently consisted of only alders and likely should contain other woody species including various willow species. Fish habitat was classified as “fair” due to the low density of woody riparian vegetation and reduced number of pools in this reach (Table 68).

Table 68. Riparian assessment results collected for one site on South Fork Marshall Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.3	17/30 (57%)	16/28 (57%)	3/10 (30%)	36/68 (53%)

Trout Creek

Trout Creek is a tributary to Flint Creek, which enters the drainage at approximately river mile 36.9 (Figure 1). Mainstem Trout Creek lies entirely on private land and the primary land uses are cattle grazing, hay production, and irrigation. Trout Creek is also the recipient of water from the East Fork Rock Creek drainage. This water is impounded at East Fork Reservoir, diverted into the Flint Creek Canal, siphoned across the East Fork Rock Creek valley, and finally transferred into the Trout Creek drainage via a trans-basin diversion. This water is ultimately used for irrigation in both the upper and lower Flint Creek valleys. This water project commonly diverts up to 150 cfs from May through September and thus Trout Creek experiences very high flows throughout the irrigation season.

Trout Creek was electrofished at two sites during September 2008 (Figure 4). The upper section was located on private land just south of Highway 38 (RM 7.5). At this site, brown trout were the only fish species captured. A total of 64 brown trout with a mean length of 181 mm were captured (Table 69, Appendix A). The lower site was again located on private land at approximate RM 1.4. In this section, brown trout were the primary fish species sampled, however mountain whitefish were also captured. A total of 50 brown trout were sampled with a mean length of 207 mm and a length range of 63-605 mm (Table 69). Three large (>500 mm) brown trout were sampled in this reach and due to their large size and the timing of the survey (late September), these fish were suspected to be migratory spawning adults, likely from mainstem Flint Creek. It is suspected that this reach of Trout Creek is used for spawning by brown trout as one brown trout redd was observed in this reach during this sampling effort.

Table 69. Electrofishing data collected in two sections of Trout Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 7.5	LL	64	64	181	72-332	100
RM 1.4	LL	50	50	207	63-605	100
	MWF	14	14	306	259-343	-

A riparian assessment was conducted at each of the sites on Trout Creek in 2008 (Table 70). At the upper site, the creek was classified as a C_b channel and the riparian plant community consisted primarily of sedges with some willows and cottonwoods also observed. Woody riparian vegetation was found to be in relatively low abundance in this reach and very little recruitment of these species was observed. Currently, the riparian vegetation consists of primarily sedges and disturbance induced plant species typically associated with agriculture. It appears that historic grazing along with the artificially high flows this reach receives due to the trans-basin diversion have both negatively influenced this riparian vegetation community leading to severely reduced densities of woody riparian species. This lack of woody riparian vegetation has led to significant bank erosion and a relatively high width to depth ratio. Fish habitat in this reach was classified as “fair” due to the lack of deep pools, channel over-widening, and relative abundance of fine sediment (Table 70). This parcel was recently purchased by a new landowner and a riparian fencing/channel reconstruction project has been proposed. Completion of this riparian fencing project and an alteration of grazing management in this reach could greatly improve the condition of this portion of Trout Creek.

The lower site on Trout Creek was classified as C channel type and riparian vegetation was comprised entirely of sedges and various grass species. The width to depth ratio of this reach was quite low and deep pools were observed throughout the reach. However, woody riparian vegetation was entirely absent from the reach. It is suspected that both willows and cottonwoods were native to this portion of Trout Creek as both species were observed at sites both up and downstream of this reach. While historic grazing may explain the lack of woody riparian vegetation, current grazing practices appear to be conducive to providing some recruitment of these species and sustaining adult willows and cottonwoods. It is uncertain the role that the artificially high flows due to the trans-basin diversion of water plays into this lack of woody vegetation. It appears possible that these high flows may reduce the recruitment of both willows and cottonwoods by eliminating depositional areas (point bars) that are key to the recruitment of these species, however some depositional areas were present during this survey in late September. Also, some young willows and cottonwoods were observed in the upstream reach, which is subject to the same artificially high flows observed in this portion of Trout Creek. Overall, fish habitat in this reach was classified as “good” due to the reach exhibiting a low width to depth ratio, quality pool habitat, and suitable spawning habitat.

Table 70. Riparian assessment results collected for two sites on Trout Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 7.5	17/30 (57%)	11/28 (39%)	3/10 (30%)	31/68 (46%)
RM 1.4	28/30 (93%)	9/28 (32%)	7/10 (70%)	44/68 (65%)

A thermograph was placed in Trout Creek at approximately river mile 0.3 on July 8, 2008 (Appendix B). Water temperatures exceeded 15°C on 42 days during 2008, with the maximum recorded temperature of 17.5°C being observed on July 8, 2008.

North Fork Flint Creek

North Fork Flint Creek is a tributary to Georgetown Lake and enters this system at approximately 1.3 miles above Flint Creek Dam. The upper portion of the North Fork Flint Creek flows primarily through National Forest land, although several private mining claims exist in this portion of the drainage. Land use in the upper North Fork Flint Creek drainage includes grazing and historic mining and logging. The lower portion of the North Fork is primarily private land and land use in this portion of the drainage is primarily residential summer homes. North Fork Flint Creek serves as a spawning tributary for some of Georgetown Lake’s brook and rainbow trout.

Two sections were electrofished on North Fork Flint Creek during September 2008 (Figure 2). The upper section was located at river mile 7.1 and fish densities were relatively low (RM 7.1). A total of one westslope cutthroat trout and five brook trout were captured at this site (Table 71, Appendix A). Three of these brook trout were classified as “ripe” spawning adults. At the lower site (RM 3.5), brook trout were again the primary species sampled with a total of 39 captured, comprising 95% of the species composition. Only one westslope cutthroat trout and one rainbow trout were captured at this site.

Table 71. Electrofishing data collected in two sections of North Fork Flint Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 7.1	WCT	1	1	152	152	17
	EB	5	5	148	93-193	83
RM 3.5	WCT	1	1	119	119	2
	RB	1	1	186	186	2
	EB	39	39	108	46-186	95

A riparian assessment was conducted at each electrofishing section on the North Fork Flint Creek in 2008 (Table 72). At the upper site, the channel was classified as a B channel type and the riparian community was comprised primarily of spruce and lodgepole pine. The width to depth ratio at this site appeared was low and woody riparian vegetation was relatively abundant in most of the reach. Fish habitat was classified as excellent due to the low width to depth ratio and the abundance of plunge pools in the reach (Table 72). Large woody debris was observed relatively infrequently throughout the reach however. At the lower site, North Fork Flint Creek was again classified as a B channel type and the riparian community was comprised of lodgepole pine, willows, spruce, and Douglas fir. This reach maintained a low width to depth ratio and woody riparian vegetation was abundant throughout the reach. Large conifer stumps were observed in the riparian area indicating that historic logging had occurred in this portion of the drainage, although the riparian community appeared to have recovered well from the disturbance. Fish habitat was classified as "excellent" in this reach due to abundant deep pools and dense riparian vegetation (Table 72).

Table 72. Riparian assessment results collected for two sites on North Fork Flint Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 7.1	30/30 (100%)	23/30 (77%)	10/10 (100%)	63/70 (90%)
RM 3.5	30/30 (100%)	27/30 (90%)	10/10 (100%)	67/70 (96%)

Perkins Creek Drainage

Perkins Creek

Perkins Creek is a tributary to the Clark Fork River near river mile (RM) 285.3. This very small stream drains for approximately 4.7 miles out of the Flint Range before reaching its terminus near Jens. Present surface connection to the Clark Fork River is unlikely as the stream appears to be captured by an irrigation ditch (originating on the Clark Fork River) prior to reaching the river. Land ownership along Perkins Creek is comprised primarily of privately owned lands, with limited U.S. Forest Service ownership in the upper extent of the watershed. Most of Perkins Creek is accessible only through private land. The primary land uses in the drainage are livestock grazing and timber harvest. Additionally, several residences/farmsteads are located along the stream close to its mouth.

Fish sampling was completed at two sections of Perkins Creek in August of 2008. The survey sites were located on private land at RM 0.5 and 3.2 (Table 73; Figure 5). No fish were observed at either of the sampled sections. Additional spot electrofishing in the most likely habitats between the two sections also yielded no fish. It is unknown if Perkins Creek historically supported fish.

Table 73. Electrofishing data collected at two sections of Perkins Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 0.5	No Fish	n/a	n/a	n/a	n/a	n/a
RM 3.2	No Fish	n/a	n/a	n/a	n/a	n/a

A riparian assessment was completed at each of the two sections electrofished on Perkins Creek in 2008. At RM 0.5, the stream was classified as a relatively low gradient Rosgen B channel type. The total riparian assessment score was 56 out of a potential score of 62 (90%) (Table 74). Within the survey reach, the riparian area was in relatively good condition and was dominated by mature cottonwoods, dogwood, wild rose, and juniper. Little grazing or browse pressure was evident, and noxious weeds, while relatively common in the uplands, were not very prevalent in the riparian corridor. Those present consisted primarily of spotted knapweed and houndstounge. The channel at RM 0.5 was slightly entrenched in some areas, yet it still appeared to have access to a small floodplain throughout much of the survey reach. Fish habitat at RM 0.5 was rated poor (score: 0 points out of a potential of 3; Table 74), with a potential of only fair. Flow was very low in the survey reach, and fine sediment accumulation was high. Most of the pools in the electrofishing section were shallow and filled in with fine sediment. A culvert at the private road crossing immediately downstream of the section was perched and appeared to be at least a partial barrier to upstream fish passage.

Higher up in the drainage at RM 3.2, Perkins Creek flowed through a narrow draw and was again classified as a Rosgen B channel type. However, downstream of the survey reach, segments of the stream were highly gullied and more characteristic of a Rosgen G stream type. The riparian area at the sample site was rather simple and was made up of an open overstory of Douglas fir and mostly grasses along the streambanks. Woody shrubs were sparse and consisted of just a few widely spaced alder. Disturbance induced plants, including noxious weeds (primarily houndstounge), were present but not overly abundant, although they did become more prevalent further downstream. Increased disturbance related to livestock use and past timber harvest appeared to be correlated with this observed pattern. The stream channel at RM 3.2 was relatively stable and was connected to a narrow floodplain. While some minor bank erosion was evident, this problem was more notable farther downstream below the section. In this area, bank erosion and gullying was relatively widespread and severe. Additionally, a number of erosive livestock/wildlife crossings were also noted. Fish habitat in the surveyed reach, as well as downstream of it, was rated as poor (score: 0 points out of a potential of 3; Table 74) due to almost a complete lack of pools. Fine sediment accumulation was notable and most of the pools were filled in completely. Additionally, as discussed above, woody shrub cover was limited and provided little cover and shade. No over-winter habitat was observed in the approximately one mile of the channel that was examined.

Table 74. Riparian assessment results for two sites surveyed on Perkins Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.5	28/30 (93%)	28/29 (97%)	0/3 (0%)	56/62 (90%)
RM 3.2	25/30 (83%)	20/26 (77%)	0/7 (0%)	45/63 (71%)

Water temperature was not monitored in Perkins Creek in 2008.

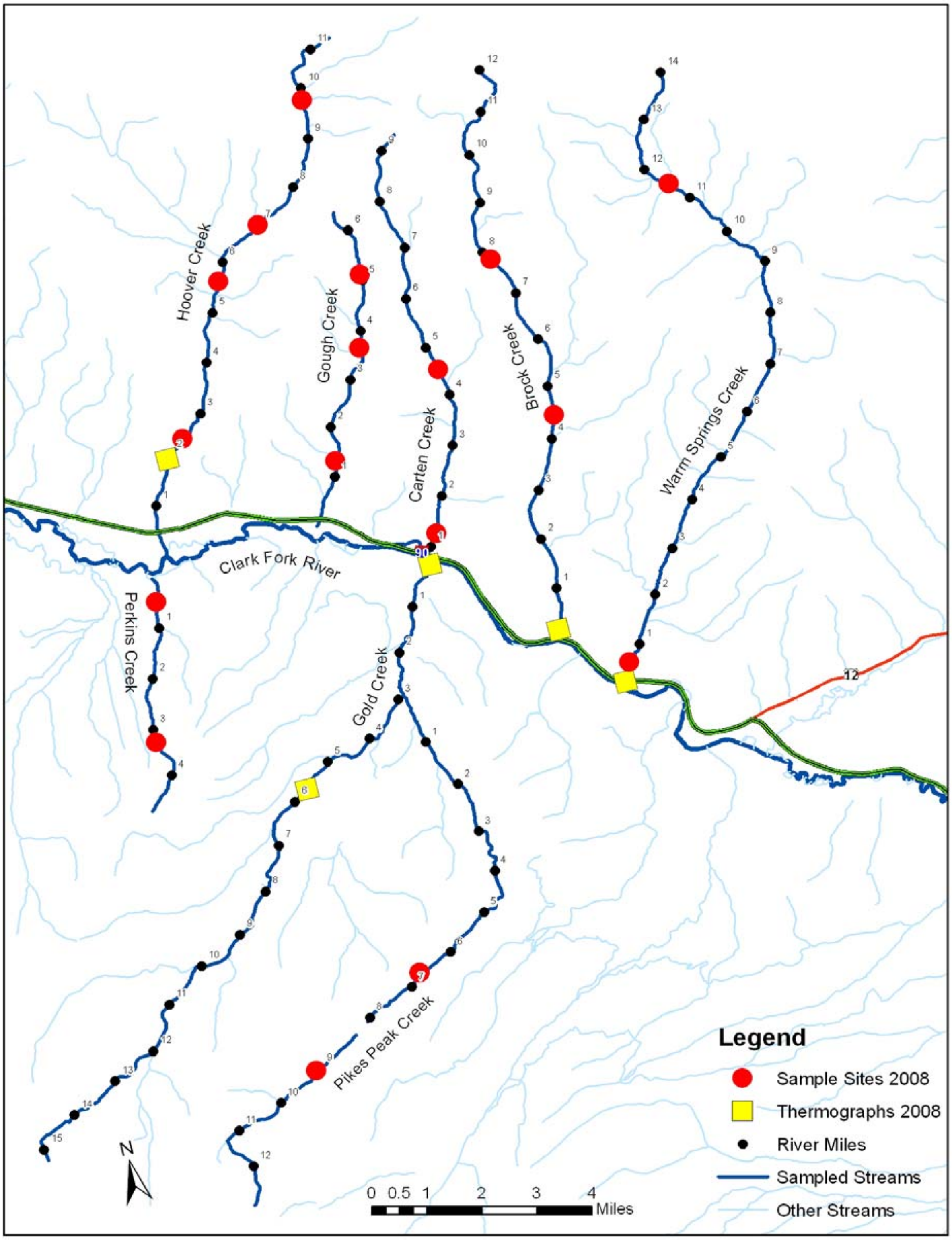


Figure 5. Map of Clark Fork River drainage downstream of Garrison, MT showing sites of fish and temperature sampling conducted in 2008.

Hoover Creek Drainage

Hoover Creek

Hoover Creek is a tributary to the Clark Fork River that drains out of the Garnet Range for approximately 11.4 miles before reaching the Clark Fork near RM 285.8. Surface connection to the Clark Fork is questionable as the stream presently flows into a historic meander of the Clark Fork River that only appears connected via surface flows during high runoff events. Physical connection to the river is also restricted by an irrigation ditch and diversion located near RM 0.1. This large irrigation ditch (originating on the Clark Fork River) captures Hoover Creek in its entirety, and the diversion appears to pass only limited flows (mostly Clark Fork River water) down the Hoover Creek channel to its terminus. Land ownership along the stream is made up almost entirely of privately owned agricultural and timber lands. Limited State ownership along the channel near RM 2.1 is the only publicly owned land along the mainstem of the creek. The primary land uses in the watershed are livestock grazing and recent and active timber harvest. Additionally, an unpaved county road runs along Hoover Creek for almost its entire length, and several logging roads (active and inactive) cross the stream in a number of locations. A small man-made pond is located on Hoover Creek near RM 3.3 and another pond site exists at RM 3.0. However, the dam has failed at RM 3.0 and the pond is not currently impounding any water. Miller Lake, a 25-acre private reservoir, is situated on Hoover Creek near RM 6.0. The earthen dams associated with each of the active impoundments on Hoover Creek appear to limit upstream (and possibly downstream) fish movement. Other likely fish barriers observed in the drainage include the diversion at RM 0.1, crossings associated with the railroad grade and Interstate 90 (Jens interchange; between RM 0.4 and 0.6), and a severely perched culvert on the county road crossing at RM 1.9.

Fish sampling was completed at four 100 m sections of Hoover Creek in late July and early August of 2008. T he sites were located at RM 2.4, 5.6, 7.0, and 9.7 (Table 75; Figure 5). The site at RM 2.4 was on State owned land, while the remaining sites were situated on private land. Additional spot electrofishing was completed near the mouth of Hoover Creek upstream of the irrigation ditch located near RM 0.1. At this location, one 242 mm brown trout and one 85 mm mountain whitefish were captured along with four redside shiners and 16 longnose suckers. All of these species occur in the Clark Fork River and likely have seasonal access to Hoover Creek through the connection with the downstream ditch. At RM 2.4, the trout community was comprised largely of juvenile brook trout, which were present at rather low density (Table 75; Appendix A). All of the trout captured in the section appeared to be one year of age or less, and almost 80% had observable cranial deformities, a possible sign of the presence of whirling disease (not confirmed). Additionally, four longnose suckers were also captured in the section. Further spot electrofishing in three pools immediately upstream of the RM 2.4 survey site turned up four more juvenile brook trout as well as two adults ranging from 191 mm to 259 mm (total length). Most of these fish also showed cranial deformities. At RM 5.6, just downstream of Miller Lake, species composition was similar to that observed at RM 2.4. While brook trout and longnose suckers were again present, brook trout density was notably different than at RM 2.4. Brook trout were far more abundant in this reach of stream, although similar to downstream, most appeared to be juveniles based on the small, 88 mm average total length (Table 75; Appendix A). Additionally, approximately 20% of the brook trout captured at RM 5.6 had cranial deformities similar to those described at RM 2.4. At RM 7.0 (just upstream of Miller Lake), brook trout were again present, although westslope cutthroat trout were also observed in this segment of Hoover Creek (Table 75). While brook trout were not as dense as immediately below Miller Lake, they were notably more common than westslope cutthroat trout, and had a more variable size composition than at downstream reaches, ranging from young-of-the-year, to adults over 200 mm in total length (Table 75; Appendix A). Westslope cutthroat trout occurred in low abundance at RM 7.0, although the presence of at least two age classes of fish showed some limited reproductive and recruitment potential (Table 75; Appendix A). At RM 9.7, brook trout density fell off considerably, whereas westslope cutthroat trout density increased (Table 75). While westslope cutthroat trout were more common, most of the fish captured in the reach were relatively small and appeared to be juveniles of approximately one year of age (based on length) (Table 75; Appendix A). Brook trout at the site tended to be small as well (Table 75; Appendix A). Genetic sampling conducted in upper extent of Hoover Creek in 1990 showed that westslope cutthroat trout were hybridized with rainbow trout, and were only approximately 88% pure.

Table 75. Electrofishing data collected at four sections of Hoover Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 2.4	EB	19	19.0	70	52-87	100
RM 5.6	EB	142	142.0	88	68-125	100
RM 7.0	WCT	6	6.0	95	76-139	12
	EB	44	44.0	124	50-238	88
RM 9.7	WCT	19	19.0	84	64-160	83
	EB	4	4.0	100	87-109	17

A riparian assessment was completed at all four of the fish sampling sections on Hoover Creek in 2008. A formal evaluation was not completed near the mouth where spot electrofishing was done (near RM 0.2), but habitat was observed as being in a highly altered state at this location. Nearby transportation networks (railroad and Interstate 90), past land use, and a private residence all impacted the stream significantly. Channelization was evident as the stream was straight and bermed on each side. Riparian vegetation consisted primarily of grasses, sedges and disturbance-induced plants. Woody shrubs and tress were largely absent from the area. Upstream of Interstate 90 (RM 0.6), Hoover Creek flowed for over a mile through an irrigated hay meadow and pasture. Reviews of aerial photographs indicate that the stream had been highly manipulated and straightened through this reach as well. The stream lacked a significant riparian area and woody vegetation was rare.

At RM 2.4, Hoover Creek was situated in a narrow portion of the valley. The stream was classified as a Rosgen Bc channel type despite that it was extremely entrenched. The total riparian assessment score was 47 out of a potential score of 67 (70%) (Table 76). Historic downcutting (approximately 15+ feet) was very apparent throughout the survey reach, although the stream appeared to be vertically stable at the time of the survey. Lateral bank erosion was moderate, and was correlated with high, vertical banks that lacked deep-rooted vegetation. A narrow floodplain was apparent that was fairly well vegetated with woody riparian shrubs consisting mostly of alder, willow, and wild rose. A few cottonwood trees were also present in the area. Establishment and regeneration of shrub species was noted, although disturbance induced plants and noxious weeds were common throughout the riparian area. Noxious weeds noted in the riparian corridor included spotted knapweed, Dalmatian toadflax, houndstounge, and Canada thistle. Fish habitat at RM 2.4 was rated only fair (score: 3 points out of a potential of 7; Table 76) and was limited by a lack of deep pools and woody debris in the channel. While spawning gravels were abundant throughout the reach, fine sediment accumulation was high. Additionally, as mentioned previously, the culvert at the county road crossing downstream of the survey section (near RM 1.9) was severely perched and appeared to be a complete barrier to upstream fish movement.

At RM 5.6, Hoover Creek remained a Rosgen Bc channel type. However, at this location the stream was not severely entrenched like it was at downstream reaches. The total riparian assessment score was 51 out of a potential score of 70 (73%) (Table 76). The channel appeared vertically stable although a minor amount of bank erosion was evident where meander bends met banks lacking deep-rooted, woody vegetation. Woody vegetation in the riparian area was comprised primarily of alder, although willow and cottonwoods were also present in lesser amounts. The density of woody plants was somewhat lacking, and the widespread presence of spotted knapweed and other disturbance-induced plants (primarily upland grasses) likely limited the establishment and regeneration of more desirable woody species. Fish habitat at RM 5.6 was rated only fair (score: 3 points out of a potential of 10; Table 76), and was not felt to be at its potential. Few pools or other holding water existed in the survey reach, and woody debris in the channel was virtually absent. Additionally, woody vegetation overhang for shade and cover was limited and patchy. Aquatic macrophytes were common within the stream channel and provided most of the available cover for the numerous juvenile brook trout found in the section. Flow was good at the time of the survey in late July, but just upstream the channel went subsurface through the earthen dam that formed Miller Lake.

At RM 7.0, Hoover Creek continued to display characteristics of a Rosgen Bc stream type similar to downstream reaches. However, at this location, riparian and stream habitat appeared to be in slightly better condition. The total riparian assessment score was 63 out of a potential score of 70 (90%) (Table 76). The channel had access to a small floodplain and appeared vertically as well as laterally stable. Additionally, past beaver activity was also noted in and around the survey reach. Woody riparian vegetation was comprised mainly of alder, willow, and conifer trees. However, woody plants were patchy in the riparian zone, and openings dominated by grasses and sedges were common. Disturbance-induced plants, including Canada thistle, were also present in the riparian area, but most were not overly dense. Widespread timber harvest was evident to the south of the channel on the adjacent hillside. Fish habitat at RM 7.0 was rated as good (score: 7 points out of a potential of 10; Table 76), but was slightly limited by a general lack of woody debris and rootwads in the channel. Also, the patchiness of woody shrubs and trees along the stream left segments lacking significant overhead cover and shade.

Near the upper extent of the drainage at RM 9.7, Hoover Creek was flowing through a narrow, conifer covered canyon, and was more representative of a Rosgen B stream type. The total riparian assessment score was 55 out of a potential score of 63 (87%) (Table 76). The riparian canopy was comprised primarily of spruce and alder, which provided a reasonable amount of shade and cover to the channel. Channel stability was good and no excessive erosion was noted. The area was immediately adjacent to a well-traveled forest road and some disturbance-induced plants (primarily bull thistle and common mullen) and noxious weeds (houndstounge and tall buttercup) were noted throughout the narrow riparian zone. Livestock presence was also evident, and browse pressure on palatable woody plants was moderate. Fish habitat in this segment of Hoover Creek was rated as fair (score: 3 points out of a potential of 7; Table 76), and was limited by a lack of deep pools. Fine sediment accumulation was notable and was likely correlated with the forest road network in the upper watershed. Culverts at two road crossings above and below (RM 9.8 and 9.4, respectively) the survey section were examined, and neither was very conducive to fish or debris passage. The lower culvert (RM 9.4) had debris buildup at the inlet, and the outlet of the upper culvert (RM 9.8) was slightly perched.

Table 76. Riparian assessment results for four sites surveyed on Hoover Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 2.4	21/30 (70%)	23/30 (77%)	3/7 (43%)	47/67 (70%)
RM 5.6	27/30 (90%)	21/30 (70%)	3/10 (30%)	51/70 (73%)
RM 7.0	30/30 (100%)	26/30 (87%)	7/10 (70%)	63/70 (90%)
RM 9.7	30/30 (100)	22/26 (85%)	3/7 (43%)	55/63 (87%)

Water temperature was monitored at one site in Hoover Creek from July 11 to October 13, 2008 (Appendix B). The thermograph was located at RM 1.9 (Figure 5). Maximum daily temperatures at this site exceeded 15ºC on 62 days, including 24 days when they exceeded 20ºC. The maximum-recorded temperature was 22.3ºC on August 18.

<u>**Gough Creek Drainage**</u>

Gough Creek

Gough Creek is a tributary flowing out of the Garnet Range near Clark Fork RM 289.2. This small stream flows for approximately 6 miles before being captured by an irrigation ditch (aerial photograph interpretation) prior to reaching the Clark Fork River. Land ownership along the stream consists mostly of privately owned parcels, with only one mile of stream flowing through State owned land in the upper portion of the watershed. The primary land uses in the drainage are livestock grazing and recent timber harvest. A primitive, private road follows the stream for most of its length, encroaching on the channel in narrower portions of the canyon. A 3-acre private reservoir is situated on Gough Creek at RM 0.6. Downstream of this impoundment, the channel flows through a farmstead and livestock corrals, as well as across an irrigated hay meadow and pasture. Gough Creek is also channeled through an approximately 250 foot long culvert where it intersects Interstate 90 (RM 0.1).

Fish sampling was completed at three sections of Gough Creek in mid July of 2008. The sites were located at RM 1.3, 3.7, and 5.1 (Table 77; Figure 5). The lower two sites (RM 1.3 and 3.7) were situated on private land while the upper-most site (RM 5.1) was on State owned land. Westslope cutthroat trout were the only fish observed at all three sample sites (Table 77). Fish density was relatively low at all sections, but was highest at RM 1.3, the sample site closest to the reservoir at RM 0.6. Average fish size tended to be small (i.e. < 150 mm) at all of the sample sites, and larger fish were notably rare (Table 77; Appendix A). It appeared that the majority of the population was comprised of immature, juvenile fish, of which only a few were surviving to maturity. However, it is also possible that fish were maturing in the reservoir downstream and only migrating upstream during the spring to carry out spawning. If this were true, many adult fish may have already returned to the reservoir by mid July. The genetic purity of westslope cutthroat trout in Gough Creek is currently unknown. Samples were collected during 2008 for analysis.

Table 77. Electrofishing data collected at three sections of Gough Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.3	WCT	26	26.0	111	75-195	100
RM 3.7	WCT	11	11.0	100	76-156	100
RM 5.1	WCT	14	14.0	77	52-108	100

A riparian assessment was completed at each of the sections electrofished on Gough Creek in 2008. At RM 1.3, the stream was classified as a Rosgen B channel type, and the total riparian assessment score was 47 out of a potential score of 70 (67%) (Table 78). Throughout much of the survey reach the channel was moderately incised from past downcutting, and active lateral erosion was evident on several high banks where deep-rooted vegetation was absent. Woody vegetation at the site consisted mostly of alder, aspen, wild rose, and dogwood, but the riparian zone was rather narrow and was largely restricted to the immediate stream banks. Openings in the riparian canopy where dominated by disturbance-induced plants and noxious weeds, which tended to be rather widespread throughout the area. Fish habitat at RM 1.3 was rated only fair (score: 3 points out of a potential of 10; Table 78), was most limited by high fine sediment accumulation and a lack of deep pools. Additionally, two small culverts located side by side were observed at an old road crossing just upstream of the survey section (near RM 1.4). These culverts were undersized and had the potential to be fish barriers at high flows due to swift velocities.

At RM 3.7, Gough Creek was transitioning out of a small upstream meadow-like area, and was classified as a Rosgen E channel type with some uncertainty. While the channel was relatively narrow and deep, the gradient was greater than expected. The total riparian assessment score was 52 out of a potential score of 70 (74%) (Table 78). Gough Creek appeared vertically stable, although the channel was slightly incised in a few areas of the surveyed reach. Lateral bank erosion was evident, but was relatively minor and mostly confined to an old road cut-bank adjacent to the channel, as well as a few outside banks lacking deep-rooted vegetation. Woody riparian vegetation was comprised mostly of alder, willow and dogwood; with, aspen, wild rose, juniper, snowberry, and conifer trees also present in the area. Despite this diverse plant community, woody plant density was somewhat sparse, leaving a number of grassy openings present throughout the riparian bottom. Disturbance induced plants and noxious weeds were present, but were generally not as abundant as at downstream reaches. Browse pressure on palatable woody shrubs was moderate, and cattle hoofshear and hummocking was noted in several areas along the channel. Fish habitat at RM 3.7 was rated only fair (score: 3 points out of a potential of 10; Table 78), and was most limited by a lack of deep pools, notable fine sediment accumulation, and a lack of habitat complexity related to the relative absence of rootwads and woody debris in the channel.

At RM 5.1, Gough Creek was confined within a narrow canyon and was classified as a Rosgen B channel type. The total riparian assessment score was 61 out of a potential score of 67 (91%) (Table 78). The channel appeared stable as no downcutting or notable lateral erosion was evident. The riparian canopy consisted of a relatively dense alder and dogwood understory, and a mature Douglas fir dominated overstory. A few noxious weeds were present in the area, but in general, disturbance-induced plants were relatively sparse. Several trails frequented by livestock and wildlife were noted in the survey reach, but browse pressure on palatable shrubs appeared light. Fish habitat at RM 5.1 was again rated only fair (score: 3 points out of a potential of 7; Table 78), and was limited primarily by a lack of deep pools. Most of the pools present in the reach were shallow and filled in with fine sediment.

Table 78. Riparian assessment results for three sites surveyed on Gough Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.3	23/30 (77%)	21/30 (70%)	3/10 (30%)	47/70 (67%)
RM 3.7	27/30 (90%)	22/30 (73%)	3/10 (30%)	52/70 (74%)
RM 5.1	30/30 (100%)	28/30 (93%)	3/7 (43%)	61/67 (91%)

Water temperature was not monitored in Gough Creek in 2008.

Carten Creek Drainage

Carten Creek

Carten Creek is a tributary that drains out of the Garnet Range for approximately 9 miles before reaching the Clark Fork at RM 290.8. Historic activities including the construction of Interstate 90 appear to have significantly impacted the stream near its terminus. The mouth of the stream is a perched culvert, which is over 250 feet in length. Fish in either the Clark Fork River or Carten Creek do not appear to have simple passage into or out of this small tributary stream. Land ownership along Carten Creek is comprised entirely of private lands. The primary land uses in the watershed are livestock grazing and irrigated hay production (lower-to-middle portion of drainage). Additionally, a well-traveled unpaved road follows the stream from its mouth to its upper extent, crossing the channel at several locations. A 12-acre impoundment is situated on Carten Creek near Interstate 90 at RM 0.4.

Fish sampling was completed at two sections of Carten Creek in early August of 2008. The sites were located at RM 1.3 and 4.5 (Table 79; Figure 5). At both sections, the fish community was comprised entirely of westslope cutthroat trout. On average, fish tended to be slightly larger at the lower section (RM 1.3), although fish density was similar between the two sample sites (Table 79; Appendix A). Although juvenile fish (< ~ 150 mm) made up a larger proportion of the population at the upper section (RM 4.5), multiple age classes were observed at each site. Genetic sampling conducted in1986 showed that Carten Creek contained a pure strain of westslope cutthroat trout. Additional genetic samples were collected in 2008.

Table 79. Electrofishing data collected at two sections of Carten Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.3	WCT	52	52.0	124	82-178	100
RM 4.5	WCT	47	47.0	105	77-171	100

A riparian assessment was completed at each of the sections electrofished on Carten Creek in 2008. At RM 1.3, the stream was situated in a narrow draw that was rather entrenched when compared to the slightly broader valley. However, the reasonably stable Rosgen B channel had access to a small floodplain throughout most of the surveyed reach. The total riparian assessment score was 61 out of a potential score of 67 (91%) (Table 80). Riparian vegetation was dense and was comprised of aspen, cottonwood trees, dogwood, willow, alder, juniper, snowberry and other woody shrubs. Disturbance induced plants and noxious weeds were relatively sparse within the riparian area, and browse pressure was fairly light on palatable shrubs and trees. However, individual plants along livestock trails and near openings did show more moderate browse pressure. Fish habitat at RM 1.3 was rated only fair (score: 3 points out of a potential of 7; Table 80), but was mostly limited by low flows and high fine sediment accumulation. Much of the habitat would have been notably improved given higher flows. In drier years, it is likely that fish are isolated to just a few deeper pools present in the reach. Upstream of the survey site between RM 2.0 and 3.0, several diversions were noted where the channel flowed through active hay meadows situated on each side of the stream. Just downstream of the survey site, the stream flowed into a small wetland area near the edge of the Gold Creek Rest Area (off Interstate 90; west bound), and then continued under the Carten Creek road until reaching the 12-acre reservoir mentioned above. Below of the reservoir, a small channel flowed down to a small pond dammed by the Carten Creek road embankment. The fate of the stream from this location across Interstate 90 to the Clark Fork River was not able to be determined.

At RM 4.5, Carten Creek was in a similar state as described at RM 1.3. The channel was relatively entrenched in a narrow ravine that was inset in a slightly wider valley. However, the stream had access to a small, well-vegetated floodplain, and appeared vertically stable at the time of the survey. The channel was characterized as a Rosgen Bc channel type due to a number of small meanders observed in the reach. The total riparian assessment score was 58 out of a potential score of 70 (83%) (Table 80). Most of the bank erosion noted in the survey reach was minor, and was related to cattle hoofshear and not lateral migration. Riparian vegetation was comprised mostly of alder, aspen, rose and juniper. Density of woody plants was fair, but a number of disturbance-induced (livestock grazing) openings were also present throughout the area. Browse pressure on palatable shrubs and trees was moderate. Fish habitat at RM 4.5 was good (score: 7 points out of a potential of 10; Table 80), although many of the pools in the reach lacked depth, and fine sediment accumulation was notable. Flow however, was much greater at RM 4.5 than was observed on the same day at RM 1.3. One additional observation made during the riparian assessment was a well-used cattle loafing area situated approximately 0.5 miles downstream of the survey site. This site was located immediately adjacent to the stream and was a likely source of fine sediment.

Table 80. Riparian assessment results for two sites surveyed on Carten Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.3	30/30 (100 %)	28/30 (93%)	3/7 (43%)	61/67 (91%)
RM 4.5	27/30 (90%)	24/30 (80%)	7/10 (70%)	58/70 (83%)

Water temperature was not monitored in Carten Creek in 2008.

Gold Creek Drainage

Gold Creek

Fish sampling (including riparian assessments) and temperature monitoring were conducted on Gold Creek in 2007. Results of this survey work were summarized in ***An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin*** (2008). In 2008, no additional fish sampling or riparian assessments were completed on Gold Creek. However, water temperature was again monitored at the 2007 locations.

Water temperature was monitored in Gold Creek from July 4 through October 13, 2008 at RM 0.1 and 5.7 (Figure 5; Appendix B). At RM 0.1, maximum daily water temperatures exceeded 15°C on 37 days. On no days did maximum daily water temperature exceed 20°C during 2008 monitoring. The maximum-recorded temperature at RM 0.1 was 16.9°C on August 17. This was 4.3ºC cooler than the maximum-recorded temperature measured during 2007 (21.2ºC). At RM 5.7, maximum daily water temperatures did not exceed 15°C during the entire 2008 sampling period. The maximum-recorded temperature at this site was 14.1°C on August 18, which was 2ºC cooler that the maximum temperature measured in 2007 (16.1ºC). Despite a general cooling trend observed throughout Gold Creek in 2008, it appeared that maximum stream temperatures were disproportionately cooler near the mouth in 2008 versus 2007. One possible explanation for this was increased flows though this reach, possibly supplemented by water left in-stream due to irrigation improvements made in lower Gold Creek in the spring of 2008 (i.e. a switch was made from flood irrigation to center pivot irrigation near the mouth of Gold Creek).

Pikes Peak Creek

Fish sampling (including a riparian assessment) was conducted at one site on Pikes Peak Creek in 2007. Results of this survey work were summarized in ***An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin*** (2008). In 2008, one additional sample site was added on Pikes Peak Creek near RM 9.1, upstream of the 2007 site located at RM 6.7 (Figure 5). Additionally, the 2007 site was re-electrofished in 2008.

At RM 6.7, 2008 electrofishing results were very similar to those from 2007. Westslope cutthroat trout were the only species captured at the site, and fish size and density appeared nearly identical to 2007 (where 52 fish were captured, averaging 113 mm in total length) (Table 81; Appendix A). At RM 9.1, westslope cutthroat trout were again the only species collected in Pikes Peak Creek during the late August sample period. At this site, fish appeared to be slightly more abundant as well as larger in average size than those captured at RM 6.7 (Table 81; Appendix A). The stream was notably larger at RM 9.1, and the increase in flow and available habitat could potentially explain the observed difference in fish size and abundance between the two sites. Genetic samples collected in Pikes Peaks Creek in 1996 indicated the presence of a pure strain of westslope cutthroat trout. Additional samples were collected in 2008 for confirmation.

Table 81. Electrofishing data collected at two sections of Pikes Peak Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 6.7	WCT	56	56	121	77-198	100
RM 9.1	WCT	78	78	153	62-255	100

A riparian assessment was completed for the section added (RM 9.1) on Pikes Peak Creek in 2008. At this site, the stream exhibited characteristics of a Rosgen B channel type, although C channel tendencies were also noted in lower gradient portions of the reach. The total riparian assessment score was 52 out of a potential score of 67 (78%) (Table 82). The stream channel appeared relatively stable throughout the survey section, although it was overly wide in a few locations. Additionally, livestock trampling as well as old mining activity had led to some bank erosion in the reach. Riparian vegetation was comprised primarily of alder and spruce, with grassy openings throughout the area as well. Livestock use of the area was evident, and palatable shrubs showed moderate browse pressure. Additionally, evidence of past timber harvest was also present in and around the survey reach. Fish habitat at RM 9.1 was rated as good (score: 7 points out of a potential of 10; Table 82), as there was sufficient flow, a number of deep pools, and abundant large woody debris throughout the reach. However, shade and overhead cover was marginal in areas were timber harvest was evident.

Table 82. Riparian assessment results for one site surveyed on Pikes Peak Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 9.1	25/30 (83%)	20/27 (74%)	7/10 (70%)	52/67 (78%)

Water temperature was not monitored in Pikes Peak Creek in 2008.

Brock Creek Drainage

Brock Creek

Brock Creek is a tributary to the Clark Fork River that drains out of the Garnet Range for approximately 12 miles before reaching the Clark Fork at RM 294.7. The mouth of the stream is the outlet of an approximately 300-foot culvert underneath Interstate 90 and the Phosphate interchange. It is unknown whether fish are capable of passing upstream (out of the Clark Fork River) through this extensive pipe. Land ownership along the lower 10 miles of Brock Creek consists mostly of private lands, while the remaining portion of the channel is situated on lands managed by the U.S. Bureau of Land Management and the State of Montana. Current land uses in the Brock Creek watershed consist mainly of livestock grazing, timber harvest (upper portion of drainage), and forest recreation. However, evidence of past mining activity (including severe channelization) is also evident throughout the lower potion of the watershed. A sizeable public road, of which a portion is paved, runs along Brock Creek for the lower 10 miles of the stream. Additionally, several houses are situated adjacent to the channel in the lower mile of the drainage. The only irrigation diversion known on Brock Creek is at RM 0.9.

Fish sampling was completed at two sections of Brock Creek in mid August of 2008. The sites were located at RM 4.4 and 7.8 (Table 83; Figure 5). The lower site (RM 4.4) was located on State land while the upper site (RM 7.8) was situated on private timberland. Access to Brock Creek closer to the mouth was denied. At RM 4.4 the trout community was comprised entirely of westslope cutthroat trout ranging from 98 to 197 mm in total length (Table 83; Appendix A). In addition to these fish, ten longnose suckers and 56 slimy sculpin were also collected at the site. At RM 7.8, westslope cutthroat trout were again the only trout species observed in Brock Creek, with slimy sculpin (9) being the only other fish species captured in the section. Westslope cutthroat trout were notably more abundant in this reach than they were at RM 4.4, and fish ranged from small young-of-the-year to over 200 mm in total length (Table 83; Appendix A). The genetic purity of westslope cutthroat trout in Brock Creek is currently unknown. Samples were collected in 2008 for analysis.

Table 83. Electrofishing data collected at two sections of Brock Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 4.4	WCT	24	24.0	141	98-197	100
RM 7.8	WCT	83	83.0	109	67-223	100

A riparian assessment was completed at each of the sections electrofished on Brock Creek in 2008. At RM 4.4, the stream was situated in a rather broad, U-shaped valley, and displayed characteristics of a Rosgen Bc channel type. The total riparian assessment score was 52 out of a potential score of 70 (74%) (Table 84). The channel showed evidence of old downcutting, although it had access to new, narrower floodplain at the time of the survey. Lateral erosion was moderate, and was mainly associated with areas where the channel was meandering up against old terraces. However, extensive cattle hoofshear and a lack of deep-rooted vegetation on many outside bends were also contributing to the observed erosion. Woody riparian vegetation was comprised mostly of alder, prickly rose, and a few willows, but the majority of plants present were restricted to the immediate stream banks. Disturbance-induced plants (upland grasses and weedy species) and noxious weeds (houndstounge, Canada thistle, spotted knapweed, and common tansy) were common in the openings present throughout the riparian bottom, and these openings showed notable livestock grazing pressure. Additionally, browse on palatable woody shrubs was moderate. Fish habitat at RM 4.4 was between fair and good, but was given a score of good (score: 7 points out of a potential of 10; Table 84) based on availability of cover. The riparian canopy, while not continuous, did provide a moderate amount of shade and overhead cover, and accumulations of coarse woody debris added to habitat complexity. However, most of the pools present in the reach were shallow, and fine sediment deposition was rather high. One additional observation made during the survey at RM 4.4 was that immediately downstream of the sample site the channel was severely straightened from past mining activity. In this area, the stream appeared to be split into two channels running on each side of what was thought to be a large vegetated tailings pile in the middle of the valley. This straightened reach was approximately 300 m in length.

At RM 7.8, Brock Creek had transitioned into a narrow, timbered canyon, and the channel was more characteristic of Rosgen B stream type. The riparian corridor was quite narrow, and was further encroached on by the forest road running along the east side of the channel. This road occupied as much as half the valley bottom in some locations. Additionally, most of the surrounding hillsides showed evidence of recent and past timber harvest. The total riparian assessment score at RM 7.8 was 63 out of a potential score of 67 (94%) (Table 84). Despite the encroachment of the adjacent road, the stream appeared stable, and little active erosion was evident. Riparian vegetation was comprised of and understory of alder and a dense, low-growing woody shrub (possibly black currant), and an overstory of mature Douglas fir. Some noxious weeds and undesirable plants were present in the area, but most were associated with the road disturbance zone. Fish habitat at RM 7.8 was good, and was thought to be near its potential (score: 7 points out of a potential of 7; Table 84).

Table 84. Riparian assessment results for two sites surveyed on Brock Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 4.4	23/30 (77%)	22/30 (73%)	7/10 (70%)	52/70 (74%)
RM 7.8	30/30 (100%)	26/30 (87%)	7/7 (100%)	63/67 (94%)

Water temperature was monitored at one site in Brock Creek from July 11 to October 13, 2008 (Appendix B). The thermograph was located near the mouth at RM 0.2 (Figure 5). Maximum daily temperatures at this site exceeded 15ºC on 47 days. The maximum-recorded temperature was 19.9ºC on July 26.

Warm Springs Creek Drainage (near Garrison)

Warm Springs Creek

Warm Springs Creek is a tributary to the Clark Fork River that drains out of the Garnet Range for approximately 14 miles before reaching the Clark Fork at RM 296.2. Physical connection to the river for both water and fish appears good despite the stream crossing under Interstate 90 near its mouth. The bulk of the land along Warm Springs Creek is privately owned, with only a few public parcels managed by the U.S. Bureau of Land Management and the State of Montana present in the upper portion of the watershed. A gravel road follows along the stream for most of its length, although a portion of it in the upper extent of the drainage is not open for public use. The principal land uses in the drainage are livestock grazing, irrigated hay production (lower portion of watershed), and active timber harvest (upper portion of watershed). Past mining activity, including associated road networks and building infrastructure, is also observable throughout the middle and upper portions of the drainage. A sizeable waterfall (i.e. ~ 50 foot drop) is located on Warm Springs Creek near RM 5.3. This feature is likely a natural barrier to any fish attempting to move upstream. Additionally, the stream goes dry during summer at approximately RM 6.1. The extent of this condition was not determined, although the channel appears to be dry upstream of this point for over a mile. Several residences and farmsteads are also located along the stream in the lower extent of the drainage.

Fish sampling was completed at two sections of Warm Springs Creek between late August and late September of 2008. The sites were located at RM 0.6 and 11.5 (Table 85; Figure 5). The lower site (RM 0.6) was situated on private land while the upper site (RM 11.5) was on State land. At RM 0.6, the trout community was comprised primarily of brown trout, although one westslope cutthroat trout was also collected in the section (Table 85). Brown trout density was very high, although many of the fish were relatively small juveniles (Table 85; Appendix A). The high number of juvenile fish and relatively low number of larger adults found in the sample section indicated that lower Warm Springs Creek may be an important spawning tributary for brown trout in the Clark Fork River. In addition to the trout captured at RM 0.6, one mountain whitefish, one slimy sculpin, and 18 longnose suckers were also captured at the survey site. At RM 11.5 (above the waterfall at RM 5.3), the fish community made a notable shift. At this location, only westslope cutthroat trout were present in Warm Spring Creek. Fish density was again high with 183 fish captured in the section, which ranged in size from young-of-the-year to adults over 200 mm in total length (Table 85; Appendix A). Genetic sampling conducted in1992 showed that Warm Springs Creek (above the waterfall at RM 5.3) contained a pure strain of westslope cutthroat trout.

Table 85. Electrofishing data collected at two sections of Warm Springs Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 0.6	WCT	1	1.0	293	293	1
	LL	178	178.0	117	70-335	99
RM 11.5	WCT	183	183.0	116	41-214	100

A riparian assessment was completed at each of the sections electrofished on Warm Springs Creek in 2008. At RM 0.6, the stream was situated in relatively wide portion of the valley and was flowing through an irrigated hay meadow. The stream was deep and rather sinuous and was classified as a Rosgen E channel type. The total riparian assessment score was 48 out of a potential score of 70 (69%) (Table 86). The channel was somewhat incised (approximately 3-6 ft), although no active downcutting was noted during the survey. However, several outside banks lacking deep-rooted woody vegetation did show notable erosion. Upstream of the sample site, an old wood retaining wall had been constructed on an outside bend, likely a past effort to control lateral erosion. Riparian vegetation was comprised heavily of hay grasses and disturbance-induced weeds. Willow and alder were also present throughout the reach, but their density was limited and their distribution patchy. Fish habitat at RM 0.6 was rated as good (score: 7 points out of a potential of 10; Table 86), but was somewhat limited by the lack of cover and shade that would have been afforded by an increased density of woody shrubs along the stream banks. Deep pools however, were common and abundant aquatic vegetation provided fair cover for fish of all sizes. Stream substrate was relatively fine (silt/sand) and areas of spawning gravel were limited and site specific. Below the survey section, the stream flowed through a farmstead and adjacent livestock corrals. At least one irrigation diversion was observed upstream of the sample site.

At RM 11.5, Warm Springs Creek was in a relatively deep canyon with a narrow valley bottom. Stream gradient was fairly low and the channel displayed characteristics of a Rosgen Bc channel type. An infrequently used road that occupied much of the riparian area was situated in the valley bottom near the survey section. The total riparian assessment score was 54 out of a potential score of 70 (77%) (Table 86). While the stream was vertically stable and had access to a small floodplain adjacent to the channel, lateral erosion was evident on outside banks lacking deep-rooted vegetation. Woody riparian vegetation was comprised largely of willow, alder, and lodgepole pine. However, the density of these plants along the stream channel was rather low, and their distribution was patchy. Disturbance-induced grasses were common throughout the riparian zone, and livestock use adjacent to the stream was notable. Fish habitat at RM 11.5 was rated as good (score: 7 points out of a potential of 10; Table 86), but was less than its potential. While there were several quality pools and undercut banks in the survey reach, the sparse woody shrubs and trees along the streambanks provided relatively little overhead cover and shade. Additionally, woody debris in the channel was mostly absent from the reach. Extensive timber harvest was noted upstream of the survey reach in much of the upper watershed.

Table 86. Riparian assessment results for two sites surveyed on Warm Springs Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.6	23/30 (77%)	18/30 (60%)	7/10 (70%)	48/70 (69%)
RM 11.5	25/30 (83%)	22/30 (73%)	7/10 (70%)	54/70 (77%)

An attempt was made to monitor water temperature near the mouth of Warm Springs Creek during the summer of 2008. However the temperature recorder was unable to be recovered and was presumed lost or stolen. Beaver activity near the site of the logger may have been correlated with the disappearance of the thermograph.

Little Blackfoot River Drainage

Little Blackfoot River

Fish sampling (including riparian assessments) and temperature monitoring were conducted at a number of sites in the Little Blackfoot River during 2007. Results of this survey work were summarized in ***An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin*** (2008). In 2008, one additional electrofishing location was added in the upper portion of the drainage near RM 36.9, and thermographs were again deployed at five locations along the stream (Figure 6).

Results of fish sampling completed at RM 36.9 in mid September of 2008, showed westslope cutthroat trout comprised the greatest proportion of trout in the reach, followed by brown trout and brook trout, respectively (Table 87). Virtually all of the brown trout captured in the reach were juveniles of a similar size, while westslope cutthroat trout ranged from young-of-the-year to larger, adult-sized fish (Table 87; Appendix A). Brook trout were rare at the site, and the two captured were relatively small being just 116 and 130 mm in total length.

Table 87. Electrofishing data collected at one section of the Little Blackfoot River in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 36.9	WCT	36	36	144	61-365	71
	LL	13	13	110	101-122	25
	EB	2	2	123	116-130	4

A riparian assessment was completed for the section added (RM 36.9) on the Little Blackfoot River in 2008. At this location, the stream was situated in a relatively narrow, high-gradient canyon, and was classified as a Rosgen B channel type. The total riparian assessment score was 64 out of a potential score of 68 (94%) (Table 88). The riparian zone next to the stream was narrow, yet appeared largely intact. Woody plants along the stream banks were comprised mostly of alder, willow and conifers. A few noxious weeds were also present, but most were associated with the steep road cut bank located to the north of the channel. Fish habitat at the site was good (score: 7 points out of a potential of 10; Table 88), but mainly consisted of abundant pocket water associated with the large boulder substrate found throughout the section. Very few pieces of large woody debris were present in the channel at the time of the survey, although the potential for future recruitment appeared good due to the frequency of beetle-killed lodgepole pine adjacent to the stream.

Table 88. Riparian assessment results for one site surveyed on the Little Blackfoot River in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 36.9	30/30 (100%)	27/28 (96%)	7/10 (70%)	64/68 (94%)

Water temperature was monitored at five locations along the Little Blackfoot River between July 11 and October 13, 2008 (Appendix B). The monitoring sites were located at RM 0.5, 9.3, 21.3, 31.0, and 39.7 (Figure 6). The lowest thermograph (RM 0.5) was placed in the same location as in 2007, while the four remaining temperature recorders were positioned in new sites throughout the drainage. At RM 0.5, daily maximum water temperatures exceeded 15°C on 61 days, including 20 days in which they exceeded 20°C. The maximum-recorded temperature at this site was 22.7°C on August 18. At RM 9.3, maximum daily temperatures exceeded 15°C on 59 days including 10 days in which they exceeded 20°C. The maximum-recorded temperature was 21.0°C on July 26. At RM 21.3, maximum daily temperatures exceeded 15°C on 49 days, and 20°C on two of those days. Maximum-recorded temperature at this site was 20.4°C on August 18. Further upstream at RM 31.0, daily high temperatures exceeded 15°C on 46 days, but on no days did temperatures rise above 20°C. The maximum daily temperature at this site was 19.5°C recorded on August 18. At RM 34.8, the most upstream site, temperatures were notably cooler than all downstream sites. The maximum-recorded temperature at this site was 16.7°C on August 18. Daily highs at RM 34.8 exceeded 15°C on only 22 days.

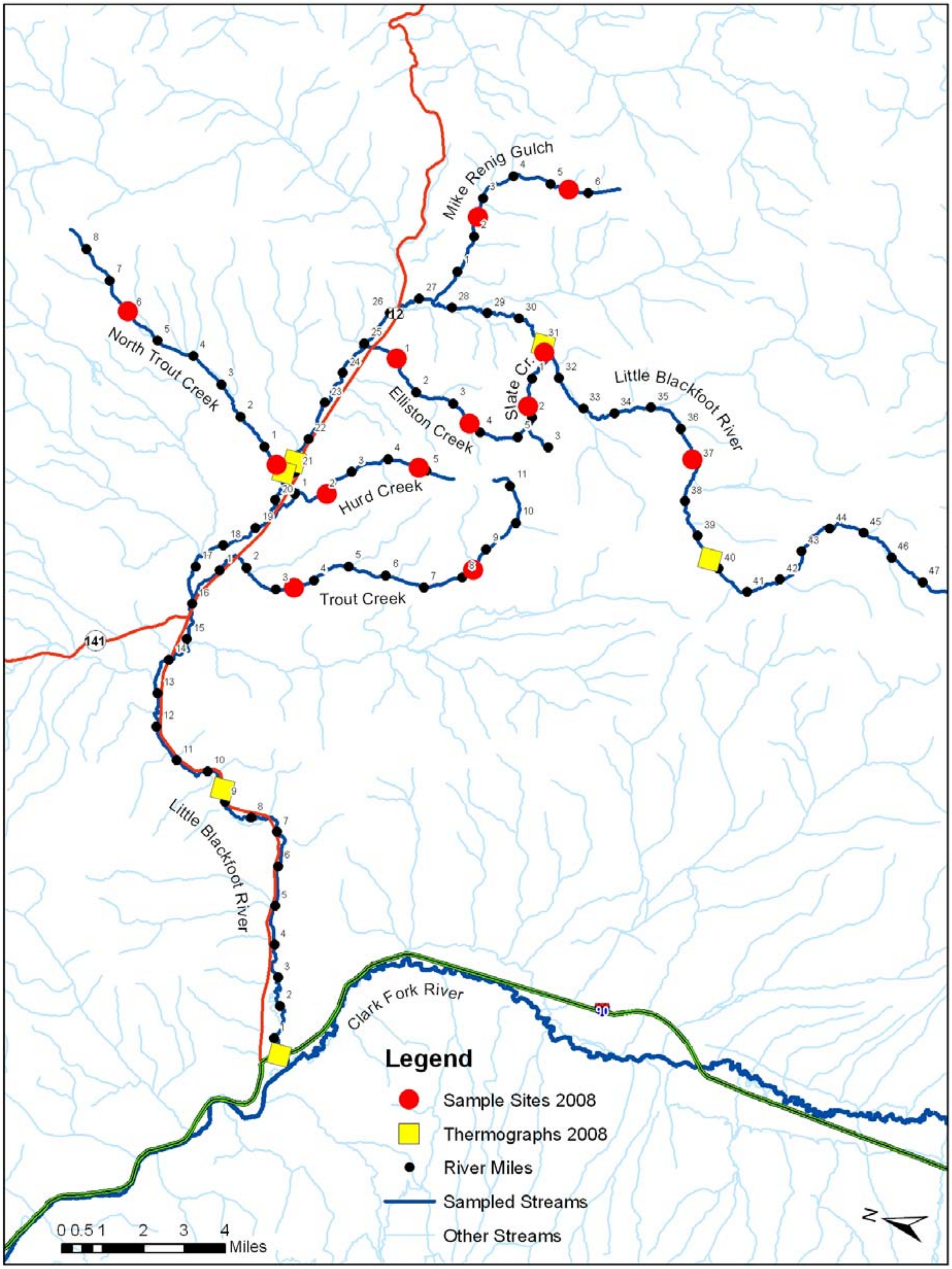


Figure 6. Map of Little Blackfoot River drainage showing sites of fish and temperature sampling conducted in 2008.

Trout Creek

Trout Creek is a tributary to the Little Blackfoot River that drains for approximately 11.5 miles before reaching its mouth near the town of Avon at Little Blackfoot RM 16.2 (Figure 6). Much of the stream flows through private lands, although isolated parcels of State ownership are present in the lower and middle portions of the drainage. Additionally, the U.S. Forest Service also manages a few parcels interspersed among private land in the upper extent of the watershed. The primary land uses in the drainage are livestock grazing, flood irrigated hay production (lower four miles of the drainage) and timber harvest (upper half of the watershed).

Fish sampling was completed at two sections of Trout Creek in early September of 2008. The sites were located at RM 3.5 and 8.3 (Table 89; Figure 6). The lower section (RM 3.5) was located on private land, while the upper site (RM 8.3) was situated on U.S. Forest Service land. At RM 3.5, the trout community was comprised of both brook trout and westslope cutthroat trout, with brook trout being the more common species (Table 89). Many of the brook trout captured in the section were quite small (< 100 mm TL) and appeared to be juveniles and young-of-the-year; however, all of the westslope cutthroat trout collected in the survey reach were rather large (>150 mm TL), with most being large enough to be resident adults (Table 89; Appendix A). The absence of juvenile westslope cutthroat trout suggested poor recruitment, or a lack of spawning and early rearing occurring near the sample site. Four longnose suckers were also collected in Trout Creek at RM 3.5. Higher in the watershed at RM 8.3, westslope cutthroat trout were the most abundant species, with brook trout becoming rare (Table 89). Westslope cutthroat trout density was high, and there was a good representation of fish ranging from young-of-the-year to what were likely resident adults (Table 89; Appendix A). Only two brook trout were captured in the reach, and both were over 200 mm in total length (Table 89; Appendix A). Both appeared to be adults capable of spawning. Westslope cutthroat trout genetic samples collected in Trout Creek (near the RM 8.3 sample site) in 1989 showed that the fish tested were genetically pure. Additional genetic samples were collected in 2008.

Table 89. Electrofishing data collected at two sections of Trout Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 3.5	WCT	17	17.0	181	139-205	24
	EB	54	54.0	110	50-270	76
RM 8.3	WCT	120	120.0	108	35-200	98
	EB	2	2.0	215	207-223	2

A riparian assessment was completed at each of the sections electrofished on Trout Creek in 2008. At RM 3.5, the stream was situated in a narrow valley and was flowing between two small hay meadows. The channel was classified as a Rosgen Bc stream type even though it was rather straight and incised throughout the survey reach. The downcutting appeared to have occurred sometime in the past as the stream had established a new, narrow floodplain that was fairly well vegetated. The total riparian assessment score was 54 out of a potential score of 70 (77%) (Table 90). The woody riparian community was comprised of willow, alder, and cottonwood trees, but all were confined to the immediate streambanks. The presence of cottonwood trees was fairly unique to the surveyed reach, as the species was absent not far outside the section. Lateral bank erosion was evident on most high banks lacking woody vegetation. Upland hay/pasture grasses dominated these sites. Fish habitat at RM 3.5 was rated as good (score: 7 points out of a potential of 10; Table 90) due to an abundance of pools, woody debris, and vegetation overhang in the reach. However, fine sediment accumulation was notable and affected habitat quality by limiting pool depth and spawning gravel composition. Streamflow was adequate at the time of the survey, but was likely correlated with heavy rains received prior to sampling. The landowner informed that late summer flows were typically much lower than what was observed. Several ditches/diversions were noted above and below the section.

At RM 8.3, Trout Creek flowed through a small forest opening that was situated in a relatively confined canyon. The stream was classified as a Rosgen Bc channel type, although above and below the section it quickly transitioned to a Rosgen A channel type. The total riparian assessment score was 35 out of a potential score of 68 (51%) (Table 90). The woody riparian community was limited, and was comprised of sparse alder and willow, as well as a few conifer trees. Upland grasses and weedy species were common in the area, and the riparian zone showed evidence of notable livestock use. Bank tramping and lateral erosion was common, and contributed to a channel that tended to be wide and shallow throughout the survey segment. Fish habitat at RM 8.3 was rated only fair (score: 3 points out of a potential of 10; Table 90), primarily due to a lack of significant and complex cover components. Most of the pools present in the reach were shallow and filled with fine sediment. The majority of the fish collected during electrofishing came from the few available pools with depth. Flow was low, but appeared naturally so. One significant observation made while in the area was that downstream of the of the survey section on private land (below the USFS road crossing at RM 7.2), Trout Creek showed evidence of significant channel instability and degradation. The channel appeared to be actively widening as well as potentially downcutting in some segments. Livestock impacts on the riparian area were notable in this reach.

Table 90. Riparian assessment results for two sites surveyed on Trout Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 3.5	23/30 (77%)	24/30 (80%)	7/10 (70%)	54/70 (77%)
RM 8.3	14/30 (47%)	18/28 (64%)	3/10 (30%)	35/68 (51%)

Water temperature was not monitored in Trout Creek in 2008.

Hurd Creek

Hurd Creek is a small tributary to the Little Blackfoot River that drains for approximately 5.5 miles before reaching the Little Blackfoot near RM 19.5 (Figure 6). Surface connection to the Little Blackfoot appears poor (at least during summer) as the stream is captured by an irrigation diversion located near its mouth along Highway 12. Land ownership along Hurd Creek consists primarily of lands in private ownership, with only one mile of the channel flowing though public land (National Forest) in the upper portion of the watershed. The primary land uses in the drainage are livestock grazing and timber harvest. A private access road follows along much of the lower four miles of the channel. Additionally, a private campground is located along the stream near RM 0.2, and a small 1.5-acre in-stream pond is present at this same location. The dam of this impoundment is likely an upstream barrier to fish movement.

Fish sampling was completed at two sections of Hurd Creek in mid August of 2008. The sites were located at RM 2.1 and 4.8 (Table 91, Figure 6). The site at RM 2.1 was located on private land, while the section at RM 4.8 was situated on U.S. Forest Service land. Fish density was low at both sites, but was lowest at RM 2.1 (Table 91). At this site, both brook trout and westslope cutthroat trout were present, with brook trout being the more common species. However, most of the brook trout collected in the reach appeared to be young-of-the-year (Appendix A). Only two adult sized brook trout were captured in the survey section. The sole westslope cutthroat trout captured at RM 2.1 appeared to be a resident adult based on its relatively large, 198 mm total length. At RM 4.8, westslope cutthroat trout comprised the entire fish community (Table 91). All of the fish captured appeared to be juveniles based on their small size (Table 91; Appendix A). No historic genetic information could be found for westslope cutthroat trout in Hurd Creek. Samples were collected in 2008 for future analysis.

Table 91. Electrofishing data collected at two sections of Hurd Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM.2.1	WCT	1	1.0	198	198	11
	EB	8	8.0	92	61-180	89
RM 4.8	WCT	14	14.0	78	56-113	100

A riparian assessment was completed at each of the sections electrofished on Hurd Creek in 2008. At RM 2.1, the stream displayed characteristics of a Rosgen B channel type. The total riparian assessment score was 50 out of a potential score of 67 (75%) (Table 92). Little active erosion was noted in the reach except were several livestock/wildlife crossings were present. Despite this, fine sediment accumulation was high, and the channel was relatively shallow with most pools lacking depth. The woody riparian community was comprised primarily of alder, aspen and conifer trees, although plant density was patchy and limited to the immediate stream banks. The numerous grassy openings throughout the riparian zone showed notable livestock use. Fish habitat at RM 2.1 was rated only fair (score: 3 points out of a potential of 7; Table 92), and was most limited by a lack of deep pools. Few pools deep enough to be considered over-wintering habitat were present in the reach. Additionally, substrate throughout the survey segment was small and consisted primarily of small gravel, sand and fine sediment. This composition offered little quality-spawning habitat.

At RM 4.8, Hurd Creek was situated in a narrow, timbered canyon, and was classified as a Rosgen Ba channel type. The total riparian assessment score was 54 out of a potential score of 57 (95%) (Table 92). Overall, the stream was stable and the riparian area was in good condition although some limited livestock impacts (mostly bank trampling) were present in the reach. Woody riparian vegetation was comprised of a sparse alder understory and a mature lodgepole pine overstory. Much of the lodgepole pine along the stream (and on the adjacent hill sides) was dead from mountain pine beetle infestation. Fish habitat at RM 4.8 was rated as fair (score: 3 points out of a potential of 3; Table 92), and was thought to be at its potential. This location appeared to be near the upstream extent of fish distribution as the stream was very small and flow was low. Pool habitat was limited and most lacked depth. The culvert at the main Forest Service road crossing upstream of the survey section (near RM 5.0) was slightly perched and appeared to be a potential barrier to upstream fish movement. However, this site appeared to be located above current fish distribution based on spot electrofishing immediately above and below the crossing.

Table 92. Riparian assessment results for two sites surveyed on Hurd Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 2.1	28/30 (93%)	19/30 (63%)	3/7 (43%)	50/67 (75%)
RM 4.8	30/30 (100%)	21/24 (88%)	3/3 (100%)	54/57 (95%)

Water temperature was not monitored in Hurd Creek in 2008.

North Trout Creek

North Trout Creek is a tributary to the Little Blackfoot River that drains for approximately 8.5 miles before reaching the Little Blackfoot at RM 20.7 (Figure 6). However, no surface connection appears to exist between the upper and lower portions of the drainage, as no defined stream channel was observed at the county road crossing near RM 3.3. The only water present at this location was in a ditch flowing out across a low hillside. The extent of this “channel-less” condition was not determined. Approximately the lower six miles of North Trout Creek lies on private land while the remainder of the upper drainage is located on public land administered by the U.S. Forest Service. The primary land use in the drainage is livestock grazing, with irrigated pastures also present throughout the middle portion of the drainage downstream of the National Forest boundary. Two private ponds are located along North Trout Creek near RM 5.4. The connection of these reservoirs to the stream was not determined although one appears to be an in-channel pond through review of aerial photographs. Both are between 2 and 3 acres in size.

Fish sampling was completed at two sections of North Trout Creek in late July of 2008. The sites were located at RM 0.4 and 6.1 (Table 93, Figure 6). The lower site (RM 0.4) was located on private land while the upper site (RM 6.1) was situated on National Forest land. No trout were found in the sample section at RM 0.4 (Table 93). The only species present was longnose sucker, most of which were young-of-the-year. Additional spot electrofishing in the best habitats upstream of the sample section (for approximately 300 m) turned up a single 226 mm brook trout. At RM 6.1, brook trout were very abundant with 152 individuals captured in the sample reach (Table 93). However, a large portion these fish were juveniles less than 100 mm in total length (Appendix A). In addition to brook trout, several phenotypic cutthroat trout-rainbow trout hybrids were also captured in the reach. These fish were rare, and the ones captured were relatively small (< 150 mm) juveniles (Table 93; Appendix A). Genetic samples collected from westslope cutthroat trout in upper North Trout Creek in 1989 (near the RM 6.1 survey site) supported our observations of hybridization. The westslope cutthroat trout tested at that time were found to be only 53% pure.

Table 93. Electrofishing data collected at two sections of North Trout Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 0.4	No Trout	n/a	n/a	n/a	n/a	n/a
RM 6.1	WCTxRB	4	4.0	109	88-141	3
	EB	152	152.0	91	56-230	97

A riparian assessment was completed at each of the sections electrofished on North Trout Creek in 2008. At RM 0.4, the stream was classified as a Rosgen E channel type. The total riparian assessment score was 35 out of a potential score of 60 (58%) (Table 94). The channel showed signs of past downcutting throughout the sample reach, but at the time of the survey, appeared to be stabilizing and developing a new inset floodplain. A number of high banks continued to show signs of lateral erosion, and woody riparian vegetation was very sparse. Only a few mature willows and cottonwood trees were present in the survey section. Upland grasses dominated the riparian zone, although sedges were also present adjacent to the channel. Snowberry and prickly rose were also beginning to establish on the drier terraces next to the stream. Fish habitat (for trout) at RM 0.4 was rated poor (score: 0 points out of a potential of 3; Table 94), but was likely not too far from its potential. Fine sediment accumulation was very high throughout the reach, and flow was especially low. The few pools that were present in the reach showed almost no signs of current (i.e. they appeared stagnant). No diversions were noted immediately upstream of the section.

At RM 6.1, North Trout Creek was classified as a Rosgen B channel type, and the total riparian assessment score was 54 out of a potential score of 68 (79%) (Table 94). The stream was vertically stable and was well connected to the broader floodplain throughout the survey section. However, some segments of the channel were rather wide and shallow, and lateral erosion was evident on several outside banks where deep-rooted vegetation was lacking (primarily were the stream approached the main Forest Service access road). The woody riparian community was comprised primarily of aspen, willow, wild rose, and conifer trees (spruce and Douglas fir). However, plant density was patchy and somewhat sparse throughout the reach. The area was within a U.S. Forest Service grazing allotment, and livestock use of the riparian zone was quite evident (i.e. some bank trampling and moderate grazing/browse pressure). Fish habitat at RM 6.1 was rated as good (score: 7 points out of a potential of 10; Table 94), but was somewhat limited by a lack of deep pools as well as sparse overhead cover. There was a good mix of pools and riffles throughout the survey reach, but most pools lacked enough depth to be considered quality over wintering habitat. Spawning habitat however, was plentiful and several shallow side channels provided good juvenile rearing habitat as well. Additionally, flow was very good in this reach of North Trout Creek at the time of the survey.

Table 94. Riparian assessment results for two sites surveyed on North Trout Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.4	21/28 (75%)	14/29 (48%)	0/3 (0%)	35/60 (58%)
RM 6.1	25/30 (83%)	22/28 (79%)	7/10 (70%)	54/68 (79%)

Water temperature was monitored at one site in North Trout Creek from July 11 to October 13, 2008 (Appendix B). The thermograph was located near the mouth at RM 0.2 (Figure 6). Maximum daily temperatures at this site exceeded 15ºC on 30 days. The maximum-recorded temperature was 17.7ºC on July 26.

Elliston Creek

Elliston Creek is a tributary to the Little Blackfoot River that drains for approximately 5 miles before reaching the Little Blackfoot at RM 24.8. Much of the stream lies on public land administered by the U.S. Forest Service, although private lands are present near the mouth and in the middle portion of the drainage. he primary land uses in the watershed are livestock grazing, timber harvest, and forest recreation. A small on-stream impoundment (~1 acre) is located at RM 2.7 (on private land), and is a fish movement barrier. Elliston Creek is relatively urbanized where it flows through the town of Elliston, and the stream is routed through a 125 foot (approximately) culvert where is crosses under Highway 12. It is unknown whether fish are capable of passing upstream through this pipe.

Fish sampling was completed at two sections of Elliston Creek in mid August of 2008. The sites were located on U.S. Forest Service land at RM 1.0 and 3.7 (Table 95; Figure 6). U.S. Forest Service electrofishing in the past had documented the presence of westslope cutthroat trout, brook trout and a few brown trout in the lower reaches of Elliston Creek. However, during our sampling, we did not observe either brook trout or brown trout in the stream. At both sites, the fish community was comprised entirely of westslope cutthroat trout. Fish tended to be slightly larger at RM 1.0, but somewhat denser at RM 3.7 (Table 95; Appendix A). However, a portion of the difference in observed density may have been attributed to poor electrofishing efficiency encountered at RM 1.0 (field note during day of sampling). Genetic sampling conducted in 1989 (near the RM 1.0 site) showed that Elliston Creek contained a pure strain of westslope cutthroat trout at that time. Additional genetic samples were collected in 2008.

Table 95. Electrofishing data collected at two sections of Elliston Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.0	WCT	35	35.0	98	42-160	100
RM 3.7	WCT	68	68.0	89	49-145	100

A riparian assessment was completed at each of the sections electrofished on Elliston Creek in 2008. At RM 1.0, the stream was situated within a fenced livestock exclosure (approximately one mile long). The channel was classified as a Rosgen B stream type, and the total riparian assessment score was 59 out of a potential score of 70 (84%) (Table 96). In several locations, the channel was slightly entrenched, and a few high banks lacking deep-rooted vegetation showed evidence of active lateral erosion. However, the number of actively eroding banks in the reach appeared to be lessening. The woody riparian community was comprised of willow, alder and dogwood, as well as a number of conifer trees (lodgepole pine and Douglas fir) situated along the edge of the riparian zone. Density of woody shrubs along the channel was relatively good, and appeared to be improving based on observed recruitment of younger plants. However, a number of disturbance-induced openings still remained in the area, a likely sign of past over-utilization by livestock. Fish habitat at RM 1.0 was good (score: 7 points out of a potential of 10; Table 96), but was slightly limited by a lack of deep pools and large woody debris in the channel. Spawning habitat however, was present in good amounts, and the improving riparian canopy provided adequate cover and shade to much of the channel.

At RM 3.7, Elliston Creek was flowing through an open meadow that was situated in a relatively narrow canyon. The location appeared to be historically part of an old beaver pond complex, and was near the upper extent of fish distribution in the drainage. The meadow was approximately 300 m in length, and the channel flowing through it was classified as a Rosgen Bc stream type. Above and below the meadow however, channel gradient increased and the canyon was more confined. The channel was more characteristic of a Rosgen A or Ba stream type in these areas. The total riparian assessment score at RM 3.7 was 46 out of a potential score of 67 (69%) (Table 96). The channel was vertically stable despite a number of small eroding banks located on outside bends where deep-rooted vegetation was lacking. The woody riparian community was comprised of willow and alder, but the canopy cover provided by these plants was extremely limited. Young willow sprouts were common, but mature plants were rare. This may have been correlated with past beaver impoundments that limited woody shrub growth throughout the inundation zone. Disturbance induced grasses and noxious weeds (primarily Canada thistle) were also common throughout the area, and likely limited the recruitment potential of woody species to some extent. Additionally, livestock use of the area was evident. Fish habitat at RM 3.7 was rated only fair (score: 3 points out of a potential of 7; Table 96), and was most limited by low flows and a lack of overhead cover. While there were a number of nice pools present, flow was low, and actually disappeared not far below the reach (natural occurrence). This lack of downstream flow effectively isolated the meadow reach from lower Elliston Creek for most of the year (if not year round in some low runoff years). The limited riparian canopy also provided little overhead cover and shade to the channel. One important observation made during the survey was the significant channel instability downstream of the survey reach (as well as upstream to some extent). In this more confined part of the canyon, the channel was largely dry, yet several large headcuts and some extensive lateral erosion areas were noted. Several of the observed headcuts were approximately 3 to 4 feet in height, and likely posed barriers to fish migrating upstream (when flows were present). One dead westslope cutthroat trout was observed in what remained of a scour pool located below a 3-foot headcut.

Table 96. Riparian assessment results for two sites surveyed on Elliston Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.0	27/30 (90%)	25/30 (83%)	7/10 (70%)	59/70 (84%)
RM 3.7	27/30 (90%)	16/30 (53%)	3/7 (43%)	46/67 (69%)

Water temperature was not monitored in Elliston Creek in 2008.

Mike Renig Gulch

Mike Renig Gulch is a tributary to the Little Blackfoot River that drains for approximately 6.5 miles before reaching the Little Blackfoot near RM 27.4. Surface connection to the river is poor and appears to be seasonal at best. Land ownership along the stream is a mixture of private, State, and U.S. Forest Service. The primary land uses in the drainage are livestock grazing, active timber harvest on State and private lands, and National Forest recreation (upper reaches). Additionally, historic mining activity is apparent throughout the drainage, and a privately owned mining claim/recreational property encompasses the upper mile of the stream.

Fish sampling was completed at two 100 m sections of Mike Renig Gulch in mid August of 2008. The sites were located at RM 2.5 (State land) and 5.5 (U.S. Forest Service land) (Table 97; Figure 6). Additional spot electrofishing was also conducted near RM 1.3 (private land). At this site, flow was relatively low and a dense alder, dogwood and willow canopy prevented access to much of the channel. Because of this, we were only able to sample accessible pool habitats (in an approximately 200 m reach). This effort turned up 21 westslope cutthroat trout (mean total length: 125 mm, range: 41-185 mm), 87 brook trout (mean total length: 103 mm, range: 55-218 mm), and eight longnose suckers. Further upstream at RM 2.5, the fish community was similar to that found near RM 1.3. Brook trout remained rather abundant, while westslope cutthroat trout continued to occur at a low density (Table 97). Fish of both species ranged in size from small young-of-the-year, to adults over 200 mm in total length (Table 97; Appendix A). However, juvenile cutthroat trout between 70 mm and 150 mm (total length) were largely absent from the sample (Appendix A). This could have been an artifact of small sample size, or an indication of several poor recruitment years in the recent past. Longnose suckers continued to be present at RM 2.5, with 16 individuals collected in the reach. At RM 5.5, brook trout remained common in Mike Renig Gulch, while westslope cutthroat trout became rare (Table 97). Brook trout varied in size from small young-of-the-year to fish as large as 221 mm in total length (Table 97). However, the majority of brook trout captured in the reach were less than 150 mm long (Appendix A). Only six westslope cutthroat trout, which averaged 142 mm in total length, were collected at RM 5.5 (Table 97; Appendix A). No young-of-the-year cutthroats were observed in the reach. Genetic sampling conducted in Mike Renig Gulch in 1990 showed that the stream supported a pure strain of westslope cutthroat trout. Additional genetic samples were collected in 2008.

Table 97. Electrofishing data collected at two sections of Mike Renig Gulch in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 2.5	WCT	16	16.0	145	37-241	15
	EB	88	88.0	110	46-228	85
RM 5.5	WCT	5	5.0	142	96-197	6
	EB	75	75.0	108	40-221	94

A riparian assessment was completed at each of the two sections electrofished on Mike Renig Gulch in 2008. At RM 2.5, the stream was transitioning out of a relatively broad valley with a number of beaver ponds, into a more confined canyon with slightly higher gradient. The stream was classified as a Rosgen B channel type within the survey reach, and the total riparian assessment score was 59 out of a potential score of 68 (87%) (Table 98). Historic placer mining activity was believed to have occurred throughout the sample section based on the overly large substrate composition observed in several segments of the channel. Additionally, this past disturbance had left a few segments of the stream slightly incised as well as a little over-widened. Despite this, the channel showed little evidence of active erosion and appeared to be in a relatively stable state. Woody riparian vegetation was comprised of a fairly dense community of willow and alder, as well as a few lodgepole pine trees. Although woody shrubs were common throughout the riparian zone, past and present disturbance activities appeared to have limited the potential canopy cover to some extent. An old road was situated in the stream bottom, and was a source of disturbance induced weeds and grasses. Additionally, there was evidence of light to moderate livestock use in and around the riparian area and stream channel. Fish habitat at RM 2.5 was rated good (score: 7 points out of a potential of 10; Table 98), but could have been improved given the presence of more large woody debris. This important habitat-forming element was largely absent from the reach, although the presence of several beetle killed lodgepole pine within a tree length of the channel did provide some future recruitment potential. Flow in the reach was naturally low at the time of the survey, and fine sediment accumulation was notable. No irrigation diversions were observed upstream of the survey section, although two were located downstream of the reach near RM 0.5 and 1.5. The diversion at RM 1.5 was sizeable, but was not running water at the time of the survey, whereas the much smaller diversion at RM 0.5 was active.

At RM 5.5, Mike Renig Gulch was situated in a narrow timbered canyon and was classified as a Rosgen B channel type. The total riparian assessment score was 55 out of a potential score of 64 (86%) (Table 98). Throughout most of the electrofishing section the stream was notably entrenched from past mining activity in the channel. Downstream of this area however, a broader, more natural floodplain was present. Despite the past mining disturbance, the channel was stable throughout the sample reach. The only erosion noted in the survey segment was associated with several livestock/wildlife crossings. Woody riparian vegetation was comprised of a relatively sparse alder and young conifer understory and a mature spruce and lodgepole pine overstory. Numerous openings were present in the riparian area, most of which appeared to be related to past mining disturbance. The area was within a U.S. Forest Service grazing allotment and livestock presence in the riparian zone was observable, but not overly heavy. Fish habitat at RM 5.5 was generally good (score: 7 points out of a potential of 10; Table 98), and was likely near its potential. However, it did appear to be somewhat limited by low streamflow and related fine sediment accumulation. An active ATV ford was noted just upstream of the electrofishing section.

Table 98. Riparian assessment results for two sites surveyed on Mike Renig Gulch in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 2.5	30/30 (100%)	22/28 (79%)	7/10 (70%)	59/68 (87%)
RM 5.5	28/30 (93%)	20/24 (83%)	7/10 (70%)	55/64 (86%)

Water temperature was not monitored in Mike Renig Gulch in 2008.

Slate Creek

Slate Creek is a small tributary to the Little Blackfoot River that drains for approximately 3 miles before reaching the Little Blackfoot near RM 31.1. The lower 0.7 miles of the stream flows primarily across private land, while the remainder of the drainage is predominately on National Forest land. The primary land uses in the watershed are livestock grazing and timber harvest. Additionally, two rural homesites are situated in the lower portion of the drainage, and a frequently used dispersed campsite is present near the mouth. At approximately RM 0.1, a large human constructed rock dam spans the stream and the floodplain. The rocks appear to have been historically placed in an effort to create a small reservoir or some sort of vehicle crossing. The dam likely restricts both upstream and downstream fish movement to some extent, but may not be a compete barrier.

Fish sampling was completed at two 100 m sections of Slate Creek in mid August of 2008. The sites were located at RM 0.2 (private land) and 1.7 (National Forest) (Table 99; Figure 6). Additional electrofishing was also conducted just upstream of the RM 0.2 section, as well as at the U.S. Forest Service property boundary near RM 0.7. These segments of the stream were sampled to gain a better understanding of overall fish distribution in the lower reaches of Slate Creek. At RM 0.2, flow was limited and fish were sparse. Only three westslope cutthroat trout, two brook trout, and a one brown trout were captured in the 100 m survey reach (Table 99; Appendix A). We sampled an extra 600 m of channel immediately upstream of the sample section (to the county road crossing near RM 0.5) and turned up 24 additional westslope cutthroat trout (mean total length: 136 mm, range: 96-197 mm. CPUE: ~ 4.0) and one more juvenile brown trout (122 mm total length). A little further upstream at RM 0.7 (the U.S. Forest Service boundary), fish density appeared to increase considerably based on a rise in catch-per-unit-effort. At this site, 28 westslope cutthroat trout (mean total length: 125 mm, range: 86-197 mm. CPUE: ~ 46.7) were captured in a 60 m sample reach. Westslope cutthroat trout were the only species collected in this segment of the stream. The apparent increase in fish abundance was likely associated with an increase in flow and available pool habitat. Further upstream at RM 1.7, the fish community continued to be comprised entirely of westslope cutthroat trout. Fish density was thought to be relatively high considering stream flow was extremely low. Most of the riffles appeared to impede fish moment due to low water, and only a handful of isolated pools remained in the 100 m survey reach. Fish ranged in size from young-of-the-year to resident adults over 200 mm in total length (Table 99; Appendix A). The genetic purity of westslope cutthroat trout in Slate Creek is currently unknown. Samples were collected in 2008 for analysis.

Table 99. Electrofishing data collected at two sections of Slate Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 0.2	WCT	3	3.0	154	106-192	50
	EB	2	2.0	196	168-224	33
	LL	1	1.0	137	137	17
RM 1.7	WCT	31	31.0	115	36-205	100

A riparian assessment was completed at each of the sections electrofished on Slate Creek in 2008. At RM 0.2, the stream was flowing through a small wooded draw bordered on each side by an irrigated pasture. The channel was classified as a relatively stable Rosgen B stream type, and the total riparian assessment score was 58 out of a potential score of 67 (87%) (Table 100). Woody riparian vegetation was comprised primarily of willow, alder, and chokecherry, as well as Douglas fir and cottonwood trees. Disturbance induced upland grasses were common throughout the riparian zone and heavily dominated areas where the irrigated pasture encroached on the stream. Fish habitat at RM 0.2 was rated only fair (score: 3 points out of a potential of 7; Table 98), and was most limited by low stream flow. At least two small diversions was noted upstream of the survey site at RM 0.5.

At RM 1.7, Slate Creek was situated in a relatively narrow willow-dominated valley bordered by an open (logged) hillside to the north and a heavily timbered slope to the south. Although the site was only near the middle of the watershed, it appeared to be close to the upper extent of perennial flow and fish distribution in the drainage. The channel was classified as a Rosgen B stream type, and the total riparian assessment score was 52 out of a potential score of 67 (78%) (Table 100). The stream was relatively stable throughout the survey reach, although lateral erosion was evident in several areas of the channel where deep-rooted vegetation was lacking. The woody riparian community, which was dominated by willow, was somewhat patchy and was interspersed with numerous disturbance-induced openings. The survey segment was within a U.S. Forest Service grazing allotment and livestock pressure on the stream and riparian area was notable. Fish habitat at RM 1.7 was rated only fair (score: 3 points out of a potential of 7; Table 98), and was most limited by very low stream flow. The habitat was largely present and would have been instantly improved given increased flow. No active water developments or diversions were noted upstream of the sample site.

Table 100. Riparian assessment results for two sites surveyed on Slate Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.2	30/30 (100%)	25/30 (83%)	3/7 (43%)	58/67 (87%)
RM 1.7	27/30 (90%)	22/30 (73%)	3/7 (43%)	52/67 (78%)

Water temperature was not monitored in Slate Creek in 2008.

Cottonwood Creek Drainage

Cottonwood Creek

Fish sampling (including riparian assessments) and temperature monitoring were conducted on Cottonwood Creek in 2007. Results of this survey work were summarized in ***An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin*** (2008). In 2008, no additional fish sampling or riparian assessments were completed on Cottonwood Creek. However, water temperature was again monitored near the 2007 locations.

Water temperature was monitored in Cottonwood Creek in 2008 from July 11 through October 13 at RM 0.3, and from July 16 through October 23 at RM 7.0 (Figure 7; Appendix B). At RM 0.3, maximum daily water temperatures exceeded 15°C on 62 days, including 26 days in which they exceeded 20°C. The maximum-recorded temperature at RM 0.3 was 22.2°C on July 26. This was 1.9ºC cooler than the maximum-recorded temperature measured during 2007 (24.1ºC). At RM 7.0, maximum daily water temperatures exceeded 15°C on 19 days, but on no days did they exceed 20°C. The maximum-recorded temperature at RM 7.0 was 16.6°C on August 18. This was 1.2ºC cooler that the maximum temperature measured in 2007 (17.8ºC).

Baggs Creek

Fish sampling (including riparian assessments) and temperature monitoring were conducted on Baggs Creek in 2007. Results of this survey work were summarized in ***An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin*** (2008). In 2008, one additional sample site was added on Baggs Creek near RM 2.5. This site was located between the 2007 sites, which were at RM 0.5 and 5.4 (Figure 7).

At RM 2.5, westslope cutthroat trout comprised the bulk of the fish community, although brook trout were also relatively common in the reach (Table 101). The size structure of both populations showed evidence of multiple age classes ranging from small juveniles to larger resident adults (Table 101; Appendix A). The largest fish captured in the reach was a 265 mm westslope cutthroat trout. Total catch-per-unit-effort (i.e. total trout catch per 100 m) at RM 2.5 was 80 fish. This was similar to what was found in 2007 at RM 0.5 and 5.4, where total catch-per-unit-effort was 72 and 76, respectively.

Table 101. Electrofishing data collected at one section of Baggs Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 2.5	WCT	47	47	159	77-265	59
	EB	33	33	141	60-244	41

A riparian assessment was completed at the section electrofished on Baggs Creek in 2008. At RM 2.5, the stream was flowing through a rather deep canyon bounded by steep, timbered hillsides. The channel was classified as a Rosgen B stream type, and the overall assessment score was 43 out of a potential score of 67 (64%) (Table 102). The channel was relatively wide and shallow throughout the survey reach, and several mid channel bars and channel braids were present in the area as well. Related to this, stream banks showed a moderate amount of lateral erosion, especially in areas lacking woody vegetation. The woody riparian community was comprised primarily of alder, willow, wild rose, and dogwood in the understory, and mature Douglas fir, cottonwood, and lodgepole pine (although much was dead from mountain pine beetle infestation) trees in the overstory. However, the woody plant community was somewhat sparse and patchy throughout the survey reach. The area was within a U.S. Forest Service grazing allotment and livestock presence in the riparian zone was very apparent. Grazing pressure in disturbance-induced openings was fairly heavy, and was likely limiting the recruitment potential of woody shrubs and trees. Many of the cottonwood trees growing in the reach were relatively decadent, and most of the saplings showed signs of moderate to heavy browse. Fish habitat at RM 2.5 was rated only fair (score: 3 points out of a potential of 7; Table 102). Much of the available habitat in the survey reach was comprised of wide riffles and shallow pocket water. These areas also lacked overhead cover due to the sparse riparian canopy. While shallow areas provided some rearing habitat for young-of-the-year and juvenile fish, they offered little in the way of over-wintering or adult fish habitat. The few deep pools that were present in the reach were primarily formed by scour at the site of large boulders, and not large woody debris. Fish habitat in the reach would likely benefit from an increase in large woody debris recruitment, which did appear promising given the number of dead and dying trees within a tree length of the channel.

Table 102. Riparian assessment results for one site surveyed on Baggs Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 2.5	21/30 (70%)	19/30 (63%)	3/7 (43%)	43/67 (64%)

Water temperature was not monitored in Baggs Creek in 2008.

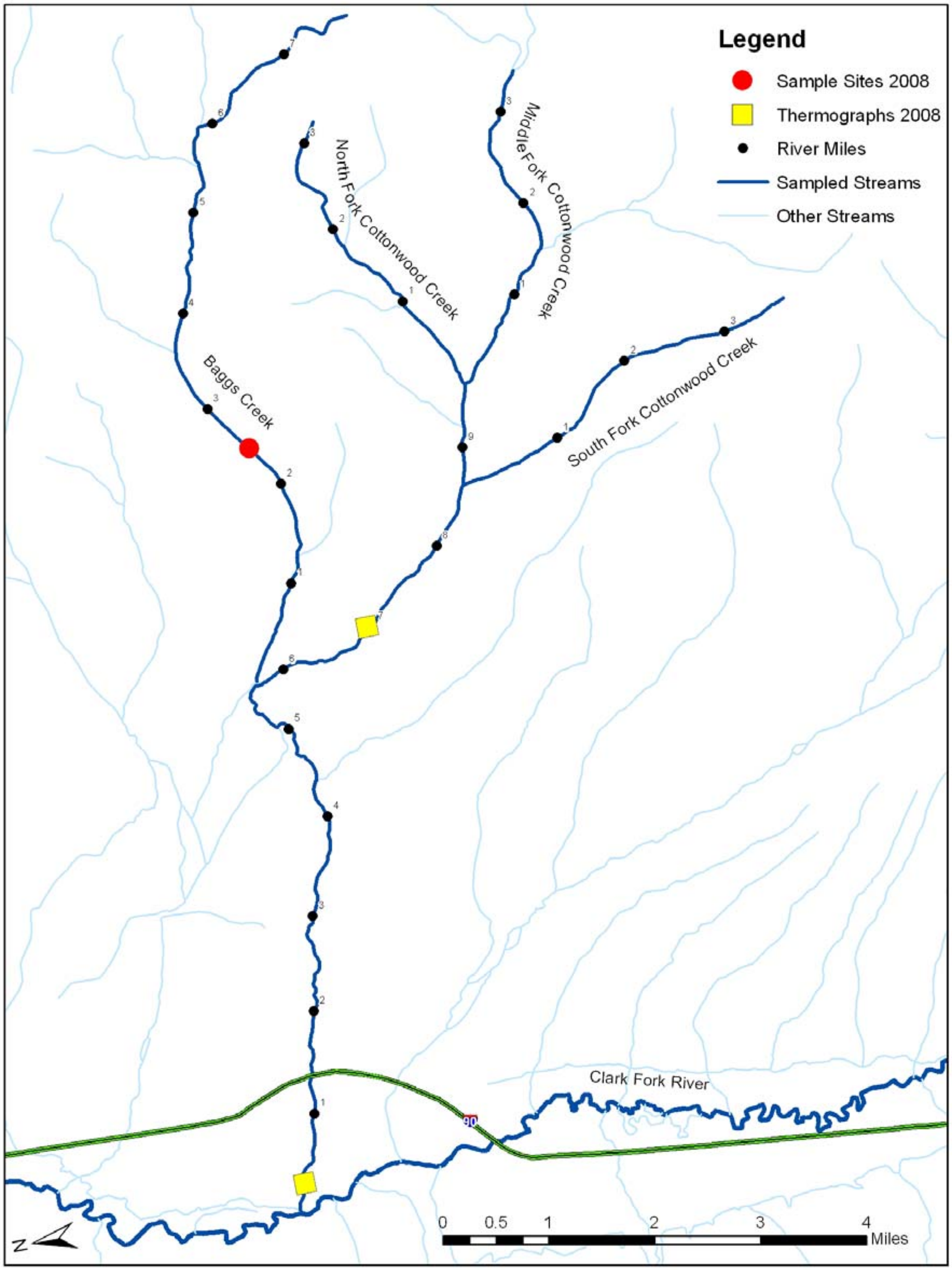


Figure 7. Map of the Cottonwood Creek drainage showing sites of fish and temperature sampling conducted in 2008.

Peterson Creek Drainage

Peterson Creek

Peterson Creek is a tributary to the Clark Fork River that drains for over 12 miles before entering the Clark Fork at RM 315.0 near the southern edge of Deer Lodge. Land ownership along this East Deer Lodge Valley stream is comprised predominately of privately owned agricultural lands. However, several small parcels of State and National Forest land are also interspersed throughout the drainage. The primary land uses in the watershed are hay production (lower half of drainage) and livestock grazing. Additionally, some timber harvest is evident in the upper extent of the drainage, and the stream is fairly urbanized downstream of Interstate 90. Peterson Creek is used heavily for irrigation, and diversions are common throughout the lower 10 miles of the stream.

Fish sampling was completed at five sections of Peterson Creek in mid to late July of 2008. The sites were located at RM 0.2, 1.1, 4.9, 7.9, and 11.5 (Table 103; Figure 8). The sites at RM 0.2 and 7.9 were on State land, while the remaining sites were situated on private land. At RM 0.2, the trout community was comprised entirely of brown trout. Fish were not overly abundant, and most appeared to be young-of-the-year less than 85 mm in total length (Table 103; Appendix A). The largest brown trout captured in the reach was 168 mm long. Longnose suckers were also present at RM 0.2, but just four individuals were captured in the reach. Upstream of Interstate 90 at RM 1.1, trout were very rare. Only four brown trout were collected in the reach, and all were similar in size between 172 and 201 mm in total length (Table 103: Appendix A). Longnose suckers were the most common fish at the sample site (CPUE: 17.0). At RM 4.9, the trout community shifted to one comprised entirely of brook trout. Longnose sucker, were the only other species noted in the reach (CPUE: 20.0). In this segment of Peterson Creek, brook trout were fairly common and ranged in size from small young-of-the-year, to adults as large as 237 mm in total length (Table 103: Appendix A). However, there was an obvious size gap between young-of-the-year sized fish and the next size-class present in the reach (which was around 140 mm; Appendix A). The absence of fish in the size gap suggested poor or failed recruitment during recent years. Further upstream at RM 7.9, the trout community was comprised of both brook trout as well as westslope cutthroat trout. Both species occurred in similar abundance, though neither was very common (Table 103; Appendix A). Additionally, the majority of fish collected in the reach tended to be from larger/older size classes (Table 103). At RM 11.5, brook trout were no longer observed to be present in Peterson Creek. At this location, westslope cutthroat trout, which ranged in size from 73 to 166 mm in total length, were the only species collected (Table 103; Appendix A). We attempted to determine the upstream extent of brook trout distribution in the drainage by spot electrofishing a number of locations between RM 7.9 and 11.5. The most upstream brook trout we documented was at RM 11.0. Other than numerous beaver ponds, no barrier preventing fish from moving upstream could be identified. Genetic sampling conducted in 1988 showed that Peterson Creek contained a pure strain of westslope cutthroat trout. Additional genetic samples were collected in 2008.

Table 103. Electrofishing data collected at five sections of Peterson Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 0.2	LL	18	18.0	92	61-168	100
RM 1.1	LL	4	4.0	183	172-201	100
RM 4.9	EB	40	40.0	110	45-237	100
RM 7.9	WCT	6	6.0	160	93-212	43
	EB	8	8.0	140	50-189	57
RM 11.5	WCT	36	36.0	98	73-166	100

A riparian assessment was completed at each of the sections electrofished on Peterson Creek in 2008. A RM 0.2, the stream was flowing through an open field located behind the Montana Department of Transportation's equipment yard. The riparian area was extremely limited and was largely restricted to the immediate stream banks. The channel was classified as a Rosgen B stream type, but had likely been manipulated and straightened in the past. The overall assessment score was 32 out of a potential score of 67 (48%) (Table 104). The channel was somewhat incised and was also bermed in areas to provide flood control. Some lateral erosion was evident throughout the reach as well. Woody riparian vegetation was sparse and was limited to a few willows and a small grove of cottonwood (or poplar) trees. Disturbance induced grasses and weeds were abundant and comprised the bulk of the riparian vegetation. Fish habitat at RM 0.2 was rated as poor (score: 3 points out of a potential of 7; Table 104), and was below its potential. There was very little flow in the reach at the time of the survey, and pool habitat was lacking. Additionally, very high levels of filamentous algae were also present in the channel. A diversion was noted immediately upstream of Interstate 90 (near RM 0.9), which appeared to divert much of the flow in Peterson Creek. The water was being diverted to a hayfield on the opposite side of the Interstate.

At RM 1.1, Peterson Creek was flowing to the west of several large hayfields and was situated near the base of a large, dry terrace (west side of the stream). The channel was classified as a Rosgen Bc stream type, and the total riparian assessment score was 50 out of a potential score of 70 (71%) (Table 104). The channel was fairly incised throughout much of the reach, and lateral erosion was evident on high banks dominated by disturbance-induced grasses. Woody riparian vegetation was comprised of willow, alder, cottonwood trees, and wild rose, but shrub and tree density was somewhat patchy. Fish habitat at RM 1.1 was rated only fair (score: 3 points out of a potential of 10; Table 104), and was most limited by low flow, high fine sediment accumulation, and a lack of deep pools. Additionally, the discontinuous riparian canopy offered only moderate overhead cover and shade to the channel. Downstream of the reach, near Interstate 90, fish did not appear to have straightforward passage upstream. Flow management at the diversion at RM 0.9 appeared to make fish passage very complex (at least during the irrigation season).

At RM 4.9, Peterson Creek was flowing between two large hay fields. The riparian zone was fairly limited and was mostly confined to the immediate streambanks. The channel was classified as a Rosgen C stream type within the survey reach; although just downstream it was more characteristic of a straightened, Rosgen E channel type. One unique feature at the site was the presence of a small grove of mature cottonwood trees. Cottonwoods were absent from the riparian area not far outside the bounds of the electrofishing section. The total riparian assessment score was 40 out of a potential score of 68 (59%) (Table 104). The channel was incised throughout much of the survey reach, and was likely manipulated and straightened historically. Several high banks where deep-rooted, woody vegetation was lacking showed significant active slumping and erosion. Willow and alder, while present, where largely confined to mature plants scattered widely apart. A dense, robust community of disturbance-induced grasses dominated the riparian vegetation. Fish habitat at RM 4.9 was rated good (score: 7 points out of a potential of 10; Table 104), but was limited by the sparse woody canopy. Flow in the reach at the time of the survey was good, but was heavily dependent on upstream irrigation demands. Downstream of the electrofishing section at RM 4.2, a sizeable pin and plank diversion was present in the channel. This structure appeared to be an upstream fish barrier when active.

At RM 7.9, Peterson Creek was flowing through a deep, timbered canyon, with an extremely limited floodplain. The stream was classified as a Rosgen B channel type, and the total riparian assessment score was 39 out of a potential score of 58 (67%) (Table 104). There was evidence of old mining activity in the reach, and several bank failures and areas of erosion were noted. Douglas fir and a few mature cottonwood trees provided most of the woody riparian canopy, although sparse alder plants were also present along the channel. Fish habitat at RM 7.9 was rated only fair (score: 3 points out of a potential of 7; Table 104), and was most limited by low flow, and a lack of deep pools. Much of the available habitat was shallow riffles and pocket water. A sizeable irrigation diversion was located upstream of the sample site at RM 10.0.

At RM 11.5, Peterson Creek was classified as a Rosgen B channel type. The survey reach was situated just upstream of an almost two mile long segment that was dominated by extensive beaver activity. Numerous ponds and dense willows were present throughout this downstream area. Within the survey reach, the channel was relatively stable and the total riparian assessment score was 58 out of a potential score of 67 (87%) (Table 104). Woody riparian vegetation was comprised of willow, alder, spruce, and aspen. A few disturbance-induced openings were present in the riparian canopy, and were likely related historic placer mining activity and current livestock use. Fish habitat at RM 11.5 was rated only fair (score: 3 points out of a potential of 7; Table 104), and was most limited by a lack of deep, quality pools. Much of the available habitat was comprised of shallow pocket water. A road crossing was present immediately below the electrofishing reach, and the culvert appeared to be a partial barrier to fish moving upstream. The outlet of the pipe was slightly perched, and the inlet had a fair amount of debris buildup on it.

Table 104. Riparian assessment results for five sites surveyed on Peterson Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.2	21/30 (70%)	11/30 (37%)	0/7 (0%)	32/67 (48%)
RM 1.1	25/30 (83%)	22/30 (73%)	3/10 (30%)	50/70 (71%)
RM 4.9	21/30 (70%)	12/28 (43%)	7/10 (70%)	40/68 (59%)
RM 7.9	19/27 (70%)	17/24 (71%)	3/7 (43%)	39/58 (67%)
RM 11.5	30/30 (100)	25/30 (83%)	3/7 (43 %)	58/67 (87%)

Water temperature was monitored at two sites on Peterson Creek from July 11 through October 13, 2008 (Appendix B). The sites were located at RM 0.2 and 7.5 (Figure 8). At RM 0.2, maximum daily temperatures exceeded 15°C on 54 days, and 20°C on 30 of those days. The maximum-recorded temperature at this site was 22.6°C on August 18. At RM 7.5, water temperatures exceeded 15°C on 46 days, but on no days did they exceed 20°C. The maximum-recorded temperature at this site was 19.9°C on July 26.

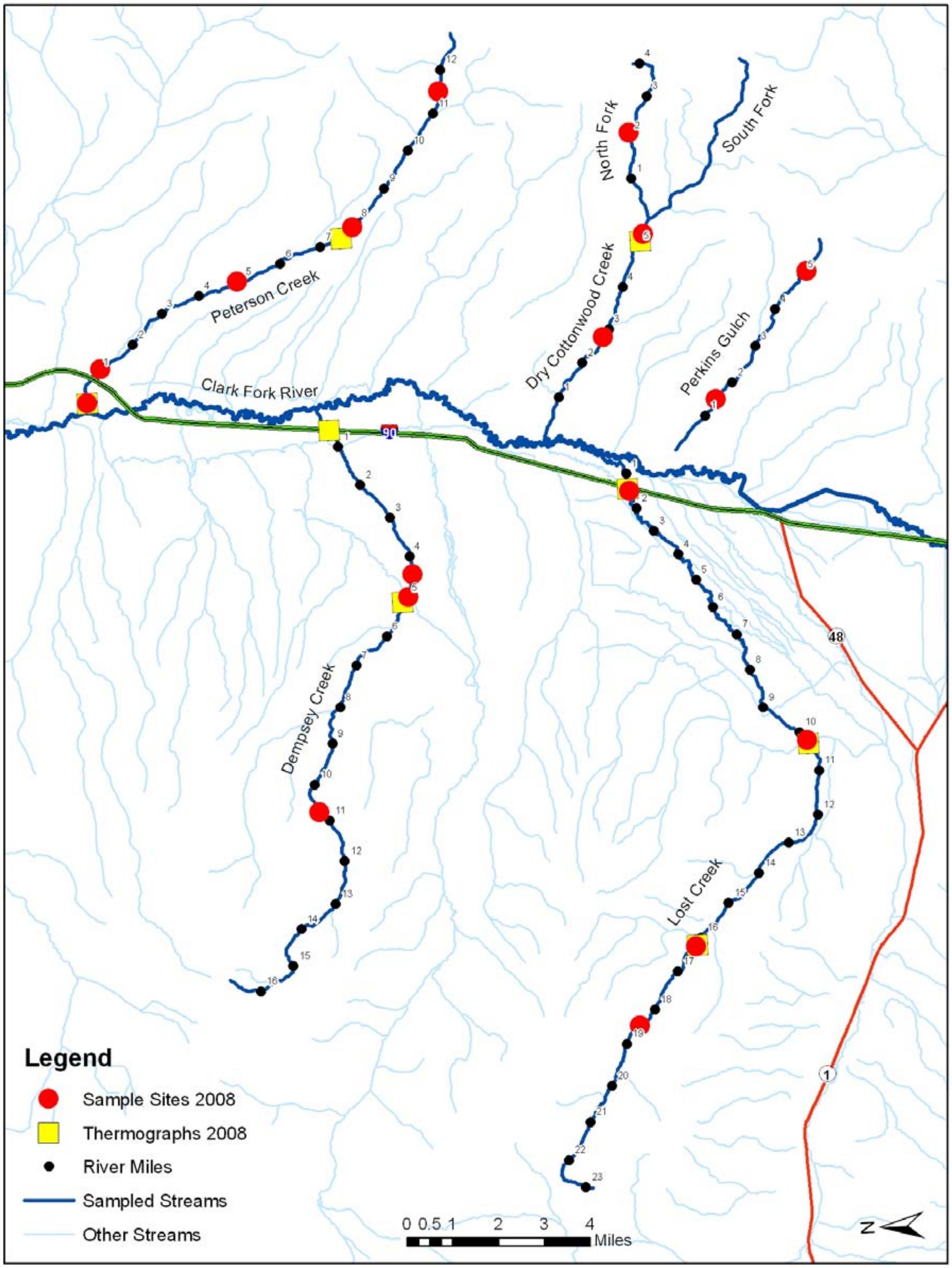


Figure 8. Map of Clark Fork River drainage between Deer Lodge and Warm Springs, MT showing sites of fish and temperature sampling conducted in 2008.

Dempsey Creek Drainage

Dempsey Creek

Dempsey Creek, a Flint Range stream, is a tributary to the Clark Fork River that drains for over 16 miles before reaching the Clark Fork near RM 322.8. The lower 10 miles of the stream flows primarily through private lands except for where it crosses property managed by the Montana State Prison (between RM 3.6 and 5.3). The upper extent of the watershed lies entirely on high elevation lands managed by the U.S. Forest Service. The primary land uses in the drainage are irrigated hay production (lower half of drainage), livestock grazing/pasturing, and National Forest recreation (upper portion of drainage). Dempsey Creek is used heavily for irrigation, and diversions are common throughout the lower portion of the drainage. Additionally, there are a number of high elevation lakes present in the headwaters of the drainage, some of which are regulated to provide summer flows for downstream irrigators.

Fish sampling was completed at three sections of Dempsey Creek in early September of 2008. The sites were located at RM 4.4, 5.0, and 10.7 (Table 105; Figure 8). The sites at RM 4.4 and 5.0 were on land managed by the Montana State Prison, while the site at RM 10.7 was situated on National Forest land. At RM 4.4, no fish were captured or observed in the 100 m section. Upon this discovery, we electrofished an additional section at RM 5.0 located upstream of several irrigation diversions. Fish were present at this site. The trout community at RM 5.0 was comprised predominately of larger sub-adult and adult brown trout (no young-of-the-year fish were observed; Table 105; Appendix A). Additionally, one 204 mm brook trout and a number of slimy sculpin were also captured at in the reach. At RM 10.7, the fish community shifted to one of comprised of brook trout and westslope cutthroat trout, with brook trout being the more common species (Table 105). Cutthroat trout ranged in size from 76 to 199 mm in total length, while brook trout were slightly more variable, ranging in size from 41 to 232 mm in total length (Table 105; Appendix A). Genetic sampling conducted in upper Dempsey Creek in 1986 showed that the stream supported a pure strain of westslope cutthroat trout. Additional genetic samples were collected in 2008.

Table 105. Electrofishing data collected at three sections of Dempsey Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 4.4	No Fish	N/a	n/a	n/a	n/a	n/a
RM 5.0	LL	21	21.0	205	141-373	95
	EB	1	1.0	204	204	5
RM 10.7	WCT	22	22.0	105	76-199	33
	EB	44	44.0	118	41-232	67

A riparian assessment was completed at each of the sections electrofished on Dempsey Creek in 2008. At RM 4.4, the stream was bounded by large hayfields on each side of the channel, and the riparian zone was very narrow. The total riparian assessment score was 39 out of a potential score of 67 (58%) (Table 106). Within the survey reach, the stream was classified as a Rosgen Bc channel type. The channel was somewhat incised and had likely been manipulated and straitened in the past. Woody riparian vegetation was very sparse and was comprised of just a few mature alder, willow, and cottonwood trees. The dominant vegetation throughout the riparian area was disturbance-induced grass. Fish habitat at RM 4.4 was rated only fair (score: 3 points out of a potential of 7; Table 106), and was most limited by a lack of pool habitat, and the absence of woody vegetation in the riparian zone. Much of the available habitat consisted of shallow runs and riffles, and grass overhang offered only limited overhead cover and shade to the channel. Flow was good at the time of the survey, but at least two large diversions where situated just upstream of the section. We were later made aware that the channel often dried up below these diversions during the irrigation season.

Just upstream of RM 4.4 at RM 5.0, Dempsey Creek remained relatively incised, but displayed a more meandering nature. The stream was classified as a Rosgen C channel type, and the total riparian assessment score was 52 out of a potential score of 70 (74%) (Table 106). Lateral erosion was not widespread in the reach, but was apparent on outside bends lacking woody vegetation. The riparian area at RM 5.0 was broader than at downstream sites, and woody vegetation was more common. However, disturbance-induced grass still dominated the riparian zone. Fish habitat at RM 5.0 was rated good (score: 7 points out of a potential of 10; Table 106), as there were a number of deep pools in the reach, as well as several rootwads that added to habitat complexity. Nevertheless, overall habitat quality was still limited by a general lack of woody vegetation along the streambanks. The dense streambank grasses were only capable of offering limited overhead cover and shade the channel.

At RM 10.7, Dempsey Creek was situated in a fairly high gradient, forested canyon. The stream was classified as a stable Rosgen B channel type, and the total riparian assessment score was a perfect 63 out of a potential score of 63 (100%) (Table 106). The woody riparian canopy was comprised of a mature spruce dominated overstory and a thin alder understory. Fish habitat was good (score: 7 points out of a potential of 7; Table 106), and was likely at its potential. Additionally, flow in the survey reach was excellent, and was likely augmented by upstream reservoir storage.

Table 106. Riparian assessment results for three sites surveyed on Dempsey Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 4.4	26/30 (87%)	10/30 (33%)	3/7 (43%)	39/67 (58%)
RM 5.0	23/30 (77%)	22/30 (73%)	7/10 (70%)	52/70 (74%)
RM 10.7	30/30 (100%)	26/26 (100%)	7/7 (100%)	63/63 (100%)

Water temperature was monitored at two sites on Dempsey Creek from July 12 through October 13, 2008 (Appendix B). The sites were located at RM 0.6 and 5.1 (Figure 8). At RM 0.6, maximum daily temperatures exceeded 15°C on only 4 days. The maximum-recorded temperature at this site was 17.1°C on July 12. At RM 5.1, water temperatures exceeded 15°C on 47 days, including 8 days when they exceeded 20°C. The maximum-recorded temperature at this site was 22.3°C on August 18.

Dry Cottonwood Creek Drainage

Dry Cottonwood Creek

Dry Cottonwood Creek is a small tributary to the Clark Fork River that flows for approximately 5.6 miles from where its upper forks converge to where it reaches its mouth near Clark Fork RM 331.9. Connection to the Clark Fork River is seasonal at best, as the stream typically dries up well before reaching its terminus. Land ownership along this East Deer Lodge Valley stream is comprised mostly of privately owned grazing lands, with some State and U.S. Forest Service lands present in the middle and upper portions of the watershed, respectively. The primary land uses in the drainage are livestock grazing, timber harvest and forest recreation. Additionally, historic mining activity is also observable throughout the upper drainage, and a main National Forest access road runs along the stream for its entire length.

Fish sampling was completed at two sections of Dry Cottonwood Creek in late July of 2008. The sites were located at RM 2.5 and 5.3 (Table 107; Figure 8). The lower site (RM 2.5) was on State land while the upper site (RM 5.3) was situated on National Forest land. The only species captured in either survey section was westslope cutthroat trout (Table 107). Fish were fairly common at each site, and ranged in size from small juveniles (likely one year old) to fish large enough to be resident adults (i.e. > 150 mm) (Table 107; Appendix A). Genetic samples collected in the drainage in 1988 and 1995 showed that westslope cutthroat trout were slightly hybridized with Yellowstone cutthroat trout.

Table 107. Electrofishing data collected at two sections of Dry Cottonwood Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 2.8	WCT	25	25.0	128	81-176	100
RM 5.3	WCT	39	39.0	120	77-207	100

A riparian assessment was completed at each of the sections electrofished on Dry Cottonwood Creek in 2008. At RM 2.8, the stream was situated in a narrow, timbered canyon. The channel was classified as a Rosgen B stream type, and the total riparian assessment score was 62 out of a potential score of 70 (89%) (Table 108). There was a minor amount of bank erosion evident in the reach, but in general, the channel appeared rather stable. Woody riparian vegetation was comprised of a diverse understory of alder, Rocky Mountain maple, dogwood, and wild rose. The overstory was made up of mostly of mature Douglas fir and a few cottonwood trees. Fish habitat at RM 2.8 was rated as good (score: 7 points out of a potential of 10; Table 108), but could have been better given a more significant presence of large woody debris in the channel. While woody debris was not absent from the reach, it was rather scarce. Recruitment potential appeared good however, given the abundance of trees within a tree length of the channel. Not far downstream of the survey reach, Dry Cottonwood Creek entered a much broader portion of the valley. In this area, beaver ponds were relatively common, and willows were the dominant woody riparian vegetation.

At RM 5.3, Dry Cottonwood Creek continued to be classified as Rosgen B channel type. The total riparian assessment score was 55 out of a potential score of 70 (79%) (Table 108). There was a minor amount of bank erosion throughout the reach, although most was confined to banks lacking deep-rooted vegetation. Alder, willow, and wild rose comprised much of the woody riparian community, but plant distribution was somewhat discontinuous along the channel. Disturbance induced openings were common, and noxious weeds were rather abundant throughout the reach as well. The area was within a U.S. Forest Service grazing allotment and the presence of livestock in the riparian zone was evident. Fish habitat at RM 5.3 was rated as good (score: 7 points out of a potential of 10; Table 108), but could have been improved given a denser woody riparian canopy. Overhead cover and shade was lacking in portions of the reach.

Table 108. Riparian assessment results for two sites surveyed on Dry Cottonwood Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 2.8	27/30 (90%)	28/30 (93%)	7/10 (70%)	62/70 (89%)
RM 5.3	27/30 (90%)	21/30 (70%)	7/10 (70%)	55/70 (79%)

Water temperature was monitored at one site in Dry Cottonwood Creek from July 9 to October 13, 2008 (Appendix B). The thermograph was located at RM 5.1 (Figure 8). Maximum daily water temperatures at this site exceeded 15ºC on 27 days. The maximum-recorded temperature was 16.9ºC on July 26.

North Fork Dry Cottonwood Creek

North Fork Dry Cottonwood Creek is a tributary to Dry Cottonwood Creek that drains for approximately 4 miles before reaching its mouth at Dry Cottonwood Creek RM 5.6. The entirety of the stream lies on National Forest lands administered by the U.S. Forest Service. The primary land uses in the watershed are livestock grazing, timber harvest and National Forest recreation. Additionally, evidence of historic mining activity is observable throughout the drainage. A culvert located near the mouth of the stream is likely an upstream fish movement barrier.

Fish sampling was completed at one section of North Fork Dry Cottonwood Creek in late July of 2008. The site was located near the middle of the drainage at RM 2.1 (Table 109; Figure 8). The fish community was comprised entirely of westslope cutthroat trout, which ranged in size from 52 to 137 mm in total length (Table 109; Appendix A). As mentioned previously, genetic samples collected from westslope cutthroat trout in the Dry Cottonwood Creek drainage in 1988 and 1995 showed evidence of slight hybridization with Yellowstone cutthroat trout. Fish from North Fork Dry Cottonwood Creek were not specifically tested, and it is uncertain whether fish in this stream show similar hybridization since there appears to be a lack of upstream connection with downstream sampled populations (i.e. culvert barrier near mouth).

Table 109. Electrofishing data collected at one section of North Fork Dry Cottonwood Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 2.1	WCT	26	26.0	88	52-137	100

A riparian assessment was completed at the one site electrofished on North Fork Dry Cottonwood Creek in 2008. At RM 2.1, the stream was classified as a Rosgen B channel type, and the total riparian assessment score was 48 out of a potential score of 67 (72%) (Table 110). The channel was relatively stable throughout the survey reach, although there was evidence of bank trampling from livestock in a few locations. The woody riparian community was comprised largely of willow, but alder and conifer trees (spruce, Douglas fir, and lodgepole pine) were also present in the area. The woody canopy was patchy and was broken up by a number of disturbance-induced openings. The frequent use of the area by livestock was evident, and many of the younger willows in the reach showed moderate browse pressure. Fish habitat at RM 2.1 was rated only fair (score: 3 points out of a potential of 7; Table 110), and was most limited by a lack of deep pools, and patchy overhead cover. Additionally large woody debris was largely absent from the channel, despite conifers being within a tree length of the stream.

Table 110. Riparian assessment results for one site surveyed on North Fork Dry Cottonwood Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 2.1	25/30 (83%)	20/30 (67%)	3/7 (43%)	48/67 (72%)

Water temperature was not monitored in North Fork Dry Cottonwood Creek in 2008.

Lost Creek Drainage

Lost Creek

Lost Creek, a Flint Range stream, is a sizeable tributary to the Clark Fork River that drains for approximately 23 miles before reaching the Clark Fork at RM 334.7. The lower 16 miles of the stream flows predominately across private lands, while the upper portion the drainage lies entirely on State and National Forest lands. Lost Creek State Park is situated along the stream from RM 16.2 to RM 18.2. The main land use in the upper portion of the watershed (public lands) is forest recreation (largely non-motorized except for within Lost Creek Stat Park where RV camping is allowed). In the lower watershed (private lands), cattle grazing/pasturing, rural homesites (most located upstream of the Galen Highway), and irrigated hay production are the primary land use activities. Lost Creek is a principal source of irrigation water for adjacent upland hay meadows, and the diversion of water from the channel often leaves diminished summer flows in several stream reaches (e.g. upstream of the Galen Highway crossing, and near Interstate 90). Dutchman Pond, a small irrigation impoundment, is located on Lost Creek at RM 7.7, and the Gardiner Ditch (originating on Warm Springs Creek) bisects the stream near RM 10.3. Both locations appear to be probable upstream fish barriers. Additionally, a natural waterfall is located in Lost Creek State Park at RM 17.6, which is also a likely barrier to upstream fish movement.

Fish sampling was completed at four sections of Lost Creek between early August and early September of 2008. The sites were located at RM 1.4, 10.2, 16.2, and 18.5 (Table 111; Figure 8). The lower two sites (RM 1.4 and 10.2) were situated on private land, while the remaining sites were on Lost Creek State Park (RM 17.6) and the National Forest (RM 18.5). At RM 1.4, the trout community was comprised entirely of brown trout, which ranged in size from 77 to 385 mm in total length (Table 111; Appendix A). However, brown trout density at the site appeared very low, and could have been related to the minimal flows (~ 2-3 cfs at USGS stream gauge near Galen) and warm water temperatures (see temperature monitoring discussion below) observed in the reach during most of the summer. In addition to the few brown trout that were captured at RM 1.4, 13 longnose suckers, nine redside shiners, and eight slimy sculpin were also collected in the reach. Further upstream at RM 10.2 (just below the Gardiner Ditch), the trout community remained comprised entirely of brown trout. And similar to RM 1.4, the species tended to be relatively uncommon, with only 16 individuals captured in the 100 m survey section. Fish size was quite variable, and ranged from small young-of-the-year, to fish as large as 347 mm in total length (Table 111; Appendix A). One slimy sculpin was also captured at the RM 10.2 sample site. At RM 16.2, the trout community was comprised of a more diverse combination of species. At this site, westslope cutthroat trout, brook trout, and brown trout were all present in the survey section. Brook trout were the most common, but also tended to be the smallest in size, on average (Table 111; Appendix A). The smallest fish captured in the reach was a 63 mm young-of-the-year cutthroat trout, whereas the largest was a 395 mm brown trout (Table 111; Appendix A). At RM 18.5, the site was situated upstream of the waterfall located within Lost Creek State Park (RM 17.6). The fish community was comprised entirely of brook trout, which ranged in size from 75 to 228 mm in total length (Table 111; Appendix A). Further upstream, a steep cascade was located near RM 18.9. We spot electrofished approximately 500 m upstream of this site, capturing 16 cutthroat trout. Fish were at very low density, and most of the ones captured appeared to be phenotypic hybrids based on inconsistent and irregular spotting patterns. Westslope cutthroat trout genetic samples were collected in Lost Creek in 1991 near RM 17.0 (downstream of the falls), and results showed that the fish tested were slightly hybridized with rainbow trout. No historic genetic information could be found for westslope cutthroat trout above the falls. Samples were collected in 2008 for future analysis.

Table 111. Electrofishing data collected at four sections of Lost Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.4	LL	9	9.0	208	77-385	100
RM 10.2	LL	16	16.0	207	67-347	100
RM 16.2	WCT	12	12.0	129	63-193	26
	EB	25	25.0	120	80-181	54
	LL	9	9.0	216	75-395	20
RM 18.5	EB	23	23.0	123	75-228	100

A riparian assessment was completed at each of the sections electrofished on Lost Creek in 2008. At RM 1.4, the stream was classified as a Rosgen C channel type, and the total riparian assessment score was 60 out of a potential score of 70 (86%) (Table 112). The reach was within a segment of the channel that had undergone complete reconstruction several years prior in an effort to restore a severely channelized area. The recently restored stream channel appeared stable throughout the survey area, and had continued to maintain good connection to its rather expansive floodplain. Woody riparian vegetation was dominated by mature willow and dogwood, although plant density was a patchy and discontinuous along the channel. Disturbance-induced grasses were common throughout the riparian zone, and in many places were the dominant streambank vegetation. The reach was within a large pasture, although livestock presence in the area appeared light. Fish habitat at RM 1.4 was rated good (score: 7 points out of a potential of 10; Table 112), but the score was conditioned on the availability of adequate flow. Throughout most of the summer, flow was extremely low in this reach of Lost Creek, and ranged between just 2 and 3 cfs at the USGS gauge (Galen gauge) located immediately downstream of the survey site. At the time of our survey in early September, flows had risen dramatically (to nearly 30 cfs), and were relatively uncharacteristic of what was present in the reach for most of the summer. The increase in flow was brought about by an intense late August-early September rain event, which likely caused upstream irrigation diversions to be shut down temporarily. Beaver activity was relatively common at RM 1.4, and actually made it difficult to find 100 m of free flowing channel to conduct our electrofishing.

At RM 10.2, the survey reach was located immediately downstream of the Gardiner Ditch crossing. As mentioned above, the pin and plank style diversion structure in the Lost Creek channel was very large, and appeared to be a barrier to fish migrating upstream. At the time of the survey, the Gardiner Ditch was capturing all of the flow coming down Lost Creek. However, this was very little, as flow in Lost Creek was extremely low at this location in the drainage (i.e. near the Galen Highway crossing). It appeared that the majority of the flow spilling over the diversion and flowing down the Lost Creek channel was actually Warm Springs Creek water. Within the survey reach, the channel was characterized as a Rosgen Bc stream type, and the total riparian assessment score was 57 out of a potential score of 68 (84%) (Table 112). Bank erosion was evident in several locations of the reach, but was mostly limited to outside bends lacking deep-rooted vegetation. Woody riparian vegetation was comprised of mature cottonwood trees, alder, wild rose, and a few willows. The riparian corridor was rather narrow, but woody shrubs and trees were fairly continuous along the channel, and provided a fair amount of shade and overhead cover to the stream. Noxious weeds (mostly spotted knapweed) were rather common in the area, and occupied most of the disturbance-induced openings in the riparian canopy. Livestock had access to the area, although their impact on the channel appeared relatively light. Fish habitat at RM 10.2 was rated good (score: 7 points out of a potential of 10; Table 112), and was likely near its potential. However, habitat complexity would have benefited from an increased amount of large woody debris in the channel.

At RM 16.2, Lost Creek was situated in a relatively narrow canyon. The stream was classified at a Rosgen B channel type, and the total riparian assessment score was 67 out of a potential score of 70 (96%) (Table 112). The stream was stable, and the riparian area was comprised of a rather dense community of willow, alder, and dogwood, as well as a few conifers (spruce and lodgepole pine). The only factor affecting the overall assessment score was the presence of a several disturbance-induced openings where a few noxious weeds (primarily Canada thistle and spotted knapweed) were present. Fish habitat at RM 16.2 was thought to be excellent (score: 10 points out of a potential of 10; Table 112), and was likely at its potential. There was a good amount of large woody debris present in the channel, as well as a number of deep pools with undercut banks. Additionally, overhead cover was ample, and spawning and rearing habitat was abundant.

At RM 18.5, Lost Creek was flowing through a narrow, timbered canyon. The stream was classified at a rather high gradient Rosgen B channel type, and the total riparian assessment score was a perfect 65 out of a potential score of 65 (100%) (Table 112). The woody riparian community was dominated by a conifer overstory of spruce, Douglas fir, sub alpine fir, and lodgepole pine. Alder was present in the understory, but was relatively sparse along the channel. Fish habitat at RM 18.5 was good (score: 7 points out of a potential of 7; Table 112), and was likely at its potential. Much of the habitat was high gradient riffle and pocket water, although there were several deep pools present in the reach that were created from large woody debris.

Table 112. Riparian assessment results for four sites surveyed on Lost Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.4	30/30 (100%)	23/30 (77%)	7/10 (70%)	60/70 (86%)
RM 10.2	27/30 (90%)	23/28 (82%)	7/10 (70%)	57/68 (84%)
RM 16.2	30/30 (100%)	27/30 (90%)	10/10 (100%)	67/70 (96%)
RM 18.5	30/30 (100%)	28/28 (100%)	7/7 (100%)	65/65 (100%)

Water temperature was monitored at three sites on Lost Creek from July 9 through October 13, 2008 (Appendix B). The sites were located at RM 1.4, 10.3, and 16.2 (Figure 8). At RM 1.4, maximum daily temperatures exceeded 15°C on 55 days, and 20°C on 40 of those days. The maximum-recorded temperature at this site was 25.2°C on July 9. At RM 10.3, water temperatures exceeded 15°C on 17 days, but on no days did they exceed 20°C. The maximum-recorded temperature at this site was 18.9°C on August 24. At RM 16.2, maximum daily water temperatures never exceeded 15ºC. The maximum-recorded temperature at this site was 11.8°C on July 26.

Perkins Gulch Drainage

Perkins Gulch

Perkins Gulch is a small East Deer Lodge Valley stream that drains for over six miles, but is ephemeral through its lower reaches and does not have significant connection to the Clark Fork River. The stream typically goes dry near RM 1.0, and it appears that only during high runoff events can flows reach the Clark Fork near RM 337.2. Land ownership along the stream is varied, with private and State owned lands in the lower half of the drainage, and U.S. Forest Service managed lands in the upper portion of the watershed. Livestock grazing is the primary land use along the stream, with cattle having access to almost the entire channel length.

Fish sampling was completed at two sections of Perkins Gulch in late July of 2008. The sites were located at RM 1.5 and 5.1 (Table 113; Figure 8). The lower site (RM 1.5) was situated on State owned land, while the upper site (RM 5.1) was on National Forest land. At both sites, westslope cutthroat trout comprised the entire fish community, but fish density was extremely low at each section (Table 113). While multiple age classes of fish were captured in Perkins gulch at each of the sample sites (Appendix A), the low overall abundance of fish suggests limited survival and recruitment. Genetic sampling conducted in 1998 and 2002 showed that Perkins Gulch contained a pure strain of westslope cutthroat trout.

Table 113. Electrofishing data collected at two sections of Perkins Gulch in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.5	WCT	3	3.0	136	97-208	100
RM 5.1	WCT	6	6.0	109	78-169	100

A riparian assessment was completed at each of the sections electrofished on Perkins Gulch in 2008. At RM 1.5, the stream was situated in a narrow wooded draw that was not far from the lower extent of perennial flow in the drainage. The channel was classified as a Rosgen B stream type, and the total riparian assessment score was 39 out of a potential score of 68 (57%) (Table 114). Within the survey reach, the channel showed evidence of notable bank trampling and erosion caused by rather heavy livestock use of the riparian area. The channel was not actively downcutting at the time of the survey, but it appeared that several coarse woody debris jams were all that was keeping it from doing so (i.e. the debris jams were acting as check structures preventing a head cut from occurring). Woody riparian vegetation was comprised mostly of aspen, alder, wild rose, and chokecherry, although the canopy afforded by these plants was patchy and discontinuous along the channel. Disturbance induced grasses and noxious weeds (mostly leafy spurge) were common throughout the area, and most of the grasses along the stream channel showed rather heavy grazing pressure. Fish habitat at RM 1.5 was rated only fair (score: 3 points out of a potential of 10; Table 114), and was not at its potential. Pools were very sparse, and those present were shallow and filled with fine sediment. Additionally, the patchy and discontinuous woody canopy provided only limited shade and overhead cover to the channel. Flow was good in the reach at the time of the survey.

At RM 5.1, Perkins Gulch was situated in a relatively narrow, timbered canyon. The channel was classified as a stable Rosgen B stream type, and the total riparian assessment score was 58 out of a potential score of 64 (91%) (Table 114). The woody riparian community was dominated by a conifer overstory of spruce and lodgepole pine. Alder was present in the understory, but was relatively sparse along the channel. The area was within a U.S. Forest Service grazing allotment, and livestock presence in the riparian zone was evident. Most of the grasses in the stream bottom showed moderate grazing pressure, and there was also evidence of hummocking in wetter areas along the channel. Fish habitat at RM 5.1 was rated good (score: 7 points out of a potential of 10; Table 114), but was slightly limited by high fine sediment accumulation and limited spawning habitat.

Table 114. Riparian assessment results for two sites surveyed on Perkins Gulch in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.5	23/30 (77%)	13/28 (46%)	3/10 (30%)	39/68 (57%)
RM 5.1	30/30 (100%)	21/24 (88%)	7/10 (70%)	58/64 (91%)

Water temperature was not monitored in Perkins Gulch during 2008.

Warm Spring Creek Drainage

Warm Springs Creek

Fish sampling (including riparian assessments) and temperature monitoring were conducted on Warm Springs Creek in 2007. Results of this survey work were summarized in ***An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin*** (2008). In 2008, we re-sampled one of the 2007 electrofishing reaches (RM 1.8), and also continued to monitor water temperature throughout the drainage.

In 2008, we re-sampled the electrofishing reach located at RM 1.8 (Figure 9). A mark-recapture population estimate was conducted at this site in 2007, and was repeated in 2008. The results of the 2008 sampling were very similar to what was found in 2007. In 2008, brown trout comprised the entire trout community at RM 1.8 (Table 115). In 2007, the species comprised over 99% of the trout composition at the site. In 2008, brown trout ranged in size from 65 to 531 mm in total length, and had a mean total length of 212 mm (Table 115; Appendix A). In 2007 the species ranged in size from 61 to 542 mm in total length, and had a mean total length of 219 mm. In 2008, the mark-recapture population estimate showed that there were approximately 807 (+/- 90: 95% confidence interval) brown trout greater than 150 mm in total length in the 1000 m section. In 2007, the population estimate for the same reach was 845 (+/- 68: 95% confidence interval) brown trout greater than 150 mm. The population estimates generated in 2007 and 2008 were very much alike, and were within the range of natural variability.

Table 115. Electrofishing data collected at one section of Warm Springs Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.8	LL	535	53.5	212	65-531	100

Water temperature was monitored at three sites on Warm Springs Creek from July 9 through October 13, 2008 (Appendix B). The sites were located at RM 1.0, 13.2, and 21.4 (Figure 5). The sites at RM 1.0 and 13.2 were locations monitored in 2007, whereas the site at RM 21.4 was a new location added in 2008. At RM 1.0, maximum daily temperatures exceeded 15°C on 41 days. The maximum-recorded temperature at this site was 19.0°C on August 18. This was 1.2°C cooler than the maximum-recorded temperature in 2007 (21.2°C). At RM 13.2, maximum daily temperatures did not exceeded 15°C in 2008. The maximum-recorded temperature at this site was 14.6°C, which occurred on July 26. This was 2.0°C cooler than the maximum-recorded temperature in 2007 (16.6°C). At RM 21.4, water temperatures were similar to what was recorded at RM 13.2. Maximum daily temperatures at this site exceeded 15°C on only 1 day. The maximum-recorded temperature at RM 21.4 was 15.1°C, which occurred on July 26.

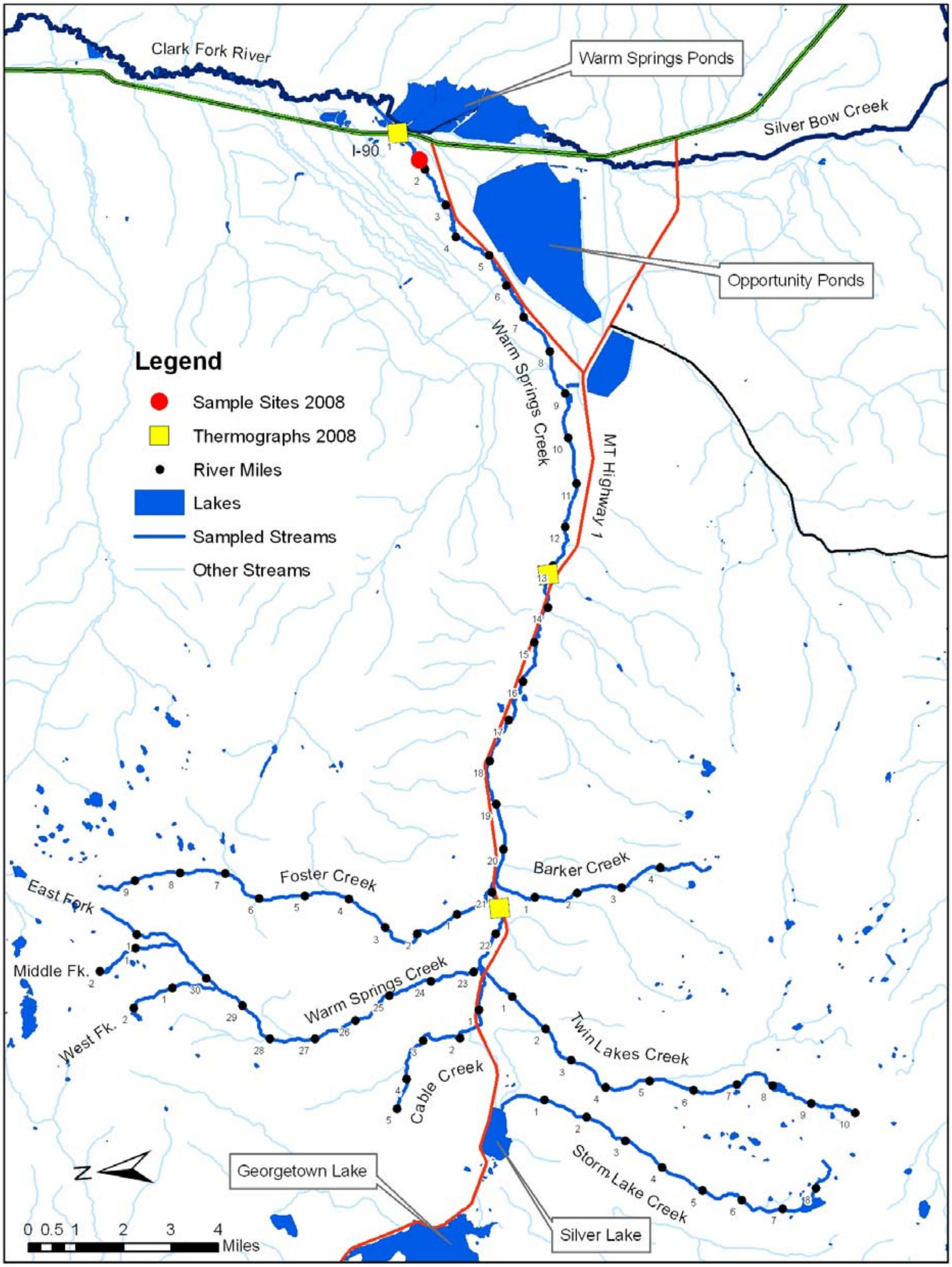


Figure 9. Map of the Warm Springs Creek drainage showing sites of fish and temperature sampling conducted in 2008.

Mill Creek Drainage

Mill Creek

Mill Creek lies within the greater Silver Bow Creek watershed, but is no longer a tributary to Silver Bow Creek. The stream drains for approximately 20 miles in a northeasterly direction before joining Willow Creek (near Opportunity) at the top of the Mill-Willow Bypass. The Mill-Willow Bypass is an over 5-mile long channel that was constructed to allow Mill and Willow Creeks to circumvent the Warm Springs settling ponds and Silver Bow Creek, which are contaminated with mining wastes washed downstream from Butte. Public land along Mill Creek is extremely limited, as most of the channel flows through lands in private ownership. In the upper portion of the watershed (upstream of approximately RM 10.0), the stream flows primarily through undeveloped lands where limited livestock grazing and timber harvest are the dominant, active land uses. In the middle portion of the drainage (approximately RM 5.0 to RM 10.0), much of the land along the stream has been subdivided into smaller parcels. A few permanent and recreational residences are located near the stream in this area, with the potential for additional development in the future. In the lower portion of the drainage (downstream of RM 5.0), the stream flows largely through lands owned and managed by Atlantic Richfield (ARCO). Much of this land has, or is going through active remediation to promote vegetation growth on soils previously contaminated from past copper smelting activities at nearby Anaconda. Additional land uses along Mill Creek include a golf course between RM 1.6 and 2.4, and several irrigation diversions located in the lower half of the watershed. A small waterfall is located on the stream near RM 11.0, and is likely an upstream barrier to fish movement.

Fish sampling was completed at four sections of Mill Creek from early August though early October of 2008. The sites sampled were located at RM 1.2, 5.2, 9.7, and 13.6 (Table 116; Figure 6). Most of the sections were located on private land with the exception of the site at RM 5.2, which was located on property owned by Anaconda-Deer Lodge County. At RM 1.2, the trout community was comprised predominately of brown trout, with brook trout and westslope cutthroat trout also present, but rare (Table 116). Brown trout varied in size from 59 to 450 mm in total length (Table 116; Appendix A). In addition to trout, several longnose suckers and numerous slimy sculpin were also collected at RM 1.2. At RM 5.2, brown trout were the only trout observed in the reach, and their density appeared similar to that found at RM 1.2 (Table 116). Fish captured in this reach ranged in size from 100 to 405 mm in total length (Table 116; Appendix A). Slimy sculpin were the only other species captured at RM 5.2. Further upstream at RM 9.7, brown trout continued to be present in similar numbers as found at downstream sites; however, westslope cutthroat trout also became relatively common, making up 46% of the trout captured in the reach (Table 116). Additionally, one 150 mm brook trout and numerous slimy sculpin were also collected in the section. Brown trout at RM 9.7 ranged in size from 68 to 370 mm in total length, while westslope cutthroat trout varied between 85 and 265 mm in total length (Table 116; Appendix A). At the most upstream section near RM 13.6, the fish community was comprised entirely of westslope cutthroat trout (Table 116). Fish density was very high in the 100 m sample reach, and fish ranged in size from young-of-the-year to adults as large as 266 mm in total length (Table 116; Appendix A). The genetic purity of westslope cutthroat trout in Mill Creek is currently unknown, although samples were collected during 2008 for analysis.

Table 116. Electrofishing data collected at four sections of Mill Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.2	WCT	1	1.0	251	251	3
	LL	26	26.0	175	59-450	90
	EB	2	2.0	97	65-129	7
RM .5.2	LL	25	25.0	209	100-405	100
RM 9.7	WCT	19	19.0	135	85-265	46
	LL	21	21.0	158	68-370	51
	EB	1	1.0	150	150	2
RM 13.6	WCT	127	127.0	135	55-266	100

A riparian assessment was completed at each of the sections electrofished on Mill Creek in 2008. At RM 1.2, the site was located just downstream of the golf course in Opportunity. The stream was classified as a Rosgen C channel type, although it also displayed strong characteristics of a Rosgen F channel type. The total riparian assessment score was 47 out of a potential score of 70 (67%) (Table 117). Throughout the survey segment, the channel was fairly entrenched and was also wide and shallow from what appeared to be historic channel degradation. Mid-channel bars and braided areas were common, and there was a significant amount of bedload present in the reach that the current channel was trying to rework to the extent possible. Many of the high banks present in the reach lacked significant woody vegetation, and there was a moderate amount of bank erosion evident. There was also evidence of past bank stabilization attempts, mostly associated with old cars bodies that were used as riprap. The woody riparian community was comprised mostly of alder, willow, and cottonwood trees, but the riparian zone was rather narrow and was not continuous along the channel. There were a number of disturbance-induced openings on the high banks that were dominated by noxious weeds (spotted knapweed and Canada thistle) and upland grasses. Fish habitat at RM 1.2 was rated between fair and good, but because of several quality pools within the reach, it was rated good (7 points out of a potential of 10; Table 117). Additionally, spawning and rearing habitat was relatively abundant throughout the survey segment, and the riparian canopy did offer some overhead cover and shade to the channel despite being discontinuous along the stream. Flow was low at RM 1.2 at the time of the survey in mid August.

At RM 5.2, Mill Creek was classified as a Rosgen B channel type, although the channel was somewhat incised and appeared to be disconnected from the broader floodplain. Despite being slightly entrenched from historic incisement, the channel appeared stable, and the total riparian assessment score was 66 out of a potential score of 67 (99%) (Table 117). The woody riparian community was comprised of alder, willow, and cottonwood trees, and the canopy provided by these plants was relatively continuous along the channel. The only factor affecting the overall assessment score was the presence of a few spotted knapweed plants in the riparian zone. Fish habitat at RM 5.2 was rated good (7 points out of a potential of 7; Table 117), and was thought to be near its potential. However, much of the available habitat was rather high gradient pocket water that subsequently made spawning and rearing habitat rather limited and site specific. Flow was good in this reach of Mill Creek despite there being a sizeable diversion located immediately upstream of sample site. At the time of the survey in mid August, this diversion appeared to be diverting roughly 1/3 of the flow in the channel. The diversion structure was a rock wing that did not appear to inhibit fish movement up or downstream. However, the ditch was unscreened and likely entrained fish given the nature of its design and the amount of flow being diverted.

At RM 9.7, Mill Creek continued to be classified as relatively high gradient Rosgen B channel type. The channel was stable and appeared to have access to the broader floodplain during high flow events. The total riparian assessment score was 64 out of a potential score of 65 (98%) (Table 117). The woody riparian community was comprised of cottonwood, alder, aspen, and wild rose. Plant density was relatively good and was continuous along the channel throughout the reach. Similar to the site at RM 5.4, the only factor affecting the overall assessment score was the presence of a few spotted knapweed plants in the riparian zone. Fish habitat at RM 9.7 was rated good (7 points out of a potential of 7; Table 117), and was thought to be near its potential. There were several nice boulder scour pools present in the reach, but the dominant habitat type was high gradient pocket water. Flow was very good in this segment of Mill Creek at the time of the survey in early October.

At RM 13.6, Mill Creek was situated in a broad, picturesque canyon. The channel was classified as a Rosgen Bc stream type, and the total riparian assessment score was 69 out of a potential score of 70 (99%) (Table 117). The channel was stable and there was a significant amount of beaver activity above and below the survey reach. The woody riparian community was fairly healthy, and was comprised primarily of willow and alder, as well as a few conifers trees (spruce and lodgepole pine). There were patches of Canada thistle nearby, but the plant was not overly abundant or widespread. Fish habitat at RM 13.6 was rated excellent (10 points out of a potential of 10; Table 117), and was thought to be near its potential. There were many quality meander pools and beaver ponds present in the area, and spawning and rearing habitat was rather abundant as well. Additionally, the fair amount of large woody debris in the channel added to habitat complexity. Flow was very good in this segment of Mill Creek at the time of the survey in mid September.

Table 117. Riparian assessment results for four sites surveyed on Mill Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.2	19/30 (63%)	21/30 (70%)	7/10 (70%)	47/70 (67%)
RM 5.2	30/30 (100%)	29/30 (97%)	7/7 (100%)	66/67 (99%)
RM 9.7	30/30 (100%)	27/28 (96%)	7/7 (100%)	64/65 (98%)
RM 13.6	30/30 (100%)	29/30 (97%)	10/10 (100%)	69/70 (99%)

Water temperature was monitored at one site in Mill Creek from July 8 to October 13, 2008 (Appendix B). The thermograph was located at RM 1.6 (Figure 10). Maximum daily temperatures at this site exceeded 15ºC on 47 days. The maximum-recorded temperature was 18.9ºC on July 26.

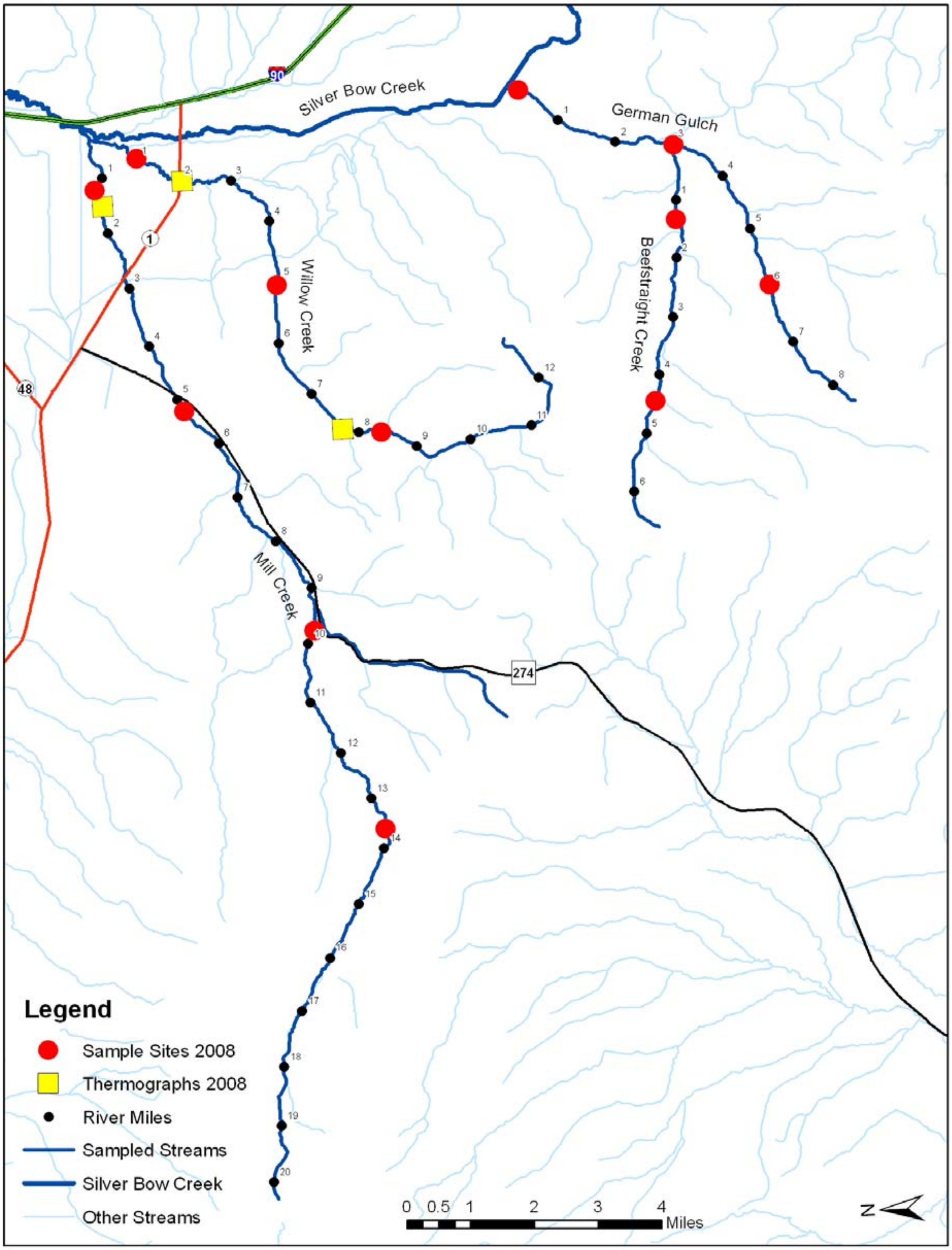


Figure 10. Map of the lower Silver Bow Creek drainage showing sites of fish and temperature sampling conducted in 2008.

Willow Creek Drainage

Willow Creek

Willow Creek is in the greater Silver Bow Creek watershed, but like Mill Creek, is no longer connected to Silver Bow Creek. The stream drains northeasterly for over 12 miles before joining Mill Creek at the head of the Mill-Willow bypass located near the town of Opportunity. As mentioned above, the Mill-Willow Bypass is an over 5-mile long channel that was constructed to allow Mill and Willow Creeks to circumvent the Warm Springs settling ponds and Silver Bow Creek, which are contaminated with mining wastes washed downstream from Butte. The lower 7.4 miles of Willow Creek flows through private land, while the upper extent of the stream lies mostly within the Mount Haggin Wildlife Management area managed by Montana Fish, Wildlife and Parks. The primary land uses in the watershed are livestock grazing and irrigated hay/pasture production (lower half of drainage). Additionally, some timber harvest is also evident in the upper part of the drainage.

Fish sampling was completed at three sections of Willow Creek in early August of 2008. The sites were located at RM 1.0, 5.1, and 8.4 (Table 118; Figure 10). The lower two sites (RM 1.0 and 5.1) where located on private land, while the upper site (RM 8.4) was situated on State owned land within the Mount Haggin Wildlife Management Area. At RM 1.0, the trout community was comprised mostly of small (<100 mm), juvenile brown and brook trout, with brown trout being the more common species (Table 118; Appendix A). In addition to trout, 13 slimy sculpin, three longnose suckers, and 2 redside shiners were also collected in the reach. Further upstream at RM 5.1, the trout community shifted to one comprised mostly of brook trout, which ranged in size from 52 to 186 mm in total length (Table 118; Appendix A). Westslope cutthroat trout and brown trout were also present at RM 5.1, but tended to be relatively rare with only two individuals of each species captured in the reach (Table 118). Longnose suckers were very common at the sample site (n=48), as were slimy sculpin (n=88). Redside shiners were present, but appeared relatively rare (n=3). At the most upstream site near RM 8.4, the trout community was comprised predominately of westslope cutthroat trout, with brook present, but a little less common (Table 118). Both species had a similar mean, as well as maximum total length, which was near 130 mm and 210 mm, respectively (Table 118; Appendix A). Slimy sculpin were the only other species (n=15) observed at the site. The genetic purity of westslope cutthroat trout in Willow Creek is currently unknown. Samples were collected during 2008 for future analysis.

Table 118. Electrofishing data collected at three sections of Willow Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.0	EB	20	20.0	101	66-256	30
	LL	47	47.0	105	66-315	70
RM 5.1	WCT	2	2.0	206	181-231	7
	LL	2	2.0	120	73-167	7
	EB	26	26.0	105	52-186	87
RM 8.4	WCT	29	29.0	129	73-214	69
	EB	13	13.0	132	102-209	31

A riparian assessment was completed at each of the sections electrofished on Willow Creek in 2008. At RM 1.0, the stream was classified as a Rosgen C channel type, and the total riparian assessment score was 39 out of a potential score of 69 (56%) (Table 119). Throughout the survey reach, the channel was rather wide and shallow, and there was a moderate amount of lateral erosion associated with banks lacking deep-rooted vegetation. The woody riparian community was comprised of mature willow, but plants were very patchy and sparse throughout the reach. Disturbance-induced plants and noxious weeds were commonly distributed throughout the riparian zone, and were the dominant stream bank vegetation throughout most of the reach. Fish habitat at RM 1.0 was rated only fair (3 points out of a potential of 10; Table 119), and was most limited by a lack of deep pools and other forms of overhead cover. Much of the habitat was relatively simple and lacked complexity. Additionally, flow appeared somewhat low, and fine sediment accumulation was notable.

At RM 5.1, Willow Creek was classified as a Rosgen C channel type. However, some of the stream segments in the reach were more representative of a degraded Rosgen G channel type. The total riparian assessment score was 41 out of a potential score of 70 (59%) (Table 119). Portions of the survey reach were relatively incised (approximately 4-6 ft in places), and there was a moderate amount of lateral erosion evident throughout the area. Historic channel degradation appeared to have been rather severe and more accelerated than what was observed at the time of the survey. The woody riparian community was comprised of willow, alder, and wild rose, but plant density was patchy along the channel. Disturbance-induced grasses and weeds were relatively common throughout the riparian zone, and dominated the high banks that were effectively disconnected from the water table. Livestock use of accessible portions of the channel and riparian area was notable, and there were several areas of the stream that had been considerably over widened. Fish habitat at RM 5.1 was rated only fair (3 points out of a potential of 10; Table 119), and was most limited by a lack of deep pools and other forms of overhead cover. Flow appeared fairly good in this reach of Willow Creek, but fine sediment accumulation was high.

At RM 8.4, Willow Creek was classified as an entrenched Rosgen Bc channel type, and the total riparian assessment score was 59 out of a potential score of 70 (84%) (Table 119). There was a fair amount of bank erosion present in the reach, and the channel appeared to have down cut sometime in the past. The woody riparian community was dominated by a rather dense, mature willow stand, which provided fairly abundant cover and shade to the channel. Despite the abundance of willows in the area, a few patches of Canada thistle were noted in the riparian zone. Fish habitat at RM 8.4 was rated good (7 points out of a potential of 10; Table 119), but was somewhat limited by notable fine sediment accumulation. Flow appeared to be unaltered in this reach of Willow Creek.

Table 119. Riparian assessment results for three sites surveyed on Willow Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.0	21/30 (70%)	15/29 (52%)	3/10 (30%)	39/69 (56%)
RM 5.1	19/30 (63%)	19/30 (63%)	3/10 (30%)	41/70 (59%)
RM 8.4	23/30 (77%)	29/30 (97%)	7/10 (70%)	59/70 (84%)

Water temperature was monitored at two sites on Willow Creek from July 8 through October 13, 2008 (Appendix B). The sites were located at RM 2.1 and 7.7 (Figure 10). At RM 2.1, maximum daily temperatures exceeded 15°C on 72 days, and 20°C on 42 of those days. The maximum-recorded temperature at this site was 24.1°C on August 17. At RM 7.7, water temperatures exceeded 15°C on 37 days, but on no days did they exceed 20°C. The maximum-recorded temperature at this site was 17.5°C on July 26.

Silver Bow Creek Drainage

German Gulch

German Gulch is a tributary to Silver Bow Creek that drains for approximately 8 miles before reaching its mouth in the Durant Canyon upstream of Gregson. Much of the stream flows through Mount Haggin Wildlife Management Area and U.S. Forest Service administered land. There are however, several privately owned in-holdings along the stream, although two of the larger ones are currently owned by Trout Unlimited (George Grant Chapter) and will soon be transferred to public ownership. Once completed, this will leave only one private in holding along German Gulch (between RM 4.6 and 5.1). The primary land uses in the drainage are recreation, livestock grazing, past timber harvest, and mining. Historic placer mining activity is evident throughout the drainage, and large tailings piles are common along the stream. Perhaps the most significant factor affecting German Gulch is the presence of the Beal Mountain Mine located near the upper extent of the watershed. This large gold mine, while closed by 1998, still poses significant threats to the fisheries and aquatic health of German Gulch. Past water quality monitoring downstream of the mine has shown elevated levels of cyanide and selenium above the State's water quality standards.

Fish sampling was completed at three 100 m sections of German Gulch in late August of 2008. The sites were located near the mouth at RM 0.2, near the middle of the drainage at RM 3.0, and below Beal Mountain Mine at RM 6.0 (Table 120; Figure 10). At RM 0.2 the fish community was comprised of brook trout and westslope cutthroat trout, with brook trout being the more common species (Table 120). However, many of the brook trout captured in the reach tended to be small, young-of-the-year fish (Appendix A). Densities of fish approximately one year and older (i.e. > 80 mm) appeared similar for each species (Appendix A). One notable finding at RM 0.2 was the presence of a relatively large, 410 mm brook trout in the reach. At RM 3.0, the fish community continued to be comprised of both brook trout and westslope cutthroat trout; however, westslope cutthroat trout became the more common species comprising 72% of the fish community (Table 120). Both species had a similar mean size of around 140 mm in total length (Table 120; Appendix A). Further upstream at RM 6.0, the fish community was comprised entirely of westslope cutthroat trout, which averaged 121 mm total length (Table 120; Appendix A). Fish density at RM 6.0 appeared lower than at downstream reaches. Genetic sampling conducted in 1984 showed that German Gulch contained a pure strain of westslope cutthroat trout. However, more recent sampling in 2002 and 2003 indicated that the population might now be slightly hybridized with rainbow trout. Additional genetic samples were collected in 2008 for confirmation.

Table 120. Electrofishing data collected at three sections of German Gulch in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 0.2	WCT	52	52.0	139	81-231	34
	EB	101	101.0	102	52-410	66
RM 3.0	WCT	49	49.0	141	77-233	72
	EB	19	19.0	138	63-211	28
RM 6.0	WCT	19	19.0	121	65-179	100

A riparian assessment was completed at each of the sections electrofished on German Gulch in 2008. At RM 0.2, the stream was classified as a Rosgen Bc channel type, and the total riparian assessment score was 57 out of a potential score of 68 (84%) (Table 121).

The channel appeared relatively stable, but was rather entrenched in a narrow draw. Past placer mining activity was evident throughout the reach. The woody riparian community was comprised of mature alder, willow, dogwood, and a few conifers. However, the woody canopy provided by these plants was not continuous along the channel. There were a number of openings throughout the area where disturbance-induced plants (grasses and weeds) were the dominant streambank vegetation. Fish habitat at RM 0.2 was rated good (7 points out of a potential of 10; Table 121), but was somewhat limited by a lack of overhead cover and large woody debris in the channel. Flow appeared to be unaltered in this reach of German Gulch, although a sizeable irrigation diversion was located just downstream of the survey segment. A fish screen was installed in this ditch in the fall of 2008.

At RM 3.0, German Gulch was again classified as a Rosgen Bc channel type. The total riparian assessment score was 55 out of a potential score of 70 (79%) (Table 121). Throughout much of the survey reach, the channel was relatively wide and shallow, and there was also evidence of some minor bank erosion in a few locations. Historic placer mining activity was again evident throughout this reach of German Gulch. The woody riparian community was mostly comprised of willow and alder, although there were also a few scattered conifers present in the area. Plant density in the riparian zone was fairly good, but there were a few disturbance-induced openings present in the canopy. These areas showed common use by livestock, as well as humans. Fish habitat at RM 3.0 was rated good (7 points out of a potential of 10; Table 121), but was somewhat limited by a lack of deep pool habitat. Much of the habitat in the reach consisted of wide riffles and shallow pocket water. Flow was relatively low at RM 3.0, and was likely caused by the loss of surface water to groundwater, which was exacerbated by past placer mining activity in the channel.

At RM 6.0, German Gulch was classified as a Rosgen B channel type, and the total riparian assessment score was 65 out of a potential score of 67 (97%) (Table 121). Despite widespread historic mining activity in and around the channel, the stream appeared stable, and was enveloped in a narrow, but dense woody riparian canopy comprised of willow, alder, dogwood, and conifers. There were a few disturbance-induced plants in the area, but they were not overly widespread. Fish habitat at RM 6.0 was rated good (7 points out of a potential of 7; Table 121), and was likely near its potential. The reach was relatively high gradient, and pocket water was the dominant habitat type. Deep pools, were relatively uncommon, but the dense woody canopy cover offered good shade and overhead cover to the channel. Flow was relatively low in this reach of German Gulch, but appeared to be unaltered.

Table 121. Riparian assessment results for three sites surveyed on German Gulch in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 0.2	28/30 (93%)	22/28 (79%)	7/10 (70%)	57/68 (84%)
RM 3.0	23/30 (77%)	25/30 (83%)	7/10 (70%)	55/70 (79%)
RM 6.0	30/30 (100%)	28/30 (93%)	7/7 (100%)	65/67 (97%)

Water temperature was not monitored in German Gulch in 2008.

Beefstraight Creek

Beefstraight Creek is a sizeable tributary to German Gulch that flows for over 6 miles before reaching German Gulch near RM 2.9. The entire stream drains through Mount Haggin Wildlife Management Area (upper portion of watershed) and National Forest lands administered by the U.S. Forest Service. Land uses in the drainage include recreation, livestock grazing, past timber harvest, and historic mining.

Fish sampling was completed at two sections of Beefstraight Creek in early September of 2008. The sites were located at RM 1.3 and 4.5 (Table 122; Figure 10). At RM 1.3, westslope cutthroat trout and brook trout comprised the entire fish community (Table 122). Overall, fish density was relatively high in the section, with westslope cutthroat trout being most abundant, as well as larger in size on average (Table 122; Appendix A). At RM 4.5, the fish community was similar to that found at RM 1.3. Westslope cutthroat trout and brook trout were the only species captured in the sample section, and like at the downstream reach, westslope cutthroat trout were more common and tended to be slightly larger in size (Table 122; Appendix A). Total fish density at RM 4.5 appeared to be approximately half of what was found at the downstream reach (RM 1.3; Table 122). Genetic sampling conducted on westslope cutthroat trout in 2002 and 2003 showed that Beefstraight Creek contained a population that was slightly hybridized with rainbow trout.

Table 122. Electrofishing data collected at two sections of Beefstraight Creek in 2008.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 1.3	WCT	78	78.0	156	32-262	79
	EB	21	21.0	112	45-189	21
RM 4.5	WCT	40	40.0	135	57-202	78
	EB	11	11.0	124	88-179	22

A riparian assessment was completed at each of the sections electrofished on Beefstraight Creek in 2008. At RM 1.3, the stream was classified as a Rosgen B channel type, and the total riparian assessment score was 60 out of a potential score of 70 (86%) (Table 123).

There was some bank erosion present in the reach, but most could be attributed to bank trampling caused by the presence of livestock in the riparian zone. Woody riparian vegetation was comprised of a willow, alder, and dogwood understory, and a conifer overstory dominated by spruce and lodgepole pine. The woody riparian canopy was relatively dense and fairly continuous along the channel. Despite this, disturbance-induced plants were also present in the area. Canada thistle was the most prevalent, and appeared to be relatively abundant in a few locations. Fish habitat at RM 1.3 was rated good (7 points out of a potential of 10; Table 123), but was somewhat limited by a lack of large woody debris in the channel. Flow was good in this reach of the stream, and appeared unaltered.

At RM 4.5, Beefstraight Creek continued to be classified as a Rosgen B channel type. The total riparian assessment score was 66 out of a potential score of 68 (97%) (Table 123). The stream appeared to be stable, and was flowing through a rather continuous conifer (lodgepole pine and spruce) dominated canopy. Willow and alder were also present along the channel, but plants were somewhat patchy and sparse. Fish habitat was rated excellent (10 points out of a potential of 10; Table 123), and was likely near its potential. There was a good mix of pools and riffles in the reach, and some of the pools appeared to be deep enough for over wintering habitat. Additionally, spawning habitat was common, and flow was good.

Table 123. Riparian assessment results for two sites surveyed on Beefstraight Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 1.3	27/30 (90%)	26/30 (87%)	7/10 (70%)	60/70 (86%)
RM 4.5	30/30 (100%)	26/28 (93%)	10/10 (100%)	66/68 (97%)

Water temperature was not monitored in Beefstraight Creek in 2008.

Blacktail Creek

Blacktail Creek is a headwater tributary to Silver Bow Creek that drains for approximately 15 miles before reaching its mouth near Father Sheehan Park in the town of Butte. Land ownership along the stream is varied but consists mainly of privately owned residential and small agricultural parcels in the lower 6.6 miles, and a mixture of primarily publicly owned lands in the upper portion of the watershed administered by Butte-Silver Bow County and the U.S. Forest Service. A subdivision with a number of private parcels encompassing the stream is also located in the upper watershed between RM 11.2 and 12.4. Land use in the Blacktail Creek drainage is varied and has a long history with its close proximity to Butte. Currently, land use on the private lands along the stream consists primarily of residential and small-scale agricultural use. Several irrigation diversions are located throughout the lower extent of the drainage, and evidence of channelization of the stream is readily apparent in several locations. Additionally, the stream flows through the Butte Country Club golf course between RM 0.4 and 1.4. Thompson Park, which is located in the upper portion of the Blacktail Creek watershed (upstream of RM 6.6), is a recreational area that is co-managed by Butte-Silver Bow County and the U.S. Forest Service.

This area is heavily used for a variety of recreational activities including hiking, fishing, picnicking and biking. Highway 2 and Roosevelt Drive are directly adjacent to Blacktail Creek between RM 6.6 and 11.2. The presence of these significant roadways have greatly constricted the active floodplain of Blacktail Creek, as well as created water quality concerns due to erosion and road runoff into the stream. In 2008, three undersized culverts within the Thompson Park area were replaced with bridges that will benefit both fish passage and water quality. Other observed land uses in the upper portion of the drainage were timber harvest (both historic as well as recent) and some livestock grazing.

Fish sampling was completed at five sections of Blacktail Creek in mid July of 2008. The sites were located at RM 3.0, 6.2, 8.2, 9.6, and 13.0 (Table 124; Figure 11). At RM 3.0, brook trout comprised the entire trout community in the sample section (Table 124). The species was very common in the reach, although many of the fish captured were young-of-the-year less than 80 mm in total length (Table 124; Appendix A). Fish one year of age or greater (i.e. > 80 mm) represented only about 30% of the trout captured in the section. Other fish captured at RM 3.0 included six central mudminnow and three longnose suckers. At RM 6.2, the trout community was comprised of brook trout as well as westslope cutthroat trout, with brook trout appearing to be the more common species (Table 124). Westslope cutthroat trout, which averaged 165 mm in total length, tended to be larger than brook trout, which averaged only 123 mm in total length (Table 124; Appendix A). Central mudminnow (n=2) were the only other species captured at RM 6.2. Farther upstream at RM 8.2, the trout community was similar to what was found at RM 6.2. Brook trout and westslope cutthroat trout were both present at low densities in the reach, although brook trout remained a little more abundant (Table 124). Westslope cutthroat trout ranged in size from 120 to 178 mm in total length, while brook trout varied in length between 85 and 170 mm (Table 124; Appendix A). At RM 9.6, westslope cutthroat trout and brook trout continued to be present in Blacktail Creek, but westslope cutthroat trout were more common than at downstream reaches, comprising 54% of the total trout community (Table 124). However, many of the cutthroat trout captured in the reach were relatively small fish (<90 mm) that appeared to be only one year of age (Appendix A). The size composition of brook trout at RM 9.6 was similar to what was found at RM 6.2 and 8.2 (Table 124; Appendix A). At RM 13.0, westslope cutthroat trout comprised the bulk of the fish community, as only one 146 mm brook trout was captured in the reach (Table 124). Westslope cutthroat trout ranged in size from a 43 mm young-of-the-year, to a 162 mm resident sized adult (Table 124; Appendix A). Limited genetic sampling conducted in upper Blacktail Creek in 1999 indicated the presence of a pure strain of westslope cutthroat trout. Additional genetic samples were collected in 2008.

Table 124. Electrofishing data collected at five sections of Blacktail Creek in 2008. Sections at RM 9.6 and 13.0 were only 75 m in length.

Section Name	Species	Number of Fish Captured	Fish per 100 m (CPUE)	Mean Length (mm)	Length Range (mm)	Species Composition (%)
RM 3.0	EB	113	113.0	75	39-199	100
RM 6.2	WCT	10	10.0	165	121-218	36
	EB	18	18.0	123	37-178	64
RM 8.2	WCT	6	6.0	141	120-178	27
	EB	16	16.0	121	85-170	73
RM 9.6	WCT	25	33.0	98	64-176	54
	EB	21	28.0	121	90-167	46
RM 13.0	WCT	11	15.0	88	43-162	92
	EB	1	1.0	146	146	8

A riparian assessment was completed at each of the sections electrofished on Blacktail Creek in 2008. At RM 3.0, the stream was classified as an entrenched Rosgen E channel type. However, there was some uncertainty with this classification given the shallow nature of the channel. Within the survey reach, the channel was fairly incised and showed signs of historic instability. Additionally, active lateral erosion was evident on several outside bends where woody vegetation was absent. The total riparian assessment score at RM 3.0 was 47 out of a potential score of 70 (67%) (Table 125). Woody riparian vegetation was comprised of mature willows, which were largely restricted to the immediate stream banks, and were not continuous along the channel. Disturbance-induced grasses and weeds were very common throughout the area, and dominated much of the streambank vegetation. Fish habitat at RM 3.0 was rated only fair (3 points out of a potential of 10; Table 125), and was not at its potential. Fine sediment accumulation was very high in the reach, and pools were shallow and rare. The substrate in the channel was comprised almost entirely of sand and small gravel that offered little in the way of habitat diversity.

At RM 6.2, Blacktail Creek was flowing on the edge of an irrigated hay meadow. With some uncertainty, the stream was classified as an incised Rosgen E channel type. The channel appeared to have been historically manipulated and straightened, making the stream type difficult to characterize. Despite the past degradation, the channel appeared relatively stable at the time of the survey. Little active erosion was evident, and beaver activity was common above and below the survey reach. The total riparian assessment score was 60 out of a potential score of 70 (86%) (Table 125). Woody riparian vegetation was comprised of willow, alder, and wild rose, but most plants were confined to the immediate streambanks. Disturbance-induced grasses were very common throughout the riparian zone, and somewhat limited the recruitment potential of woody vegetation. Fish habitat at RM 6.2 was rated good (7 points out of a potential of 10; Table 125), but was somewhat limited by the incomplete woody canopy cover.

At RM 8.2, Blacktail Creek was flowing through a rather narrow canyon that was further restricted by the presence of Highway 2 in the stream bottom. The stream was classified as a Rosgen Bc channel type, and the total riparian assessment score was 64 out of a potential score of 70 (91%) (Table 125). The channel was somewhat entrenched throughout the survey reach, but was otherwise fairly stable. Woody riparian vegetation was comprised of a rather dense community of mature willow, although alder and a few conifer trees were also present in the area. Fish habitat at RM 8.2 was rated good (7 points out of a potential of 10; Table 125), but was somewhat limited by notable fine sediment accumulation and a lack of large woody debris in the channel.

At RM 9.6, Blacktail Creek was classified as a Rosgen B channel type, and the total riparian assessment score was 62 out of a potential score of 70 (89%) (Table 125). Roosevelt Drive crossed the channel immediately below the survey section, and considerably constricted the floodplain in the lower portion of the reach. Woody riparian vegetation was comprised mostly of alder and willow, although a few conifers and aspen trees were also present in the area. The density of woody shrubs in the survey segment was somewhat patchy, and there were number of openings where grasses and forbs were the primary vegetation. Fish habitat at RM 9.6 was rated good (7 points out of a potential of 10; Table 125), but was somewhat limited by a lack of large woody debris in the channel. Pocket water was the dominant habitat type in the reach.

At RM 13.0, Blacktail Creek was situated in a fairly narrow timbered canyon. The stream was classified as a stable Rosgen B channel type, and the total riparian assessment score was 63 out of a potential score of 68 (93%) (Table 125). Woody riparian vegetation was dominated by a lodgepole pine overstory, and a relatively young spruce understory. Alder was also present in the reach, but plants were sparse throughout the section. Fish habitat at RM 13.0 was rated good (7 points out of a potential of 10; Table 125), but was somewhat limited shallow pools and a lack of large woody debris in the channel. Recruitment potential of future wood was promising given the abundance of mature lodgepole pine within a tree length of the channel.

Table 125. Riparian assessment results for five sites surveyed on Blacktail Creek in 2008.

Section	Geomorphology	Vegetation	Fish Habitat	Total Score
RM 3.0	23/30 (77%)	21/30 (70%)	3/10 (30%)	47/70 (67%)
RM 6.2	28/30 (93%)	25/30 (83%)	7/10 (70%)	60/70 (86%)
RM 8.2	28/30 (93%)	29/30 (97%)	7/10 (70%)	64/70 (91%)
RM 9.6	28/30 (93%)	27/30 (90%)	7/10 (70%)	62/70 (89%)
RM 13.0	30/30 (100%)	26/28 (93%)	7/10 (70%)	63/68 (93%)

Water temperature was monitored at two sites on Blacktail Creek from July 8 through October 13, 2008 (Appendix B). The sites were located at RM 0.2 and 6.6 (Figure 11). At RM 0.2, maximum daily temperatures exceeded 15°C on 47 days. The maximum-recorded temperature at this site was 19.3°C on July 26. At RM 6.6, water temperatures exceeded 15°C on 22 days. The maximum-recorded temperature at this site was 17.7°C, which was also measured on July 26.

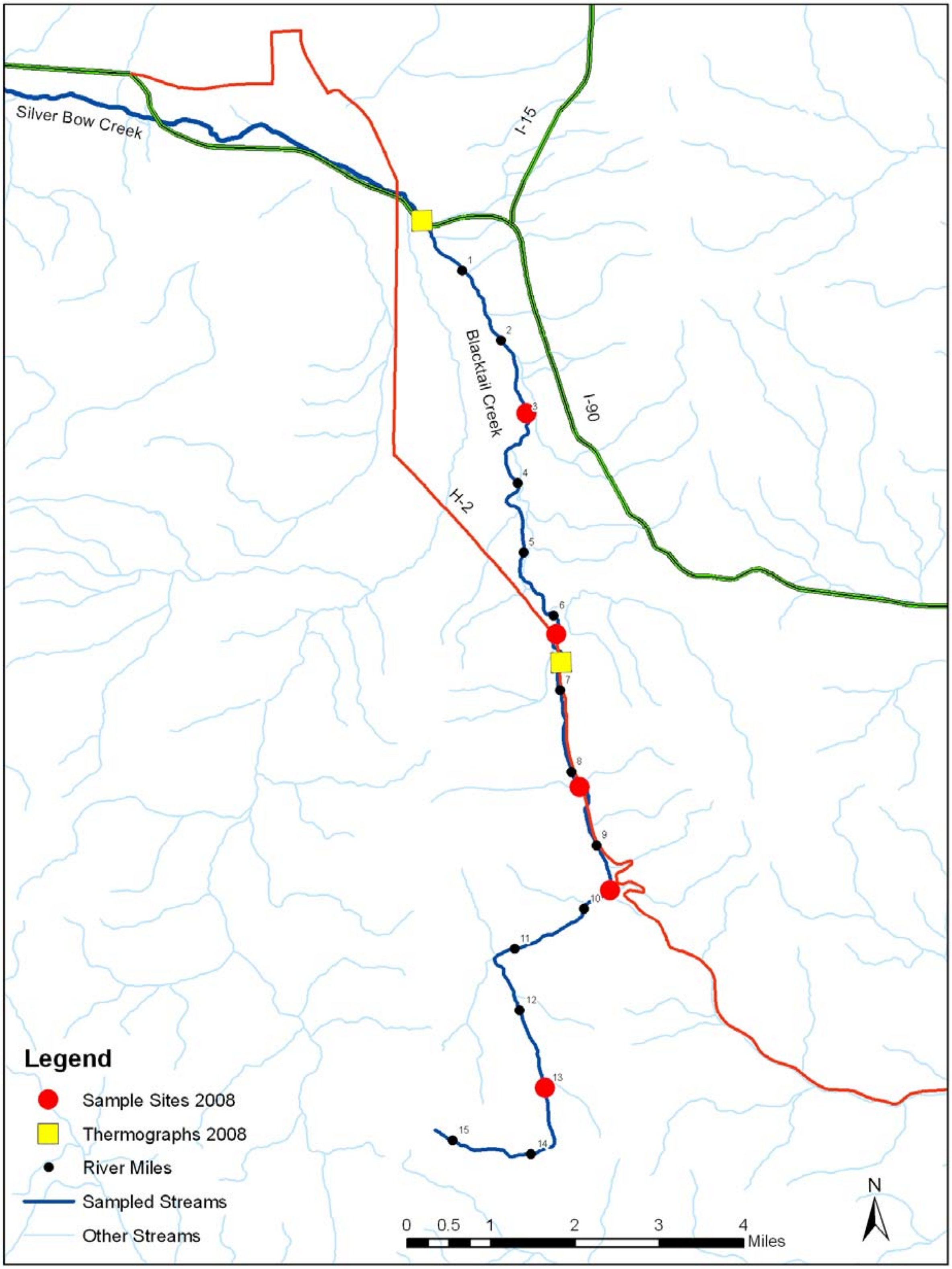
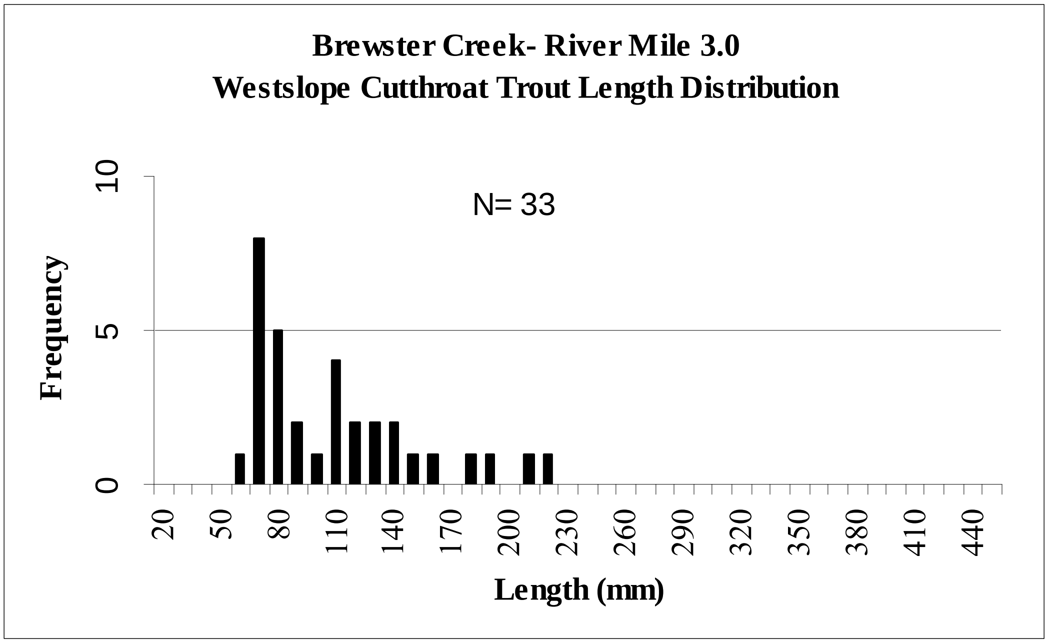


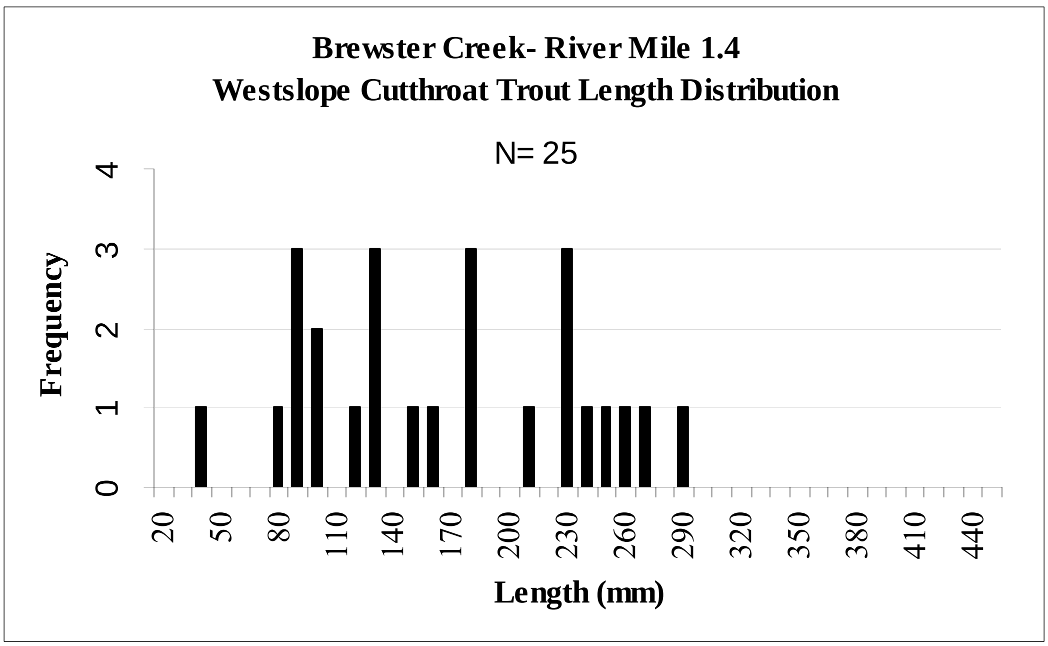
Figure 11. Map of Blacktail Creek showing sites of fish and temperature sampling conducted in 2008.

Appendix A

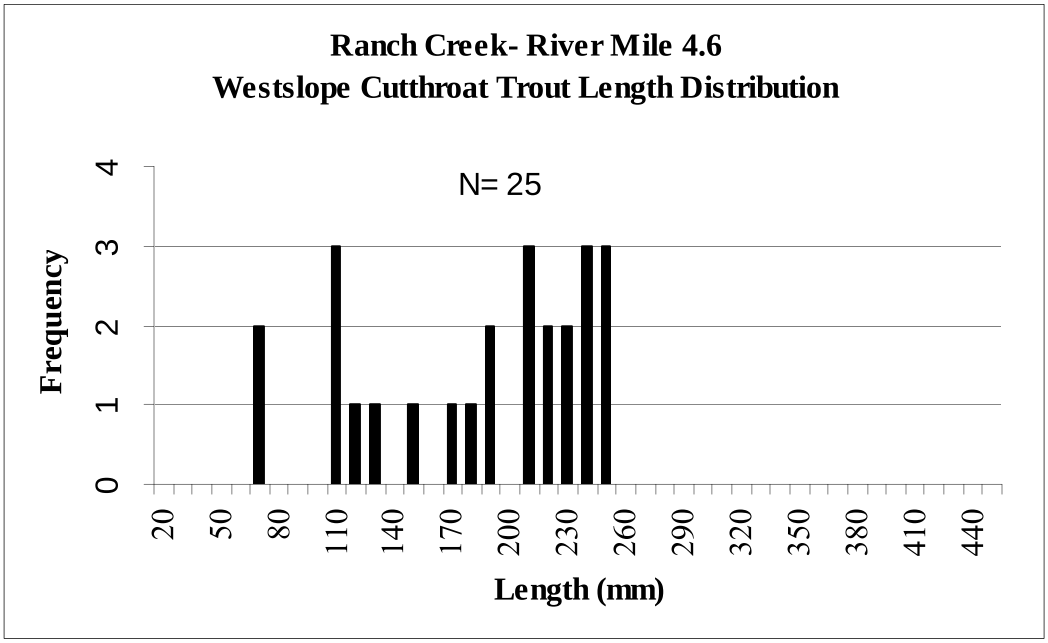
Rock Creek Drainage

Brewster Creek

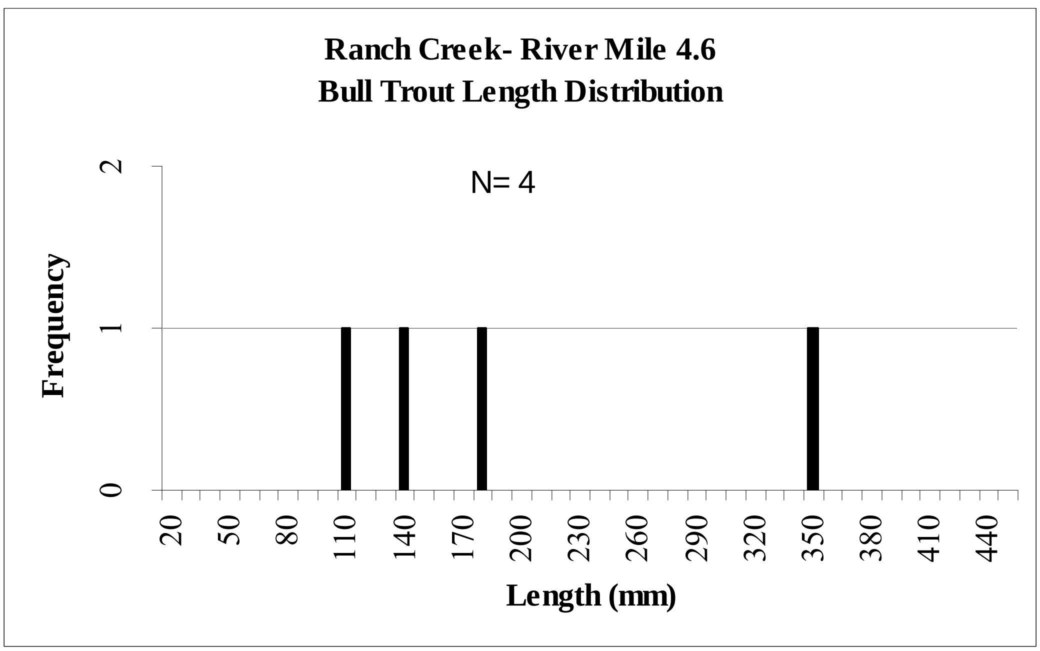




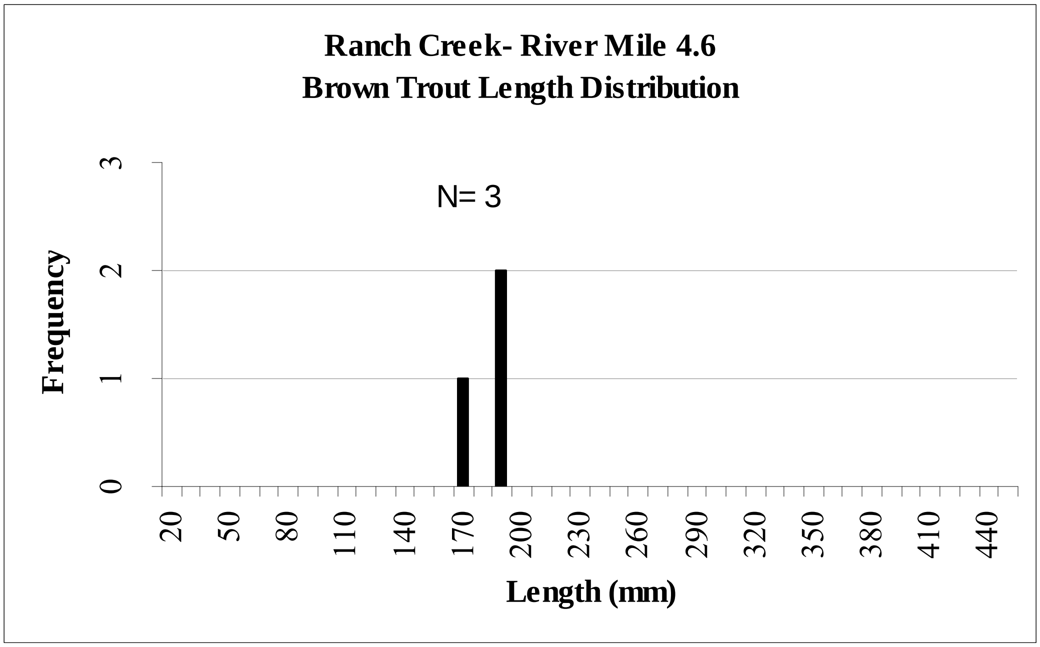
Ranch Creek



Ranch Creek- River Mile 4.6
Westslope Cutthroat Trout Length Distribution
N= 25
Frequency
0
1
2
3
4
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)



Ranch Creek- River Mile 4.6
Bull Trout Length Distribution
N= 4
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


Ranch Creek- River Mile 4.6
Brown Trout Length Distribution
N= 3
Frequency
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1
2
3
20
50
80
110
140
170
200
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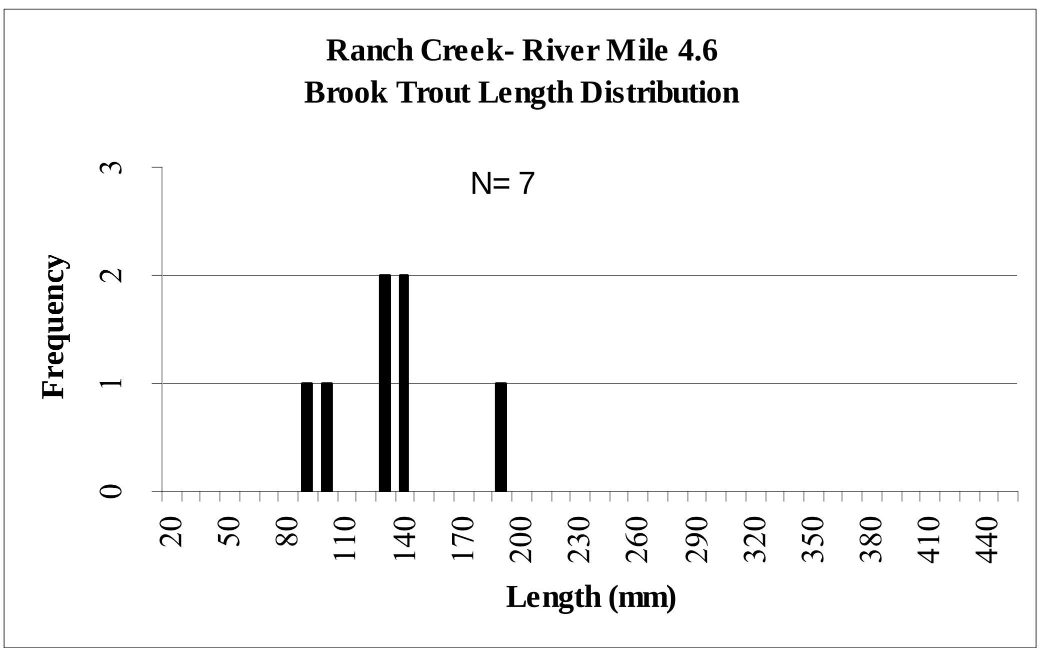
290
320
350
380
410
440
Length (mm)


Ranch Creek- River Mile 4.6
Brook Trout Length Distribution
N= 7
Frequency
0
1
2
3
20
50
80
110
140
170
200
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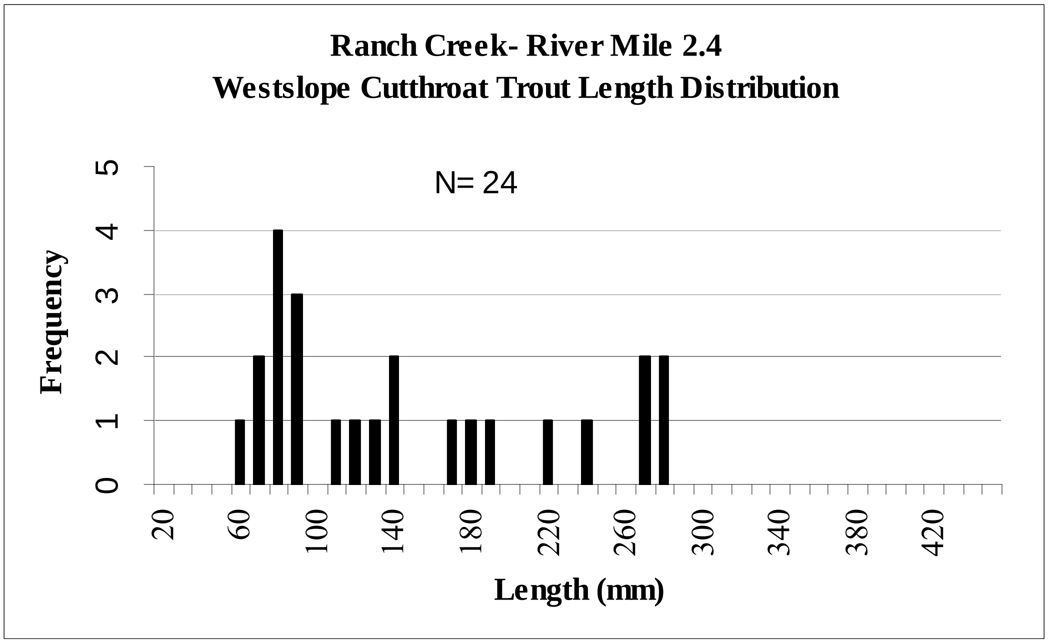
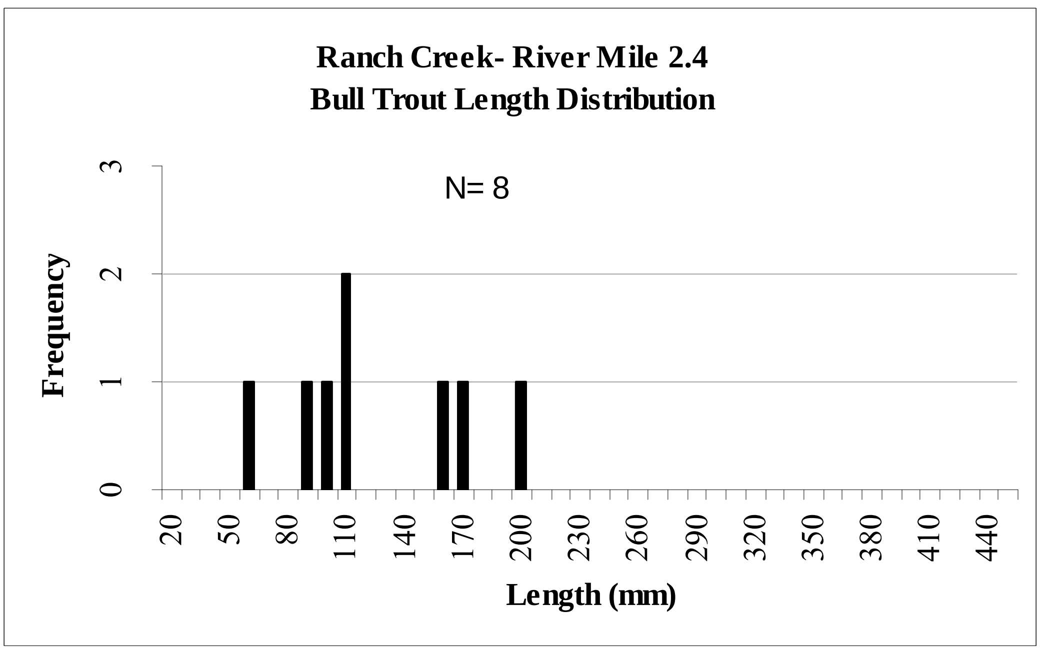
320
350
380
410
440
Length (mm)


Ranch Creek- River Mile 2.4
Westslope Cutthroat Trout Length Distribution
N= 24
Frequency
0
1
2
3
4
5
20
60
100
140
180
220
260
300
340
380
420
Length (mm)


Ranch Creek- River Mile 2.4
Bull Trout Length Distribution
N= 8
Frequency
0
1
2
3
20
50
80
110
140
170
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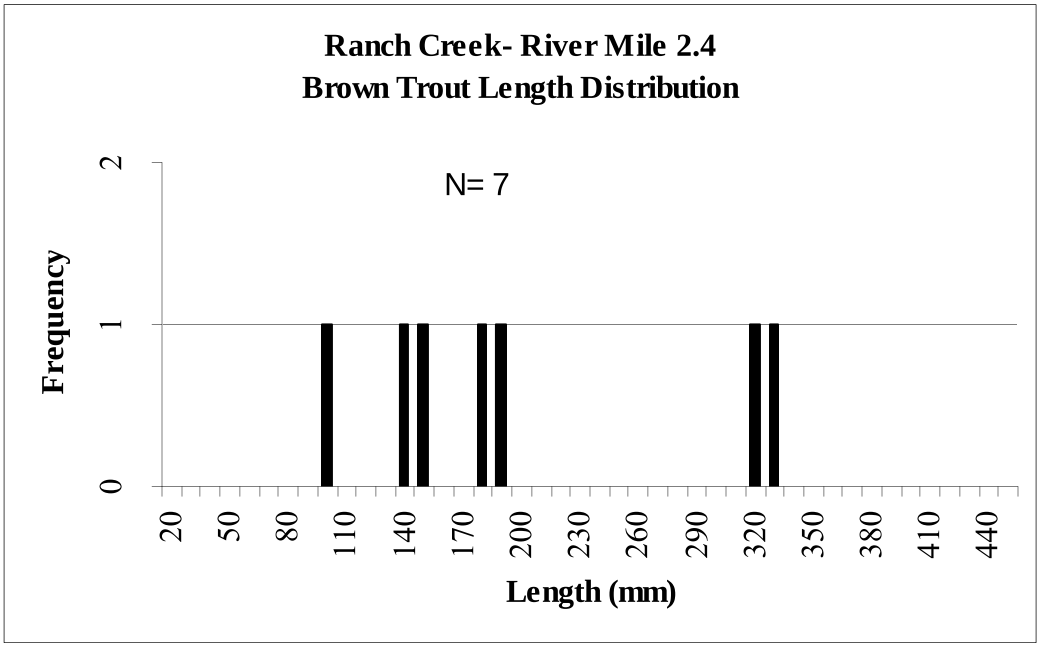
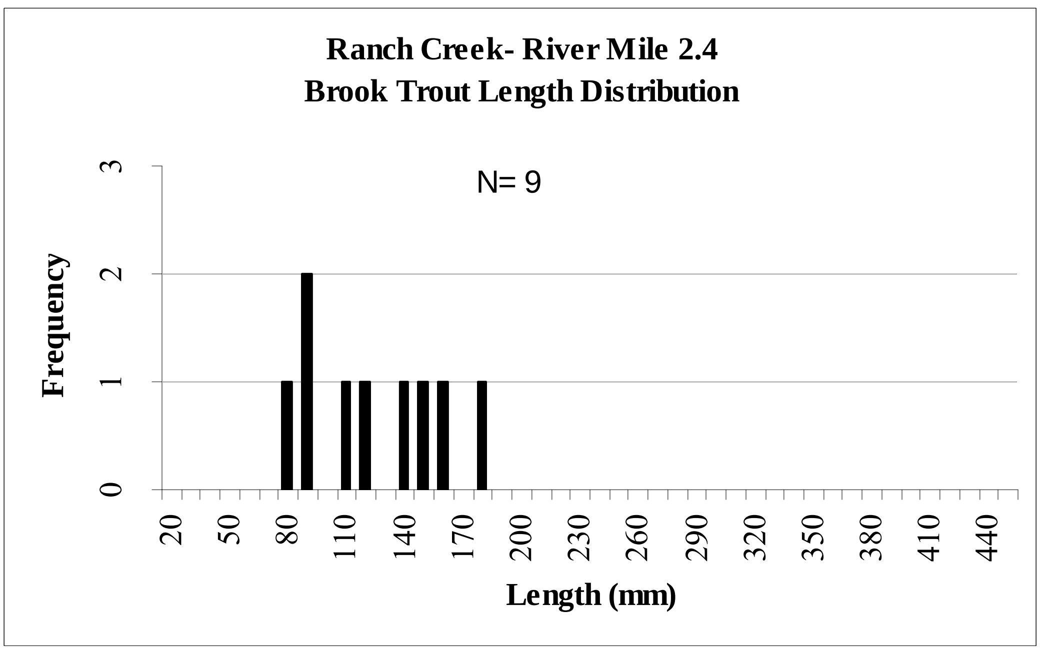
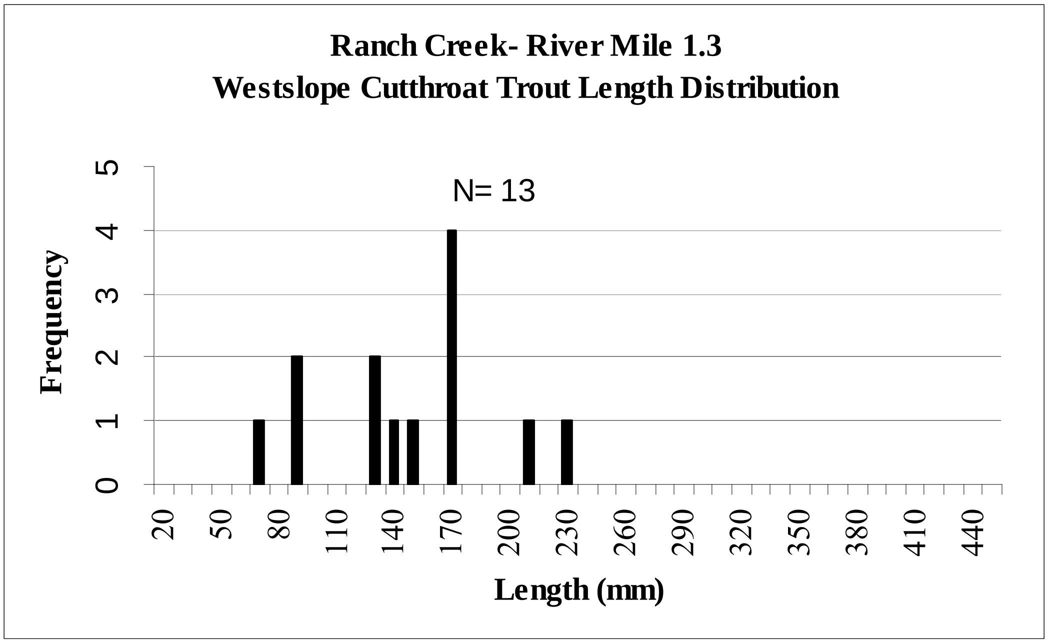
350
380
410
440
Length (mm)



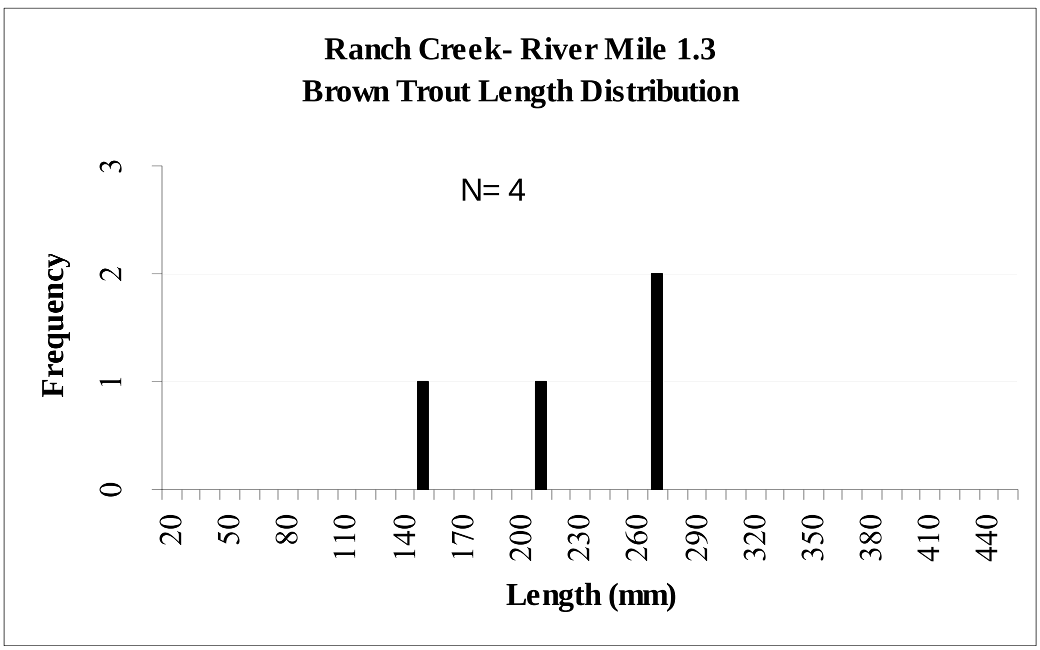
Ranch Creek- River Mile 2.4
Brown Trout Length Distribution
N= 7
Frequency
0
1
2
20 50 80 110 140 170 200 230 260 290 320 350 380 410 440
Length (mm)



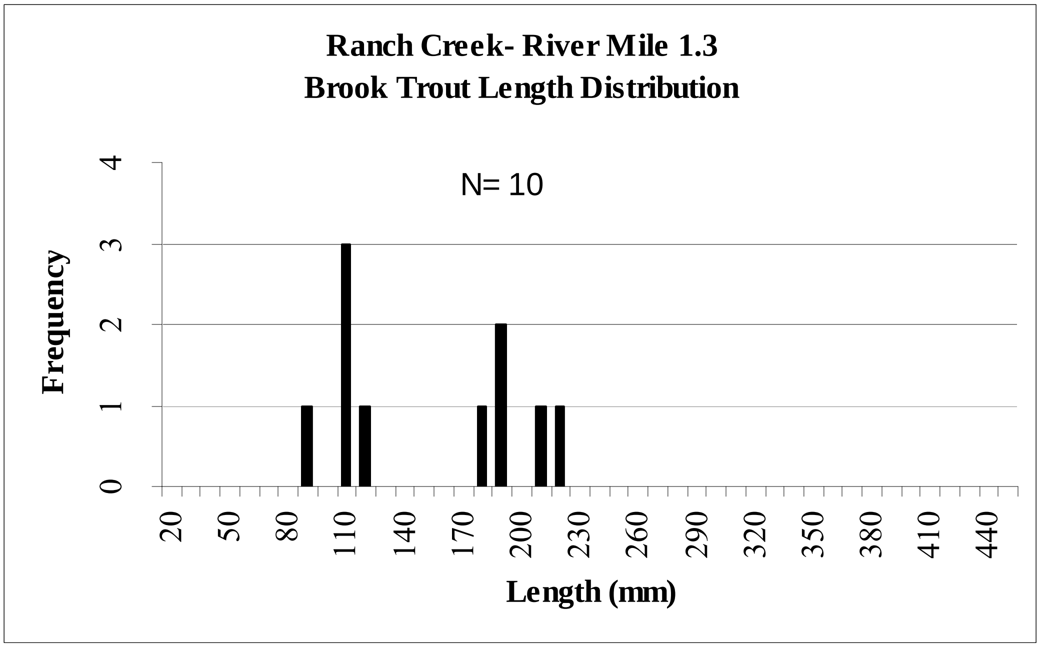
Ranch Creek- River Mile 2.4
Brook Trout Length Distribution
N= 9
Frequency
0
1
2
3
20 50 80 110 140 170 200 230 260 290 320 350 380 410 440
Length (mm)



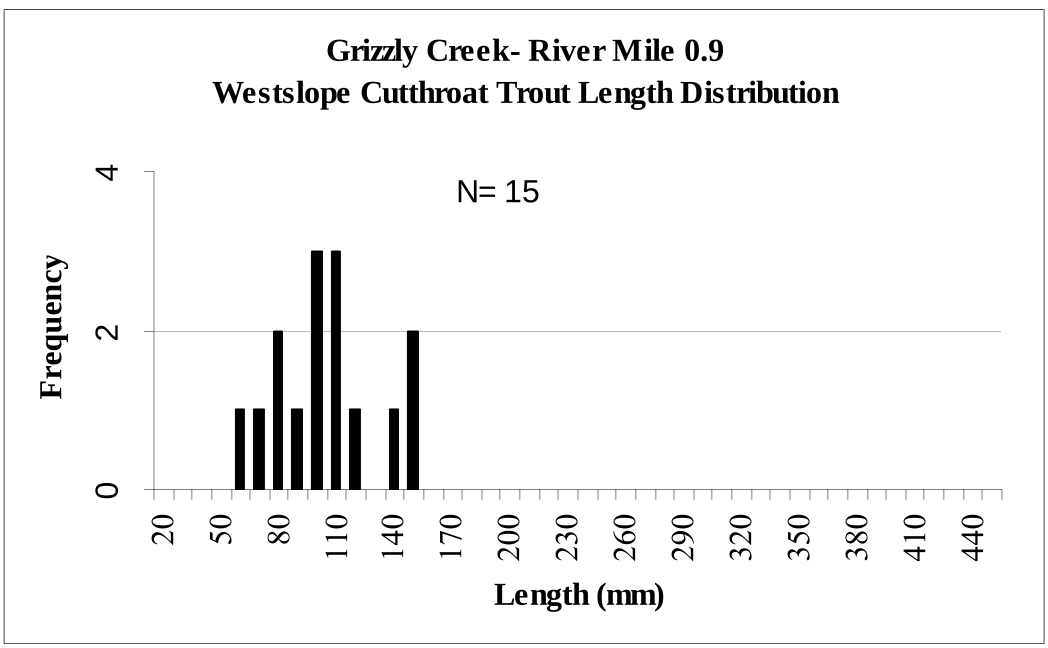
Ranch Creek- River Mile 1.3
Westslope Cutthroat Trout Length Distribution
N= 13
Frequency
0
1
2
3
4
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)



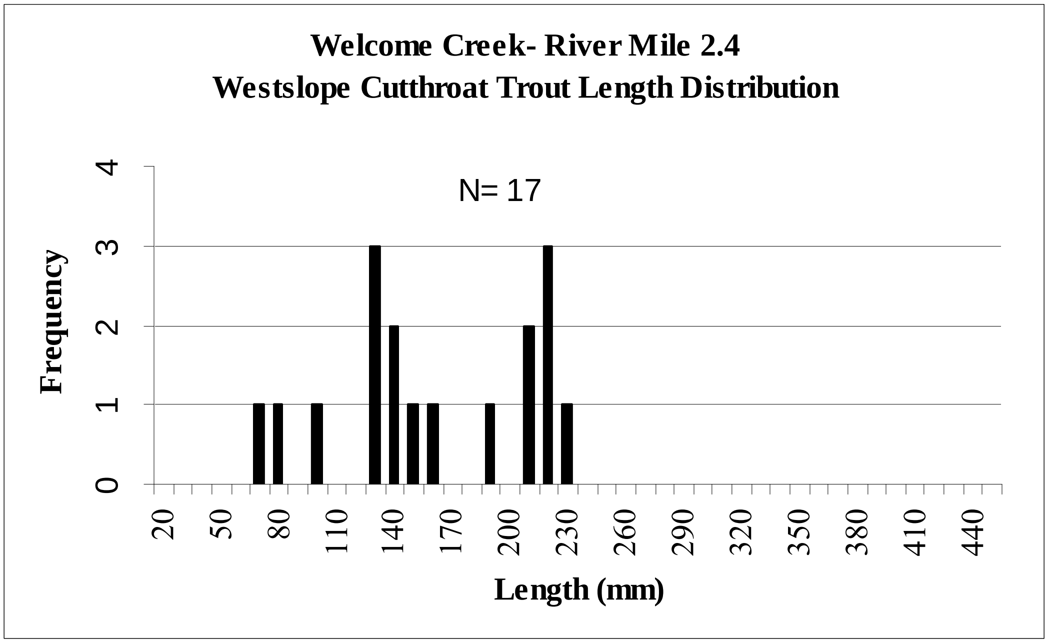
Ranch Creek- River Mile 1.3
Brown Trout Length Distribution
N= 4
Frequency
0
1
2
3
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

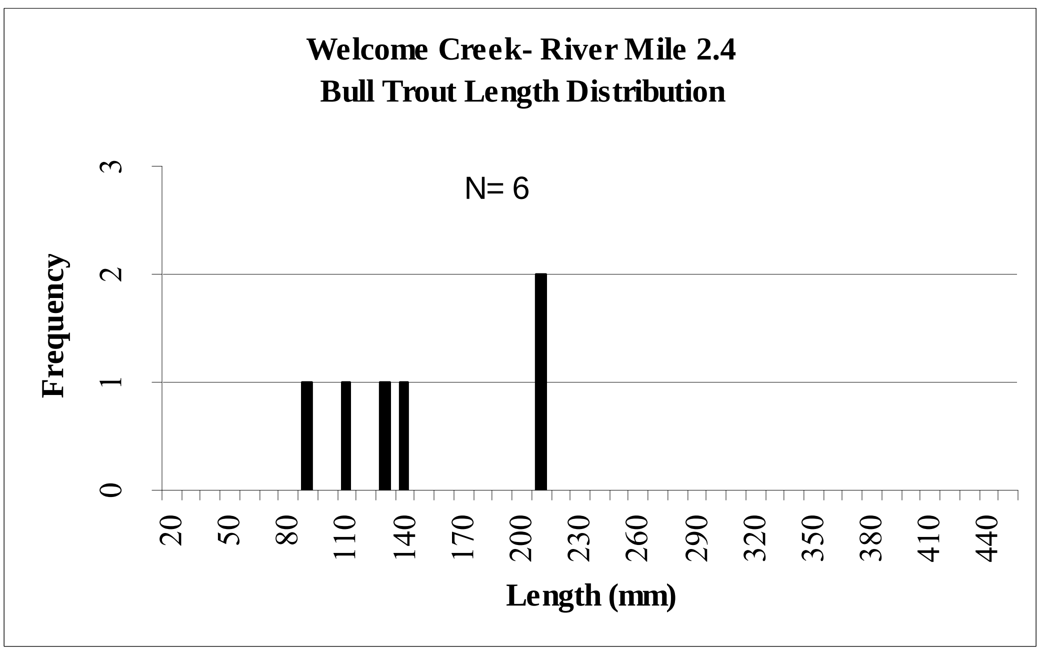


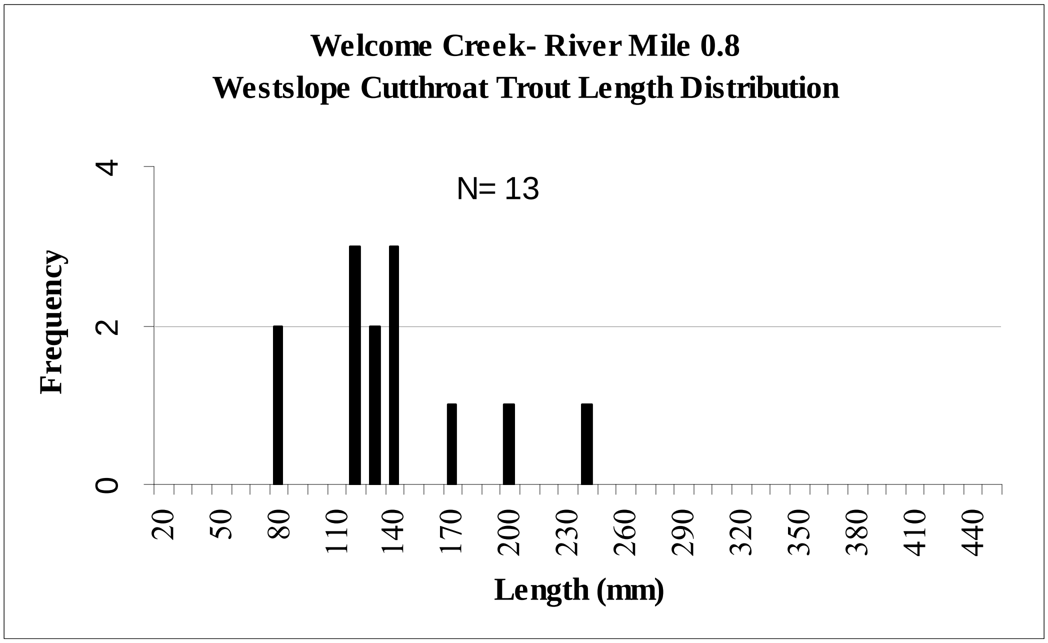
Grizzly Creek

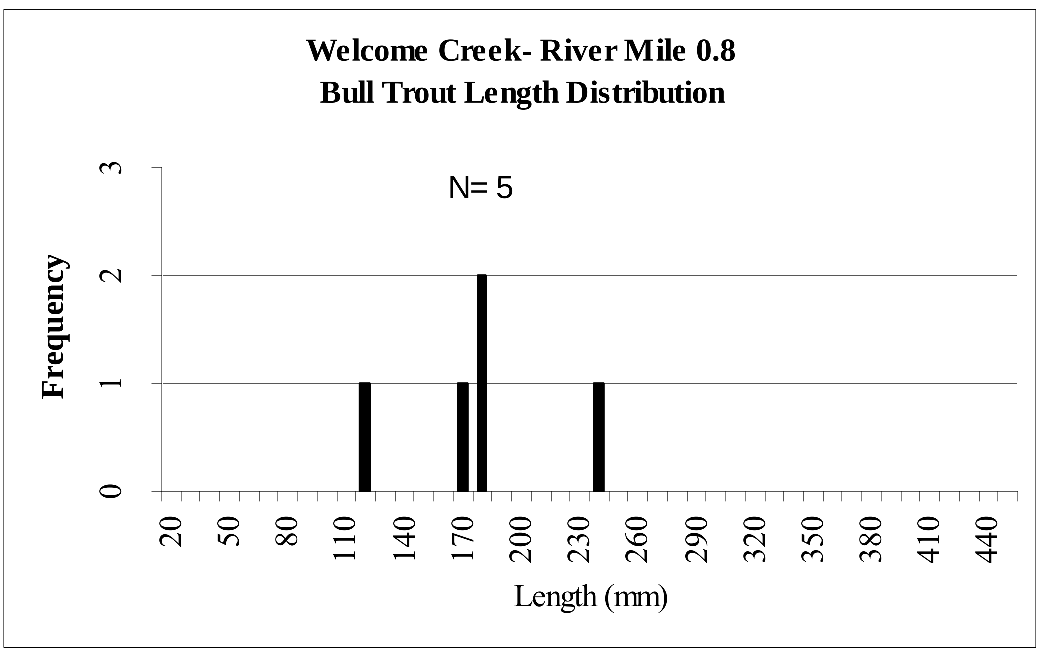


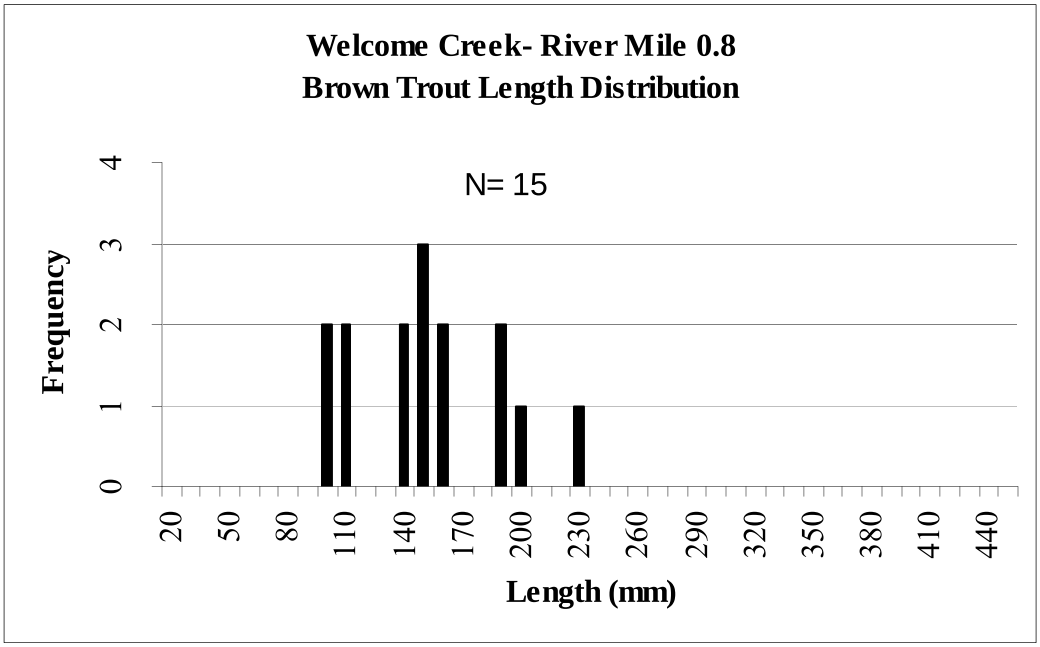
Welcome Creek

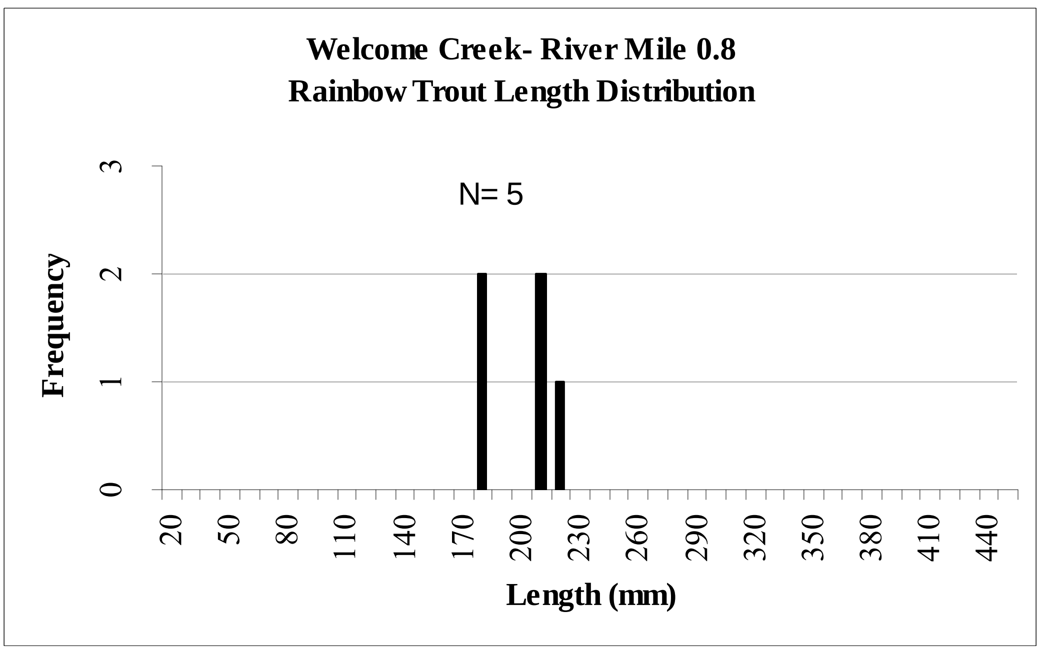




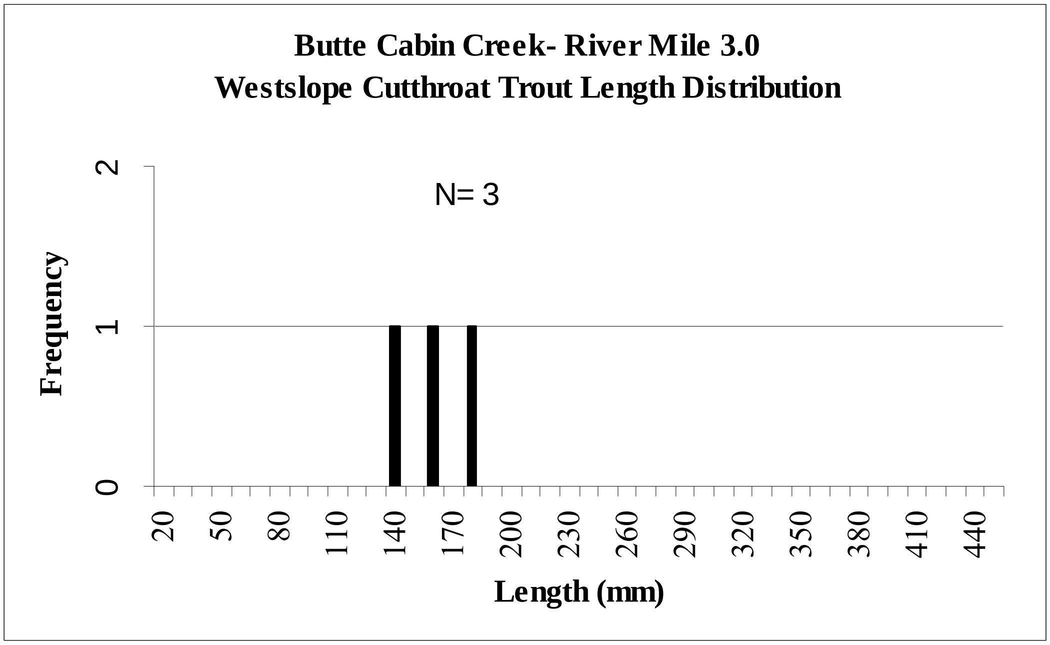

Welcome Creek- River Mile 0.8
Westslope Cutthroat Trout Length Distribution
N= 13
Frequency
0
2
4
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

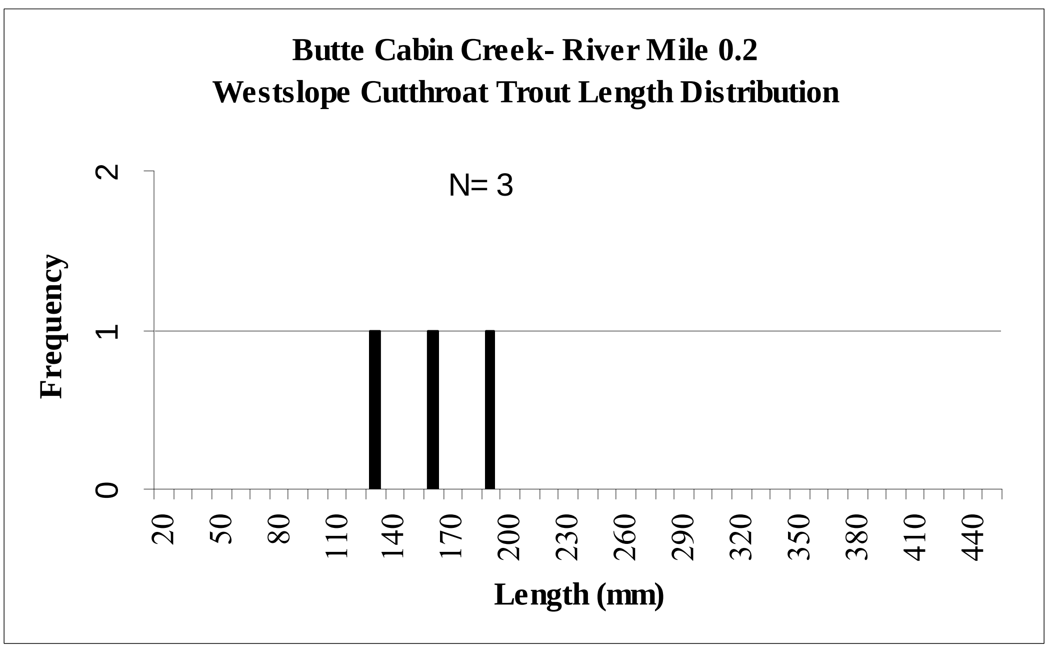

Welcome Creek- River Mile 0.8
Bull Trout Length Distribution
N= 5
Frequency
0
1
2
3
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

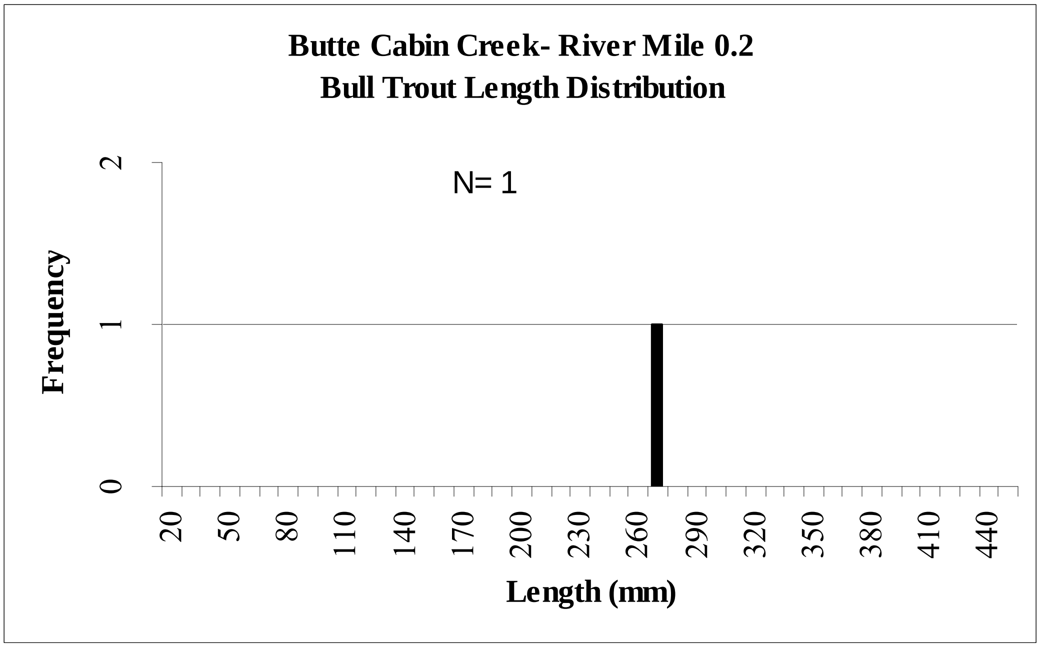

Welcome Creek- River Mile 0.8
Brown Trout Length Distribution
N= 15
Frequency
0
1
2
3
4
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


Welcome Creek- River Mile 0.8
Rainbow Trout Length Distribution
N= 5
Frequency
0
1
2
3
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

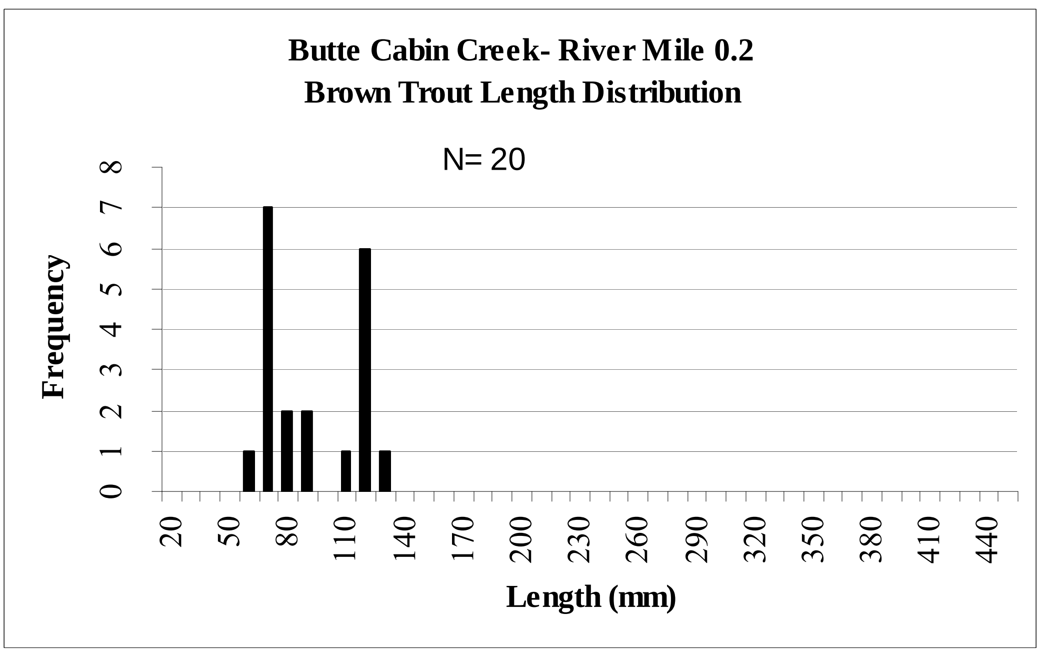
Butte Cabin Creek



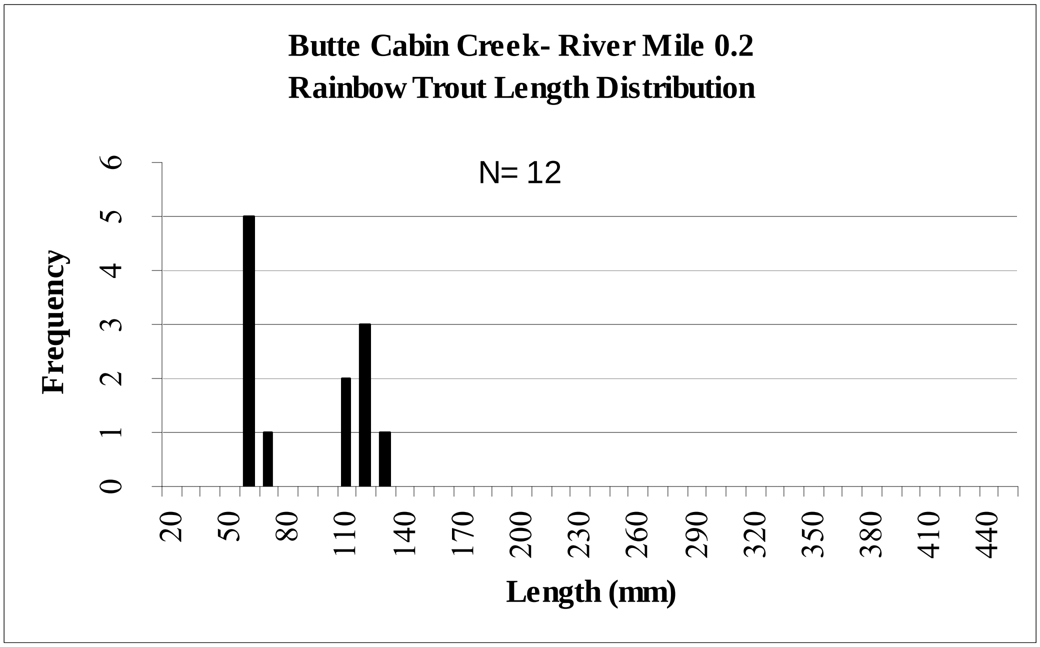




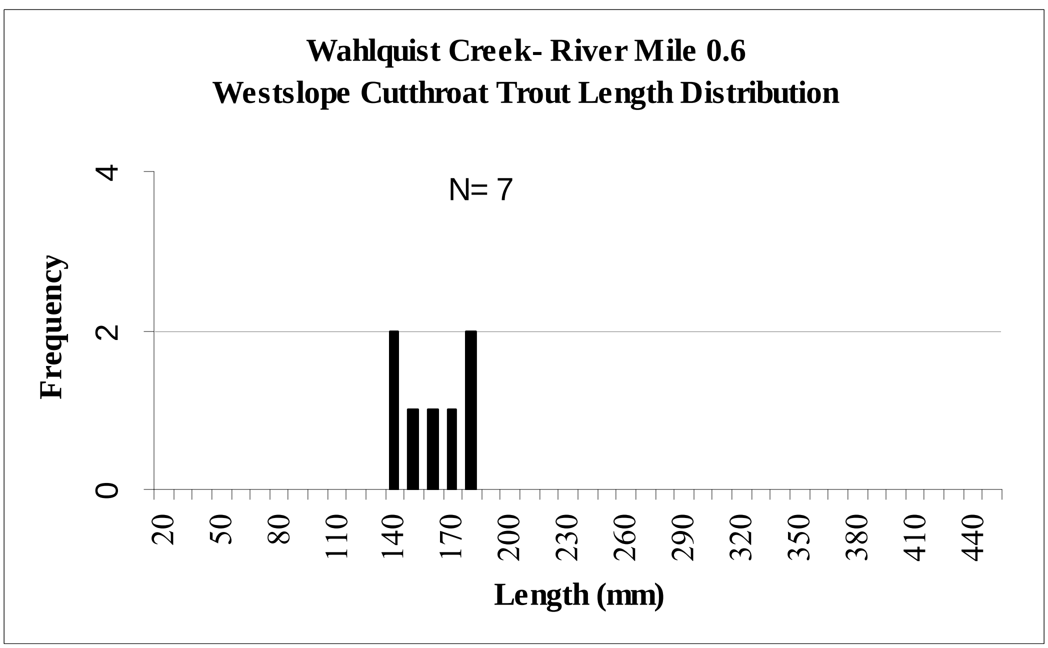
Butte Cabin Creek- River Mile 0.2
Bull Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)



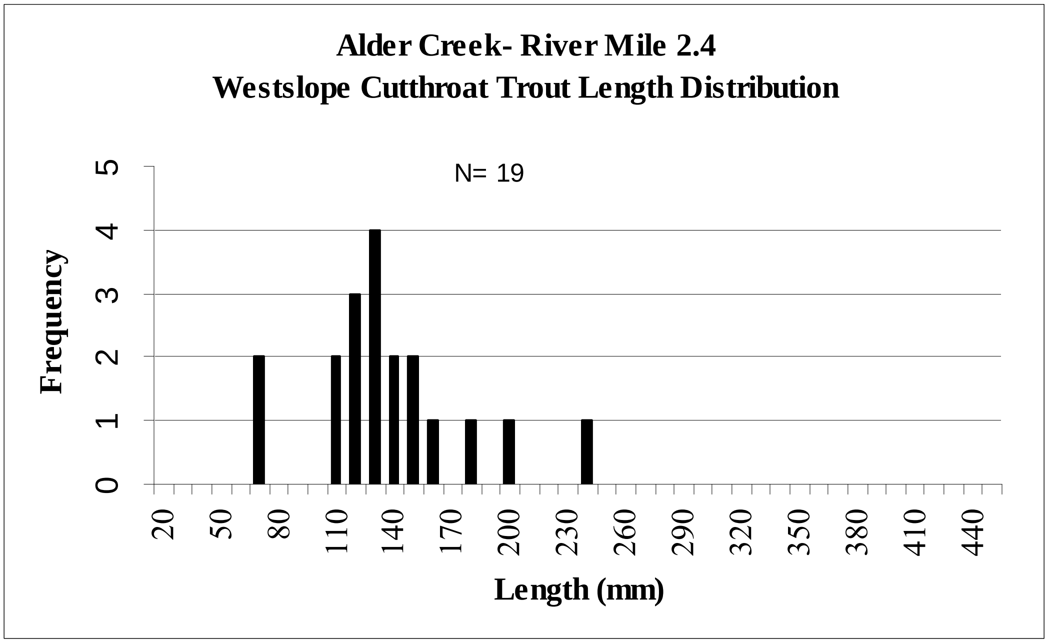
Butte Cabin Creek- River Mile 0.2
Brown Trout Length Distribution
N= 20
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)



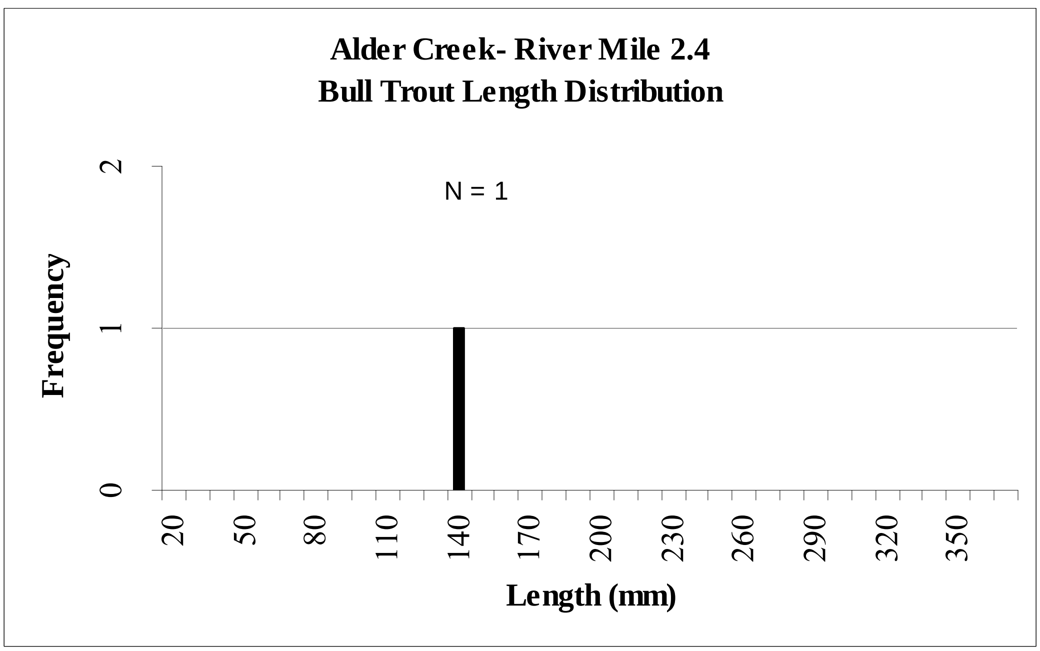
Wahlquist Creek



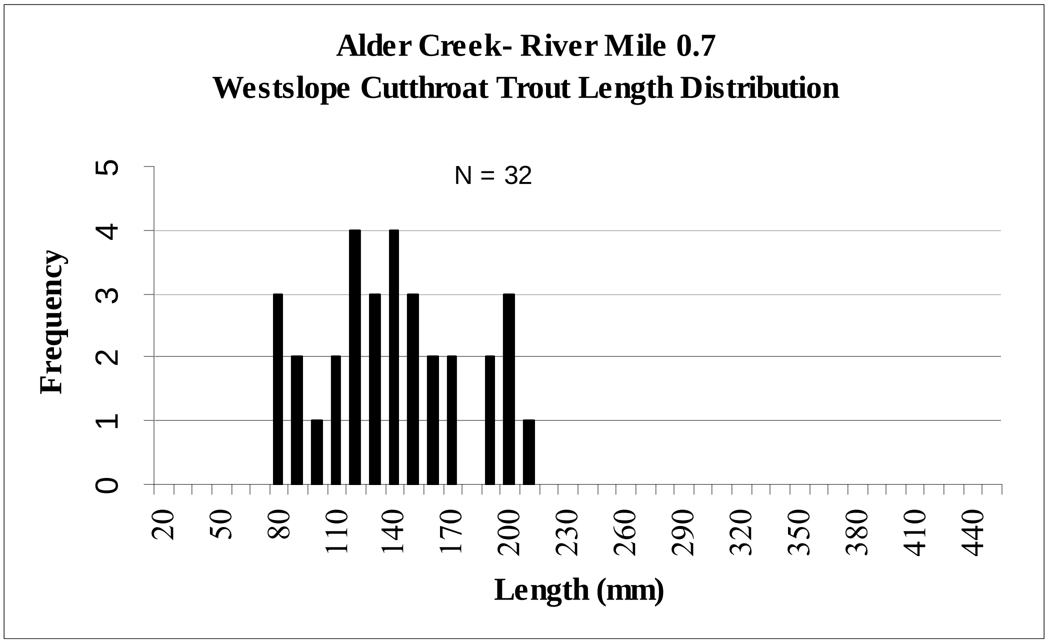
Alder Creek

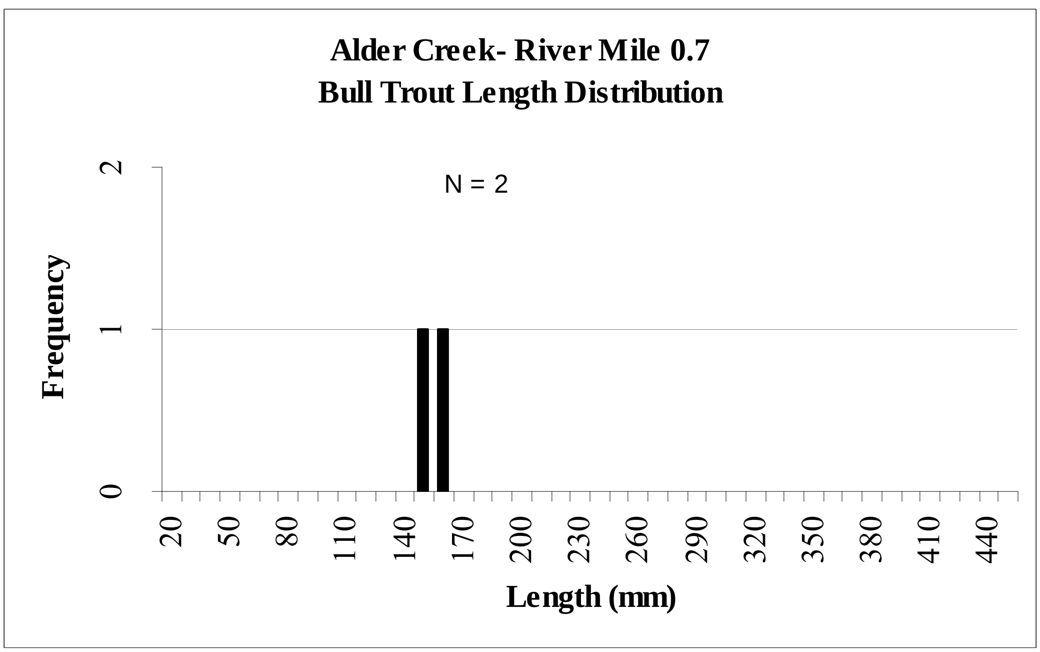


Alder Creek- River Mile 2.4
Westslope Cutthroat Trout Length Distribution
N= 19
Frequency
0
1
2
3
4
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

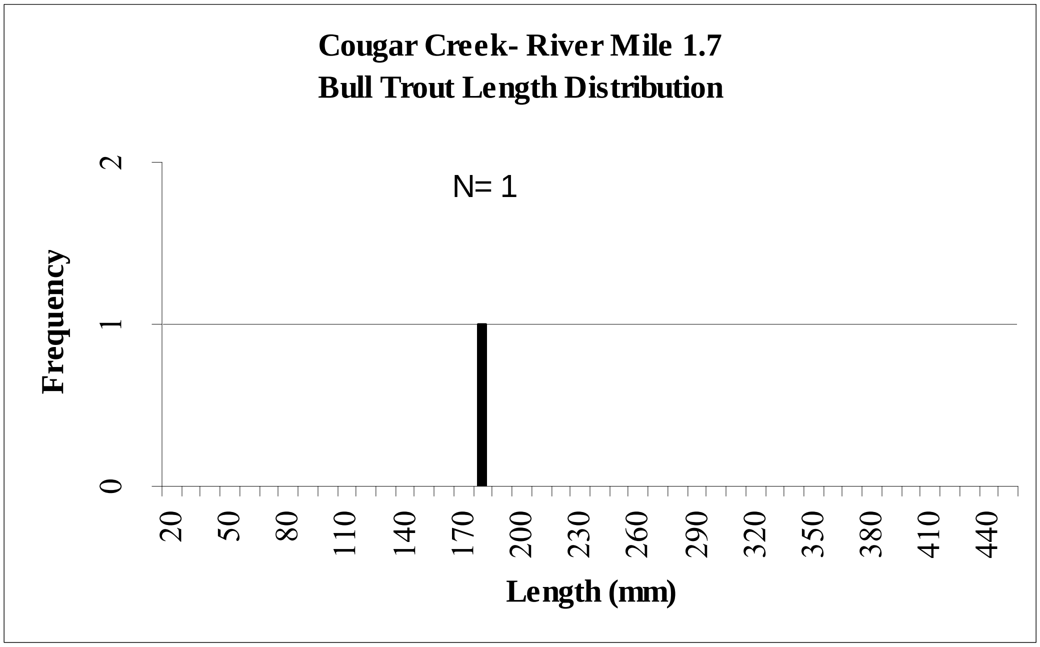


Alder Creek- River Mile 2.4
Bull Trout Length Distribution
N = 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
Length (mm)

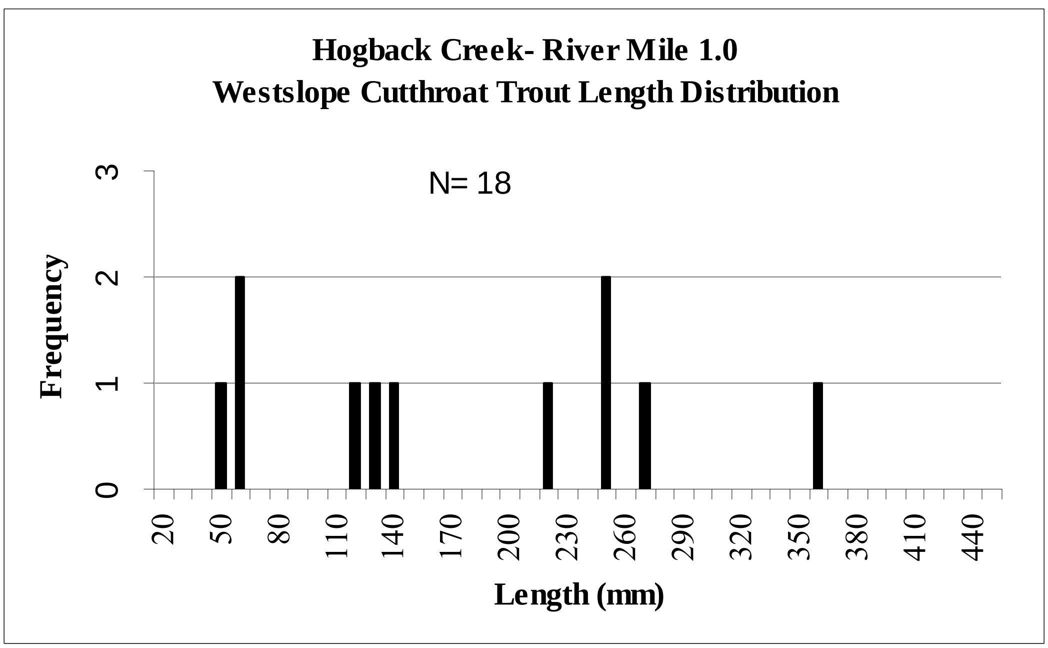

Alder Creek- River Mile 0.7
Westslope Cutthroat Trout Length Distribution
N = 32
Frequency
0
1
2
3
4
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

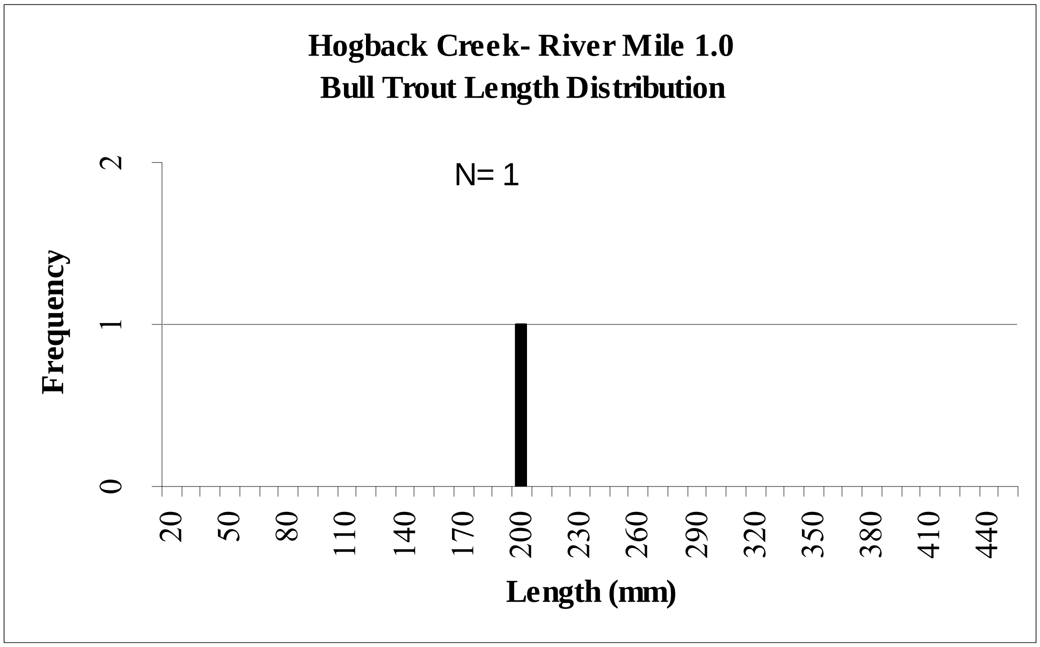

Alder Creek- River Mile 0.7
Bull Trout Length Distribution
N = 2
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

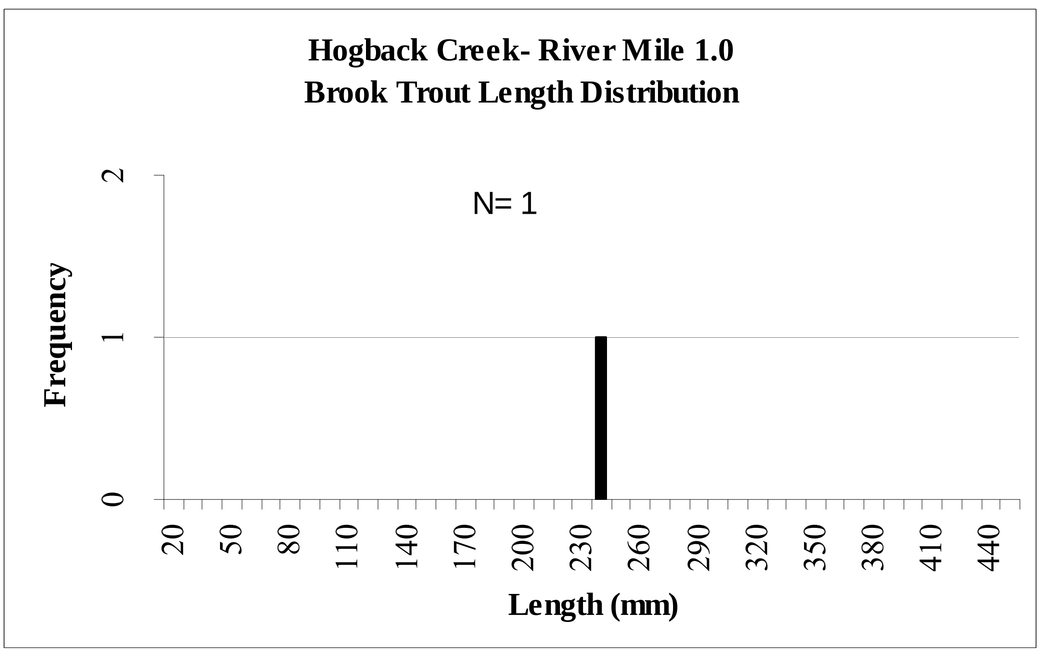
Cougar Creek

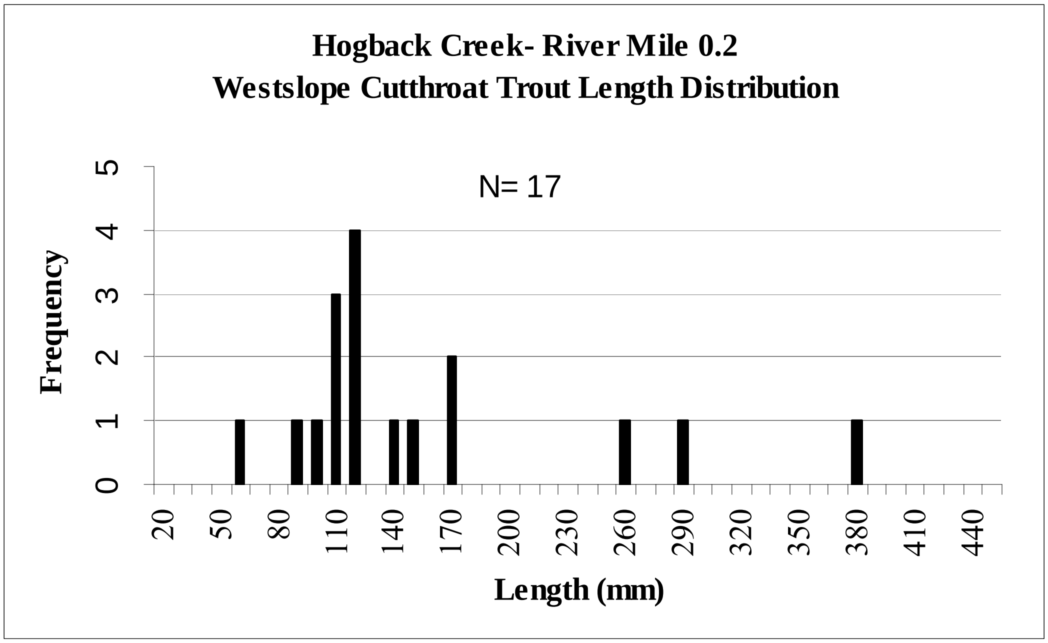


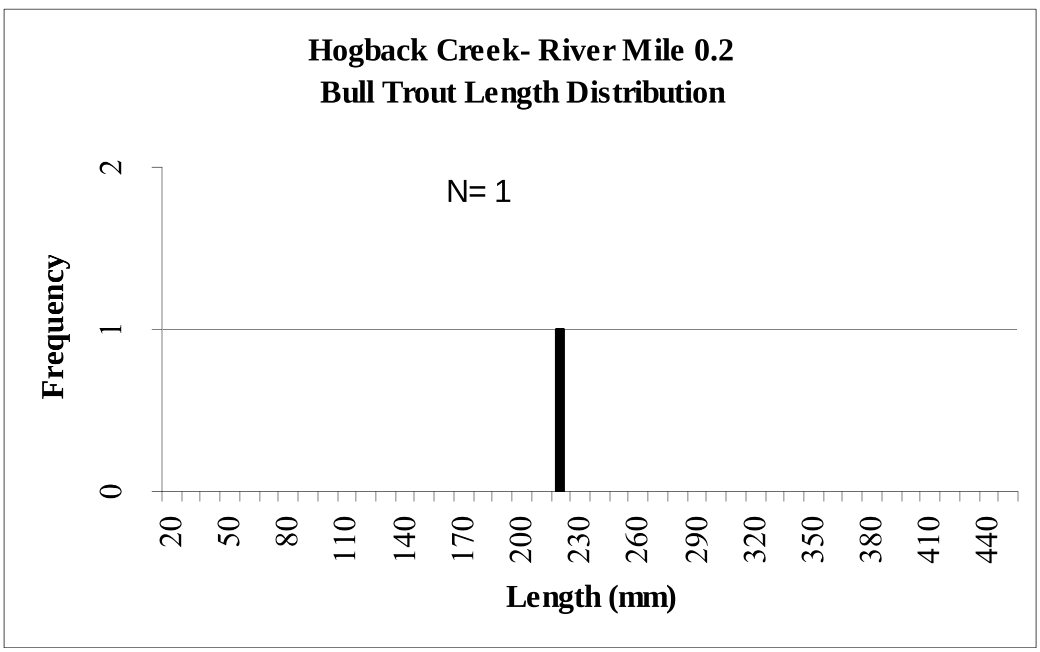
Hogback Creek

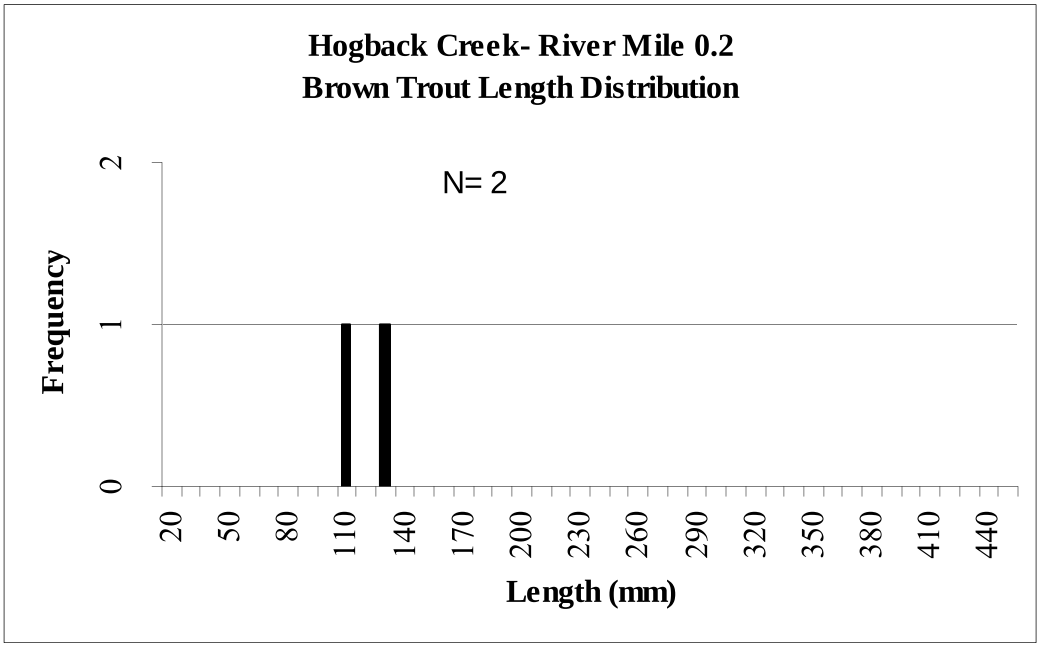


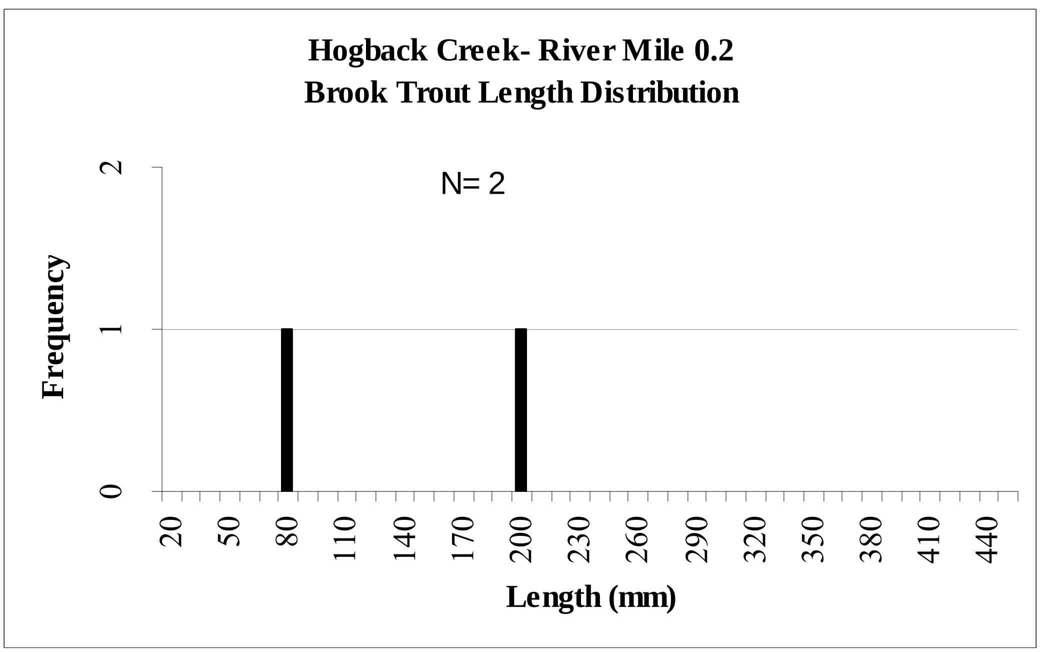

Hogback Creek- River Mile 1.0
Bull Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


Hogback Creek- River Mile 1.0
Brook Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

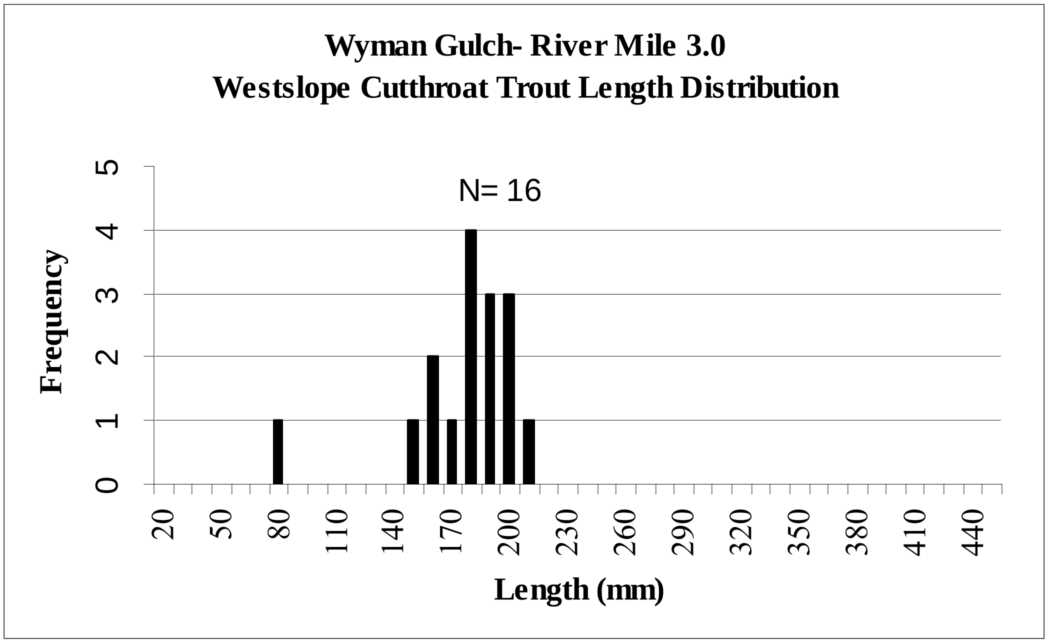

Hogback Creek- River Mile 0.2
Westslope Cutthroat Trout Length Distribution
N= 17
Frequency
0
1
2
3
4
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

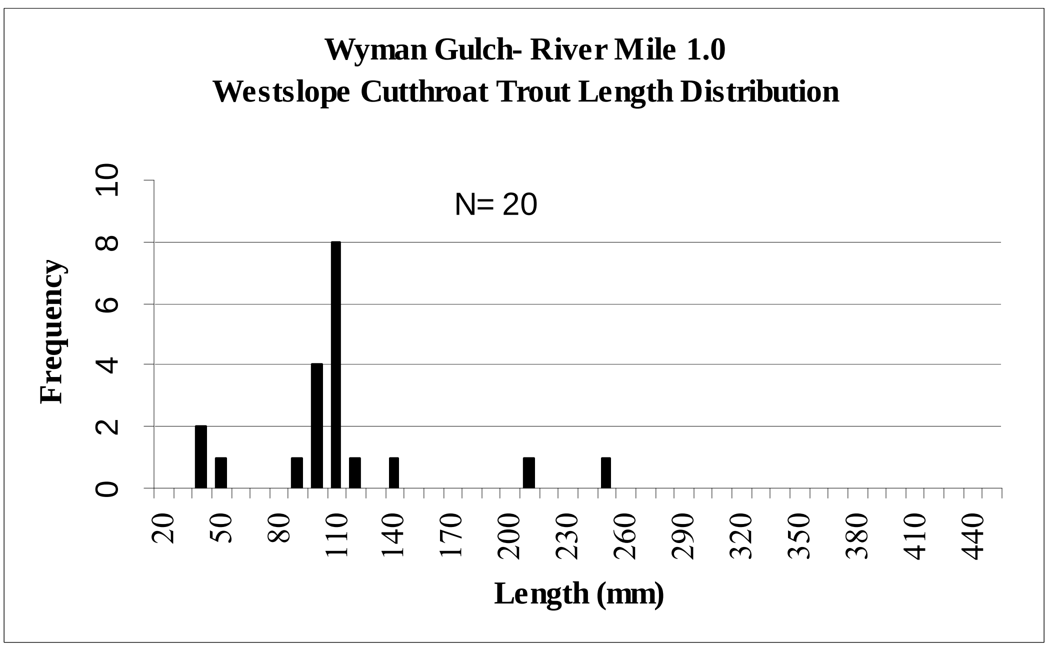

Hogback Creek- River Mile 0.2
Bull Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

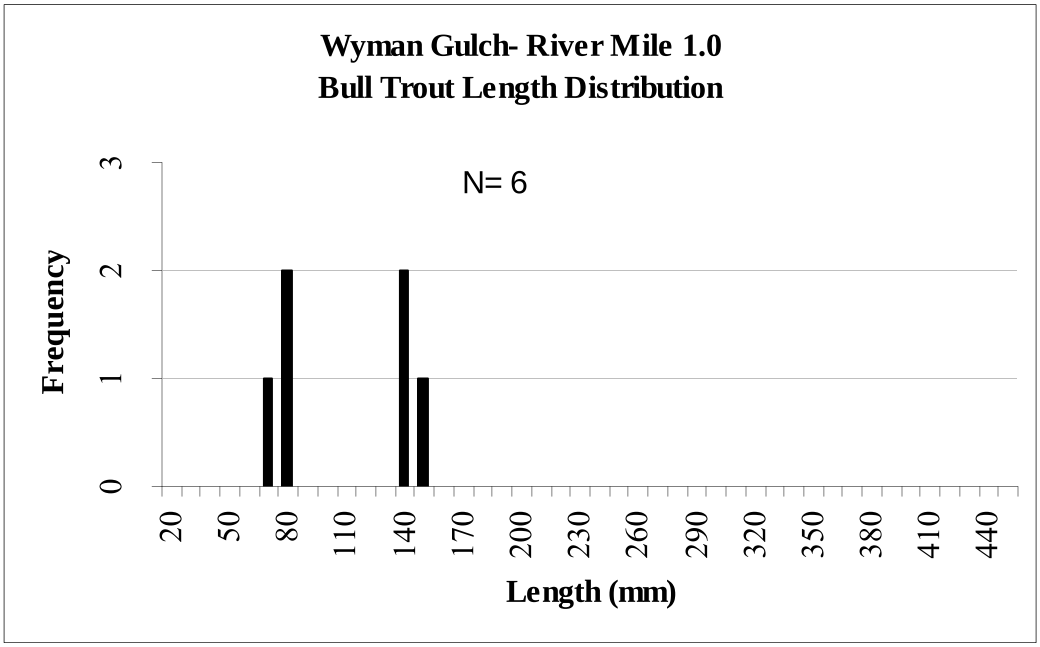

Hogback Creek- River Mile 0.2
Brown Trout Length Distribution
N= 2
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

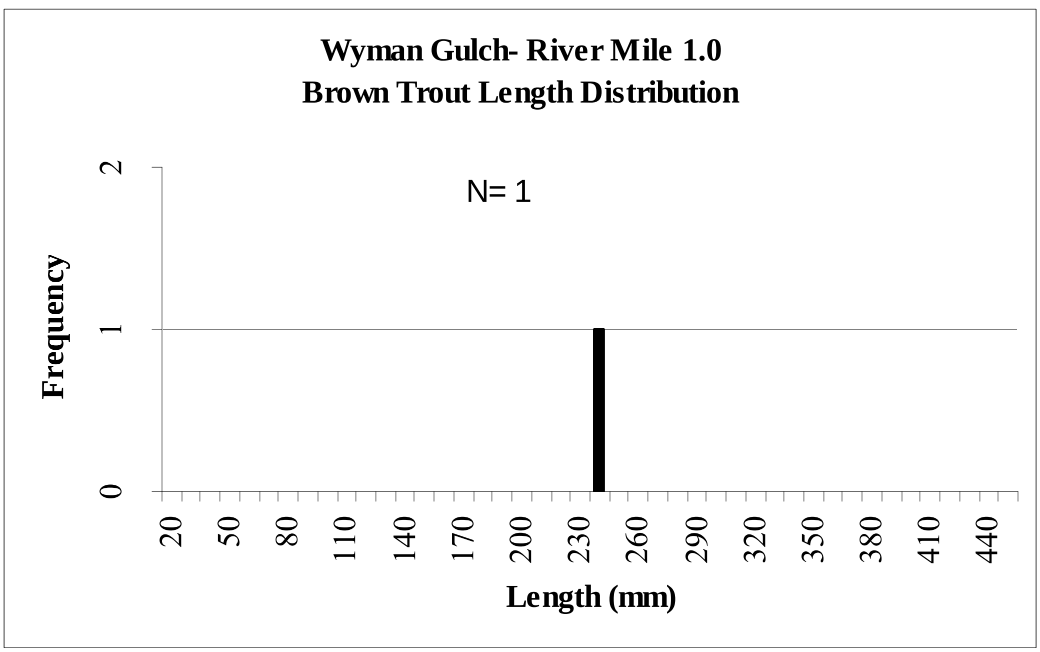

Hogback Creek- River Mile 0.2
Brook Trout Length Distribution
N= 2
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

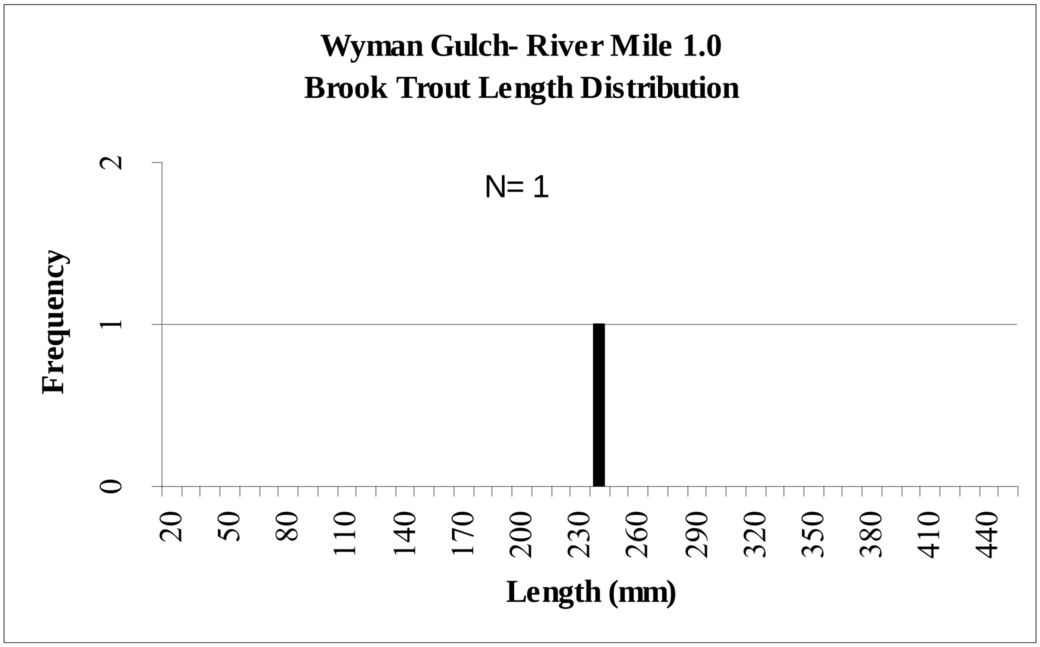
Wyman Gulch


Wyman Gulch- River Mile 3.0
Westslope Cutthroat Trout Length Distribution
N= 16
Frequency
0
1
2
3
4
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

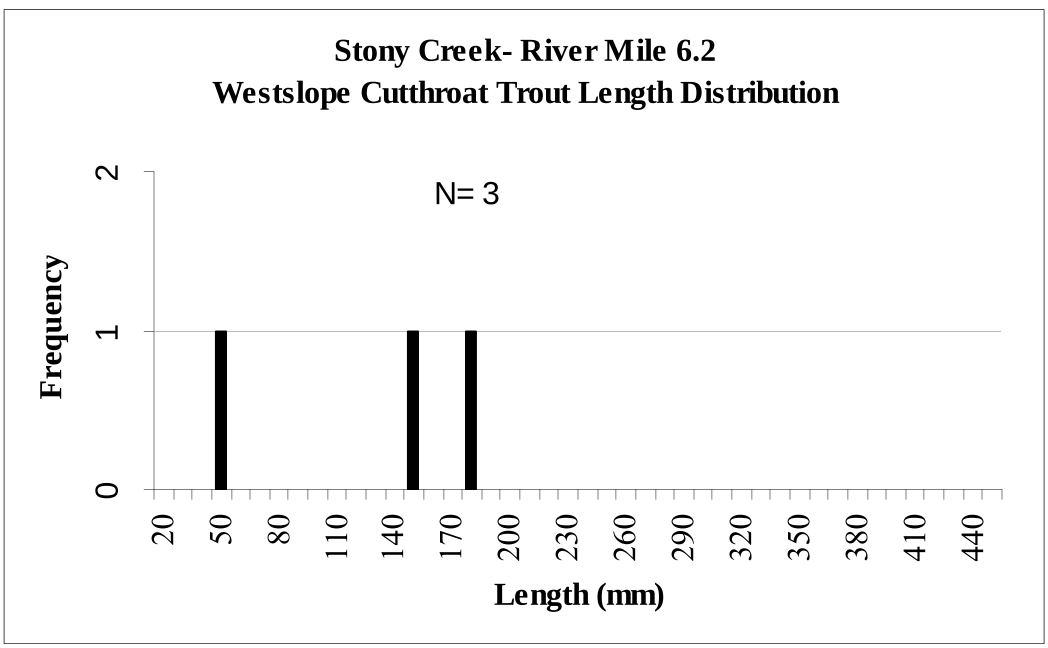

Wyman Gulch- River Mile 1.0
Westslope Cutthroat Trout Length Distribution
N= 20
Frequency
0
2
4
6
8
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

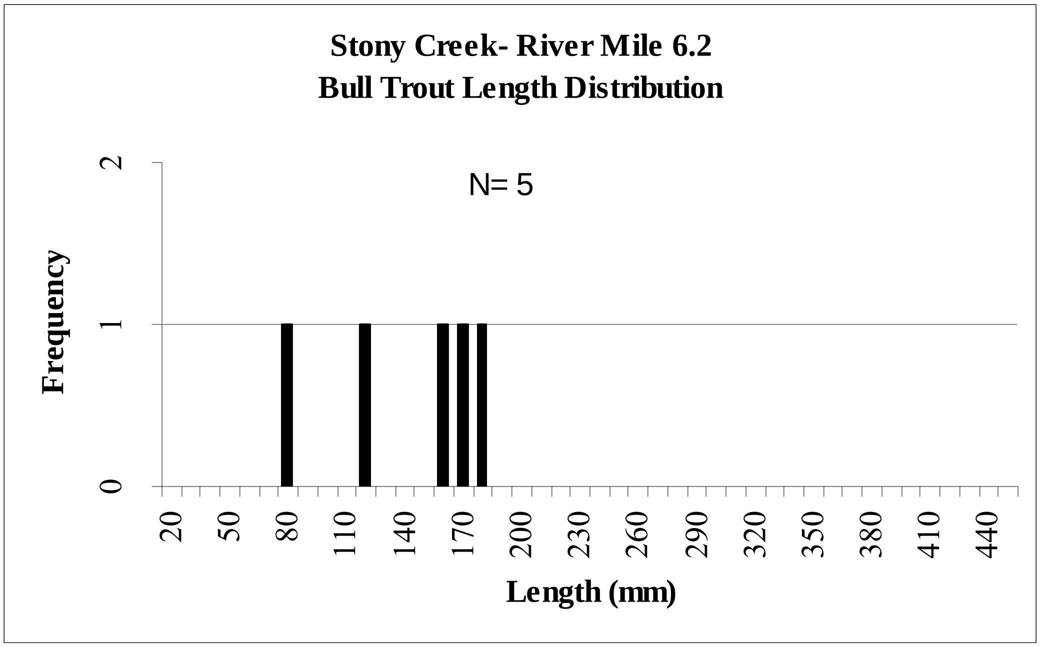

Wyman Gulch- River Mile 1.0
Bull Trout Length Distribution
N= 6
Frequency
0
1
2
3
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

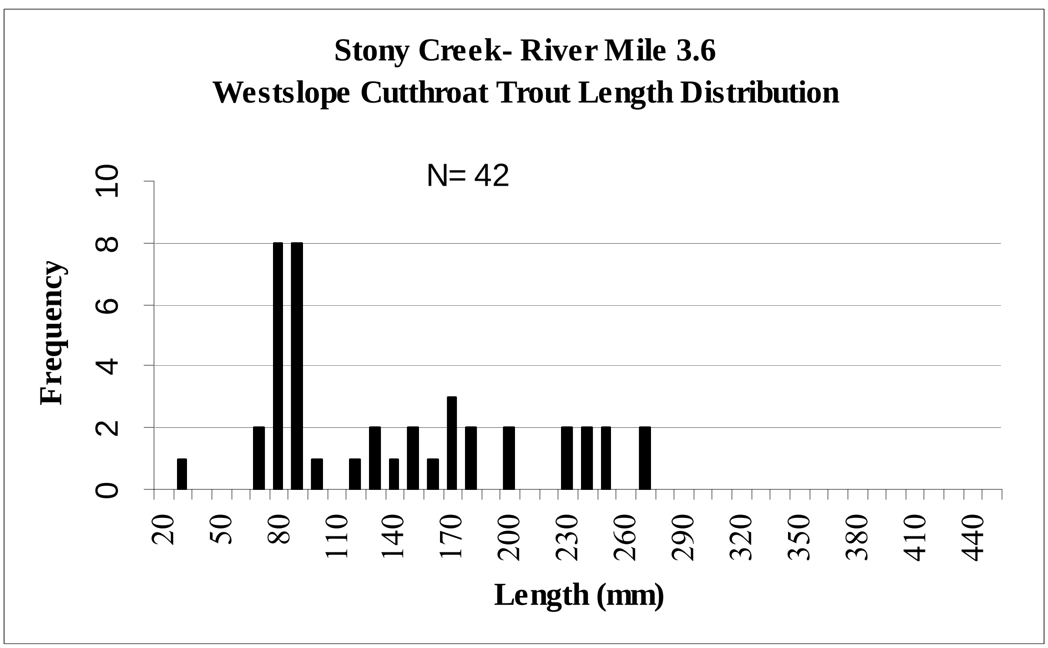

Wyman Gulch- River Mile 1.0
Brown Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

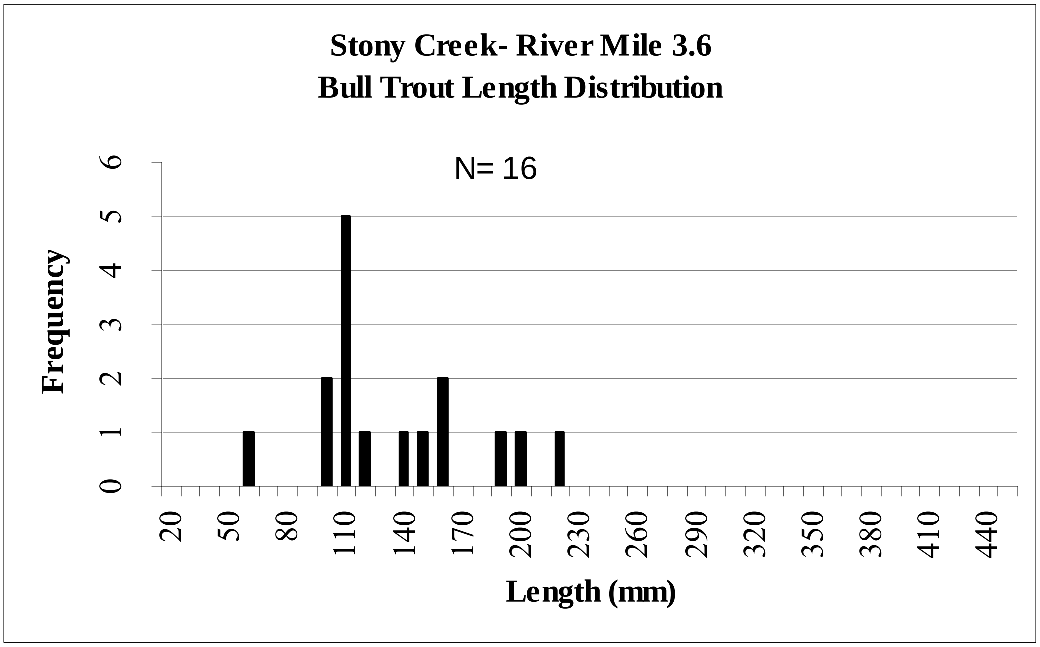

Wyman Gulch- River Mile 1.0
Brook Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

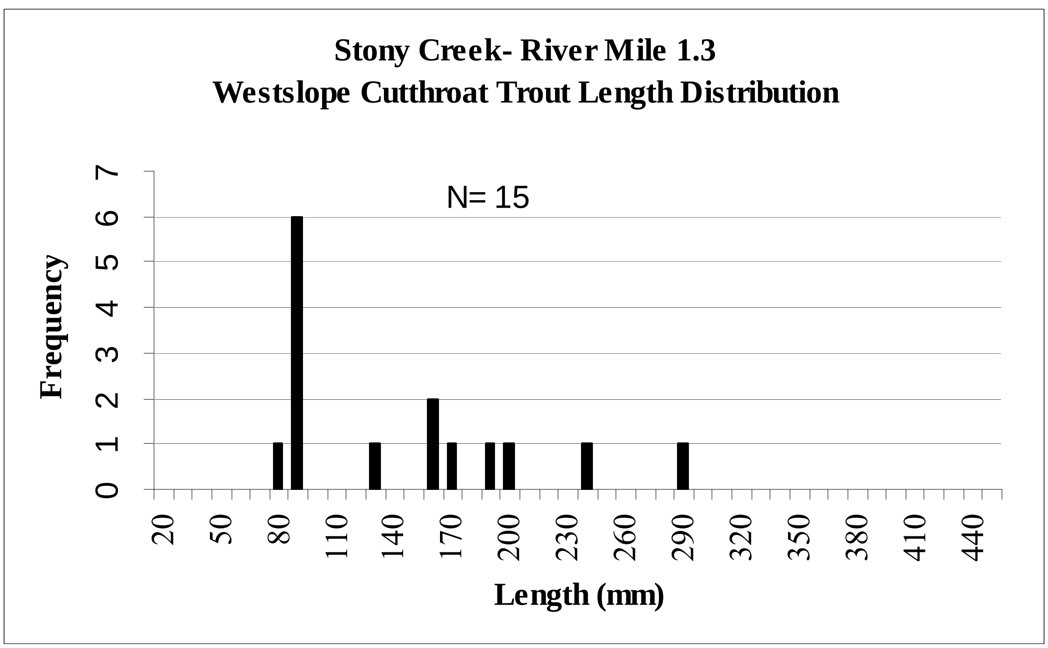
Stony Creek

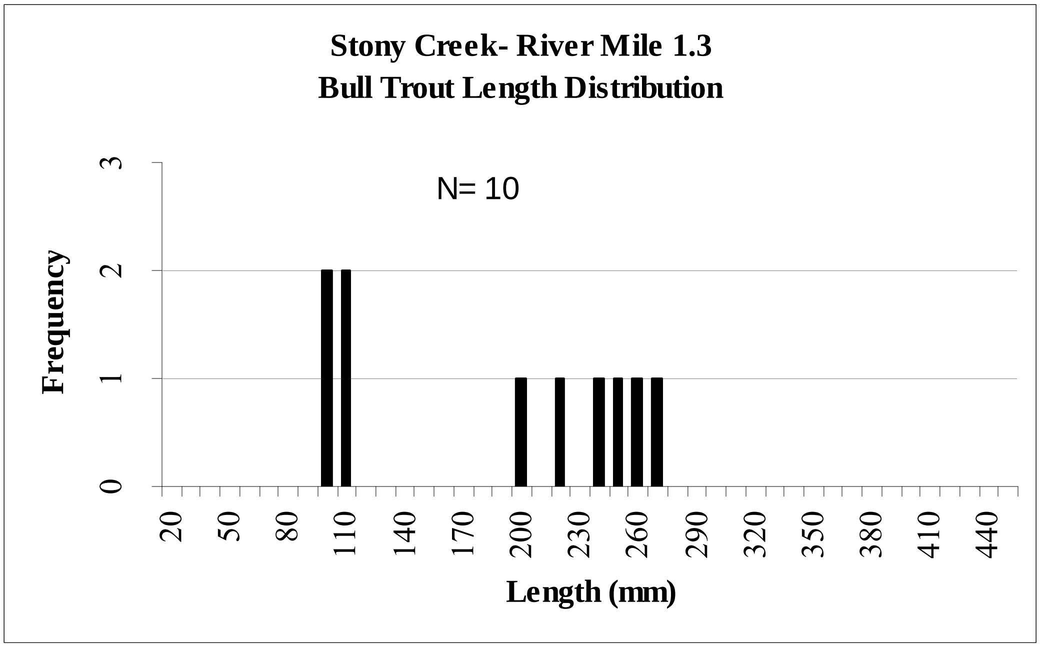

Stony Creek- River Mile 6.2
Westslope Cutthroat Trout Length Distribution
N= 3
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


Stony Creek- River Mile 6.2
Bull Trout Length Distribution
N= 5
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

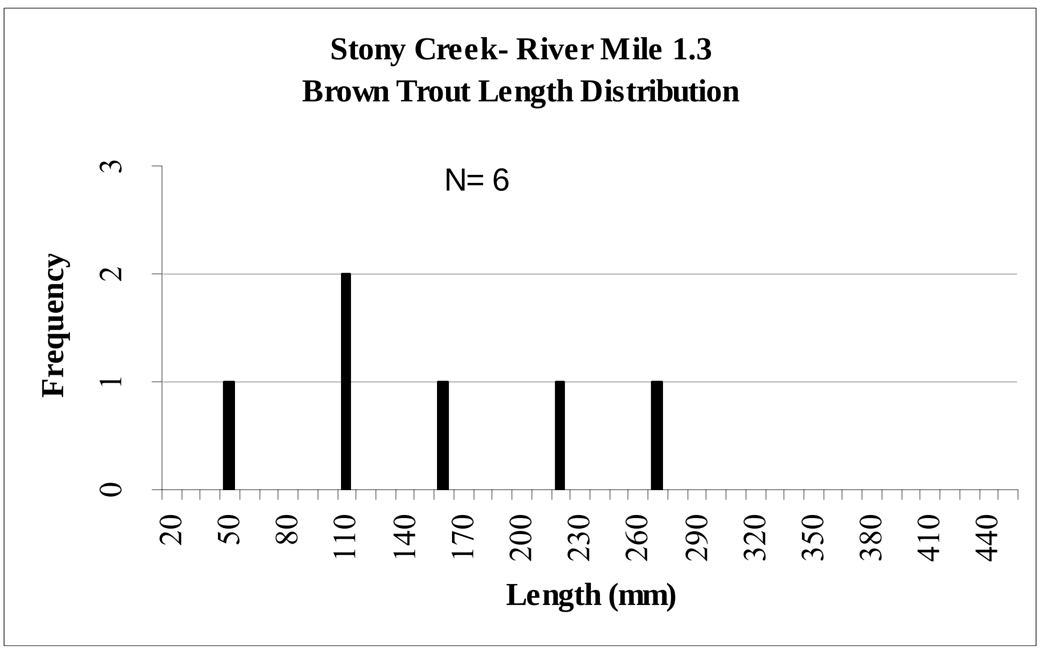

Stony Creek- River Mile 3.6
Westslope Cutthroat Trout Length Distribution
N= 42
Frequency
0
2
4
6
8
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


Stony Creek- River Mile 3.6
Bull Trout Length Distribution
N= 16
Frequency
0
1
2
3
4
5
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


Stony Creek- River Mile 1.3
Westslope Cutthroat Trout Length Distribution
N= 15
Frequency
0
1
2
3
4
5
6
7
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

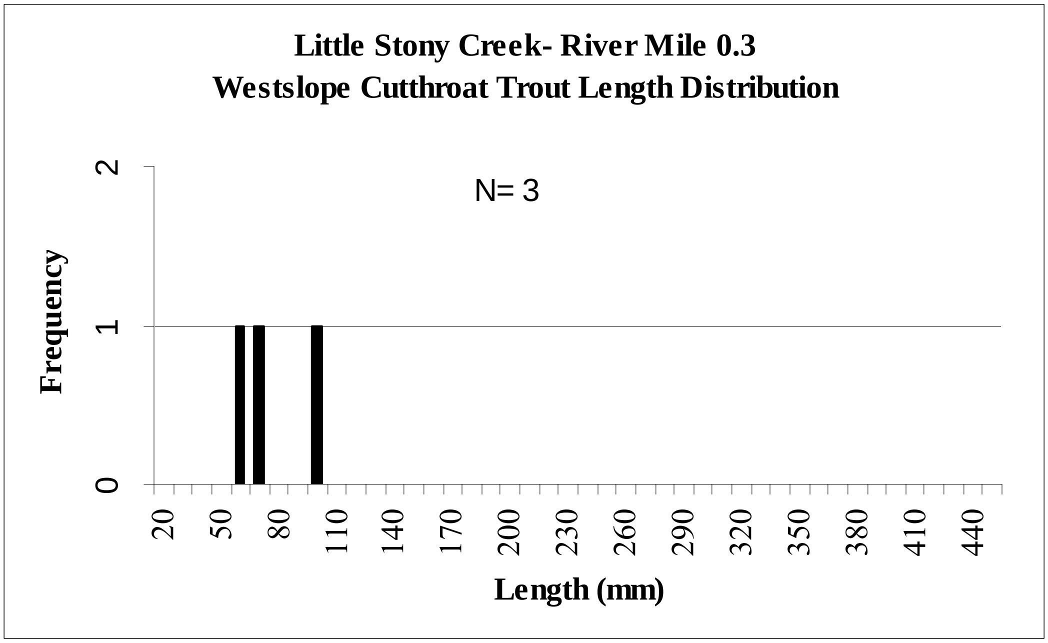


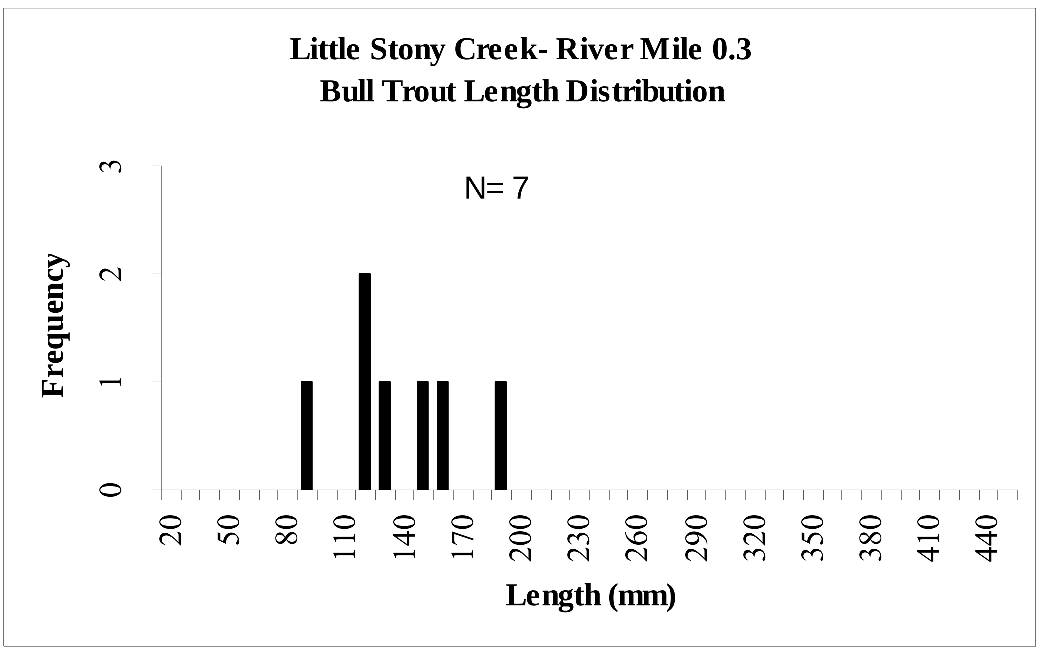
Stony Creek- River Mile 1.3
Bull Trout Length Distribution
N= 10
Frequency
0
1
2
3
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)



Stony Creek- River Mile 1.3
Brown Trout Length Distribution
N= 6
Frequency
0
1
2
3
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

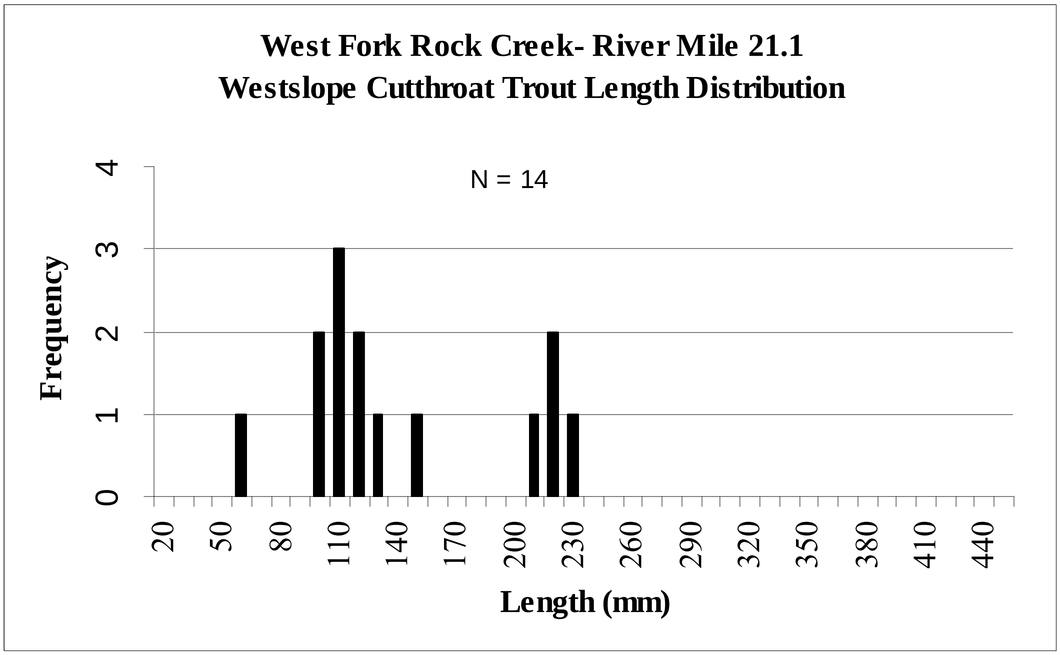
Little Stony Creek

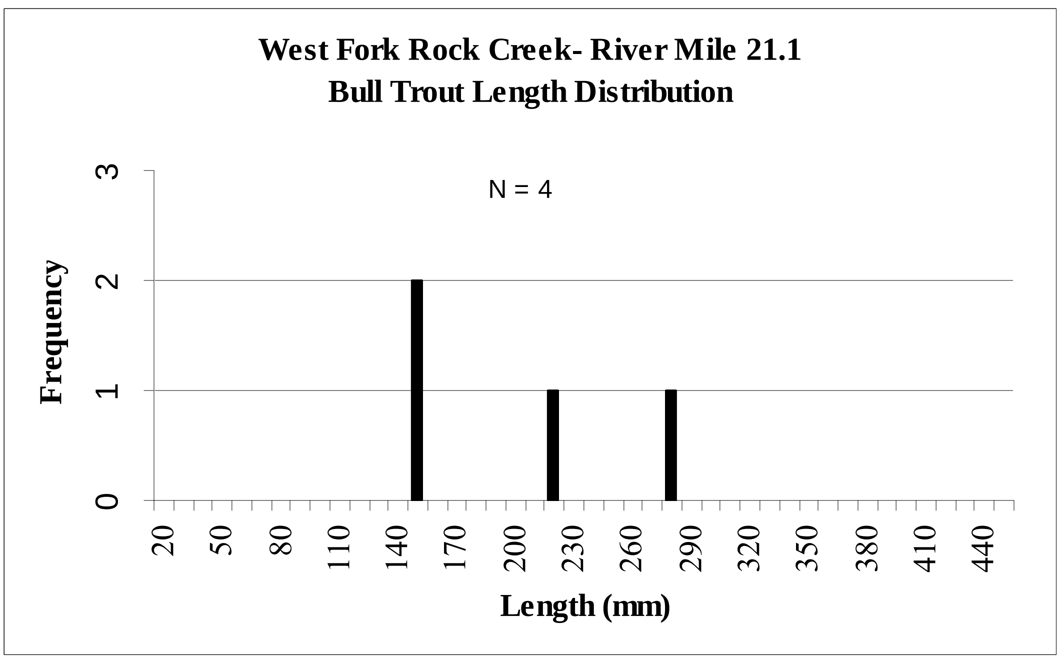


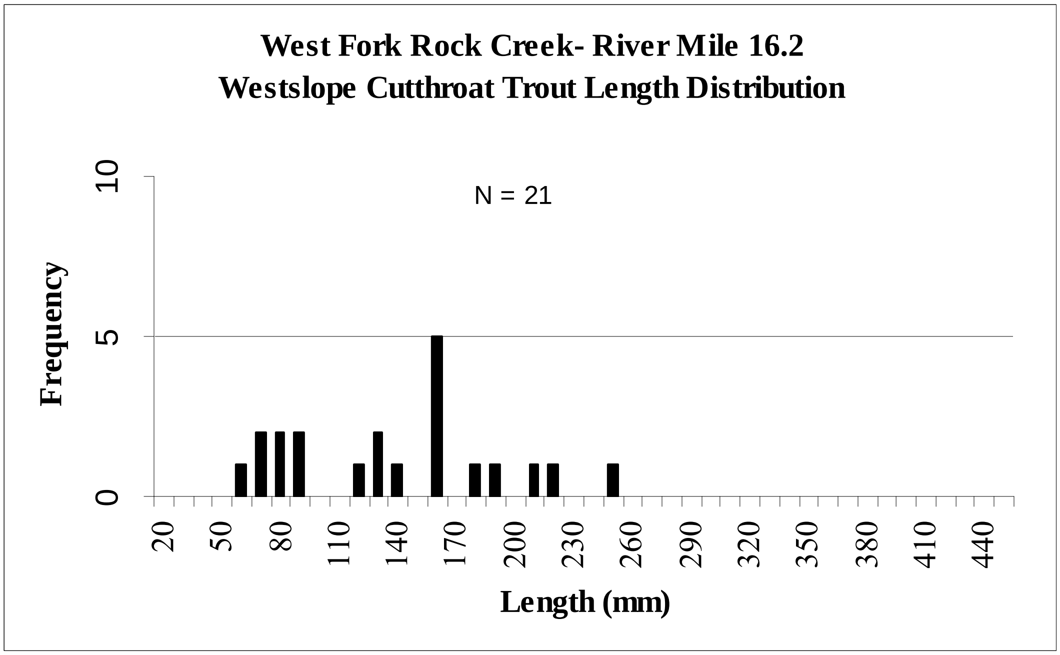


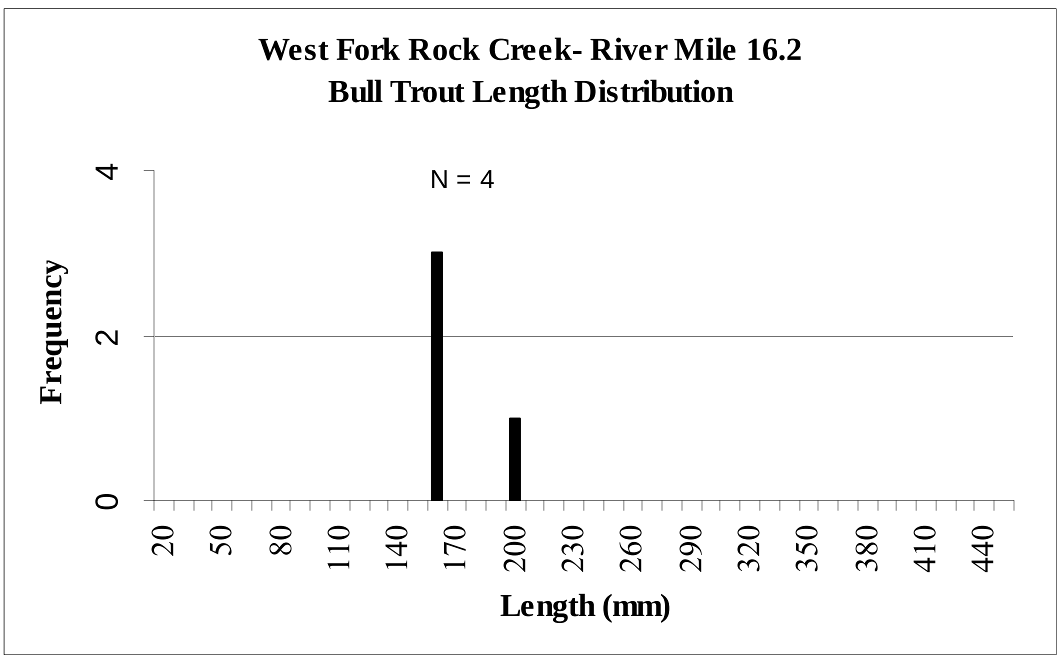
West Fork Rock Creek Drainage

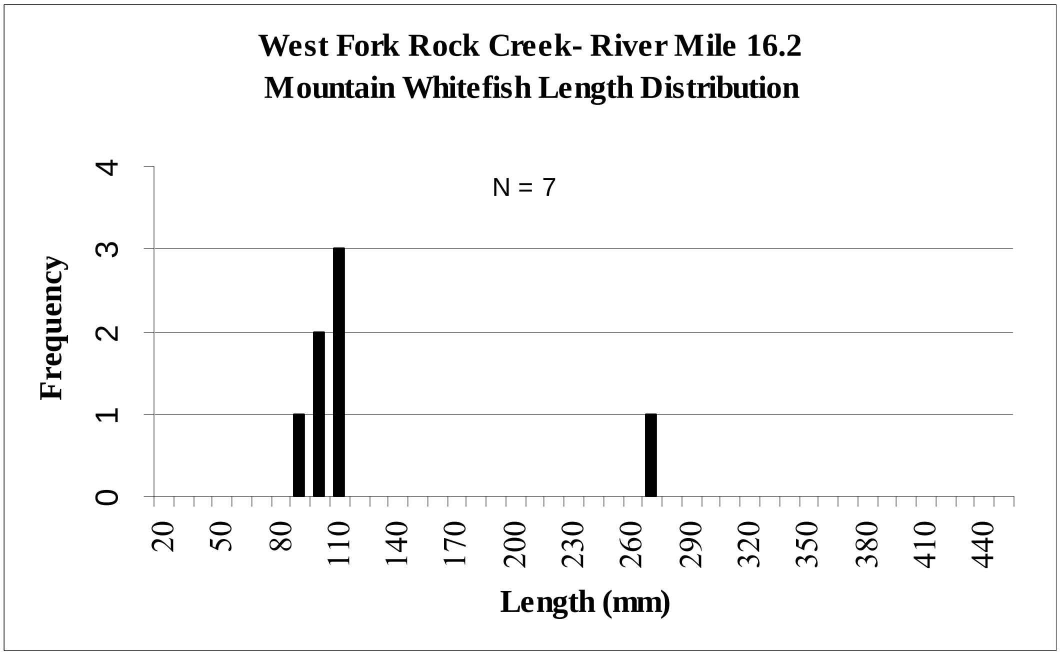
West Fork Rock Creek

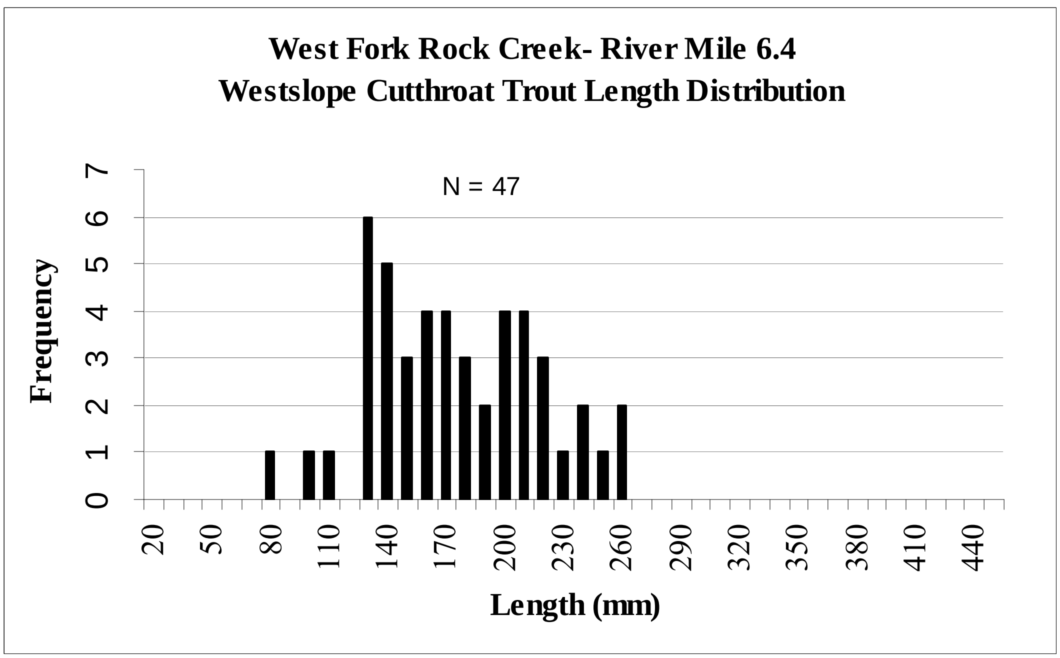


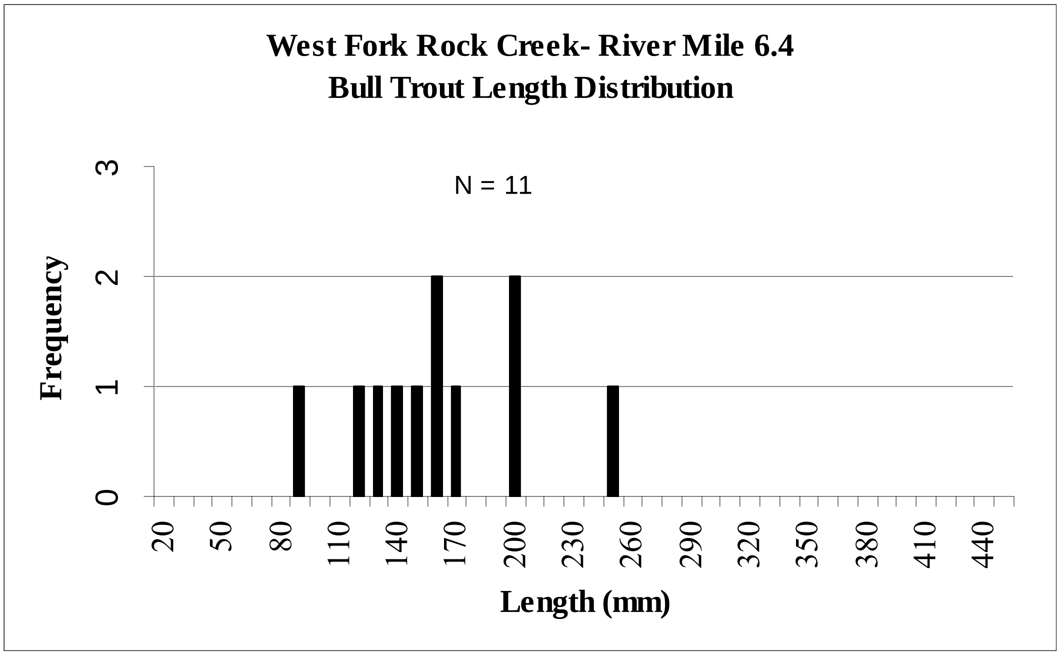


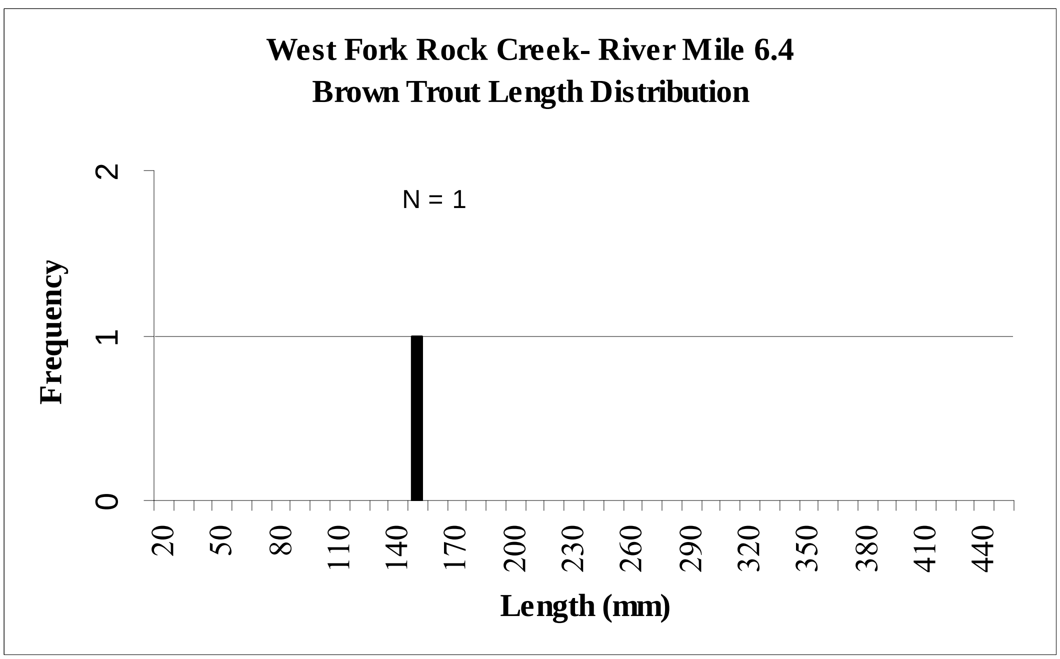

West Fork Rock Creek- River Mile 16.2
Westslope Cutthroat Trout Length Distribution
N = 21
Frequency
0
5
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

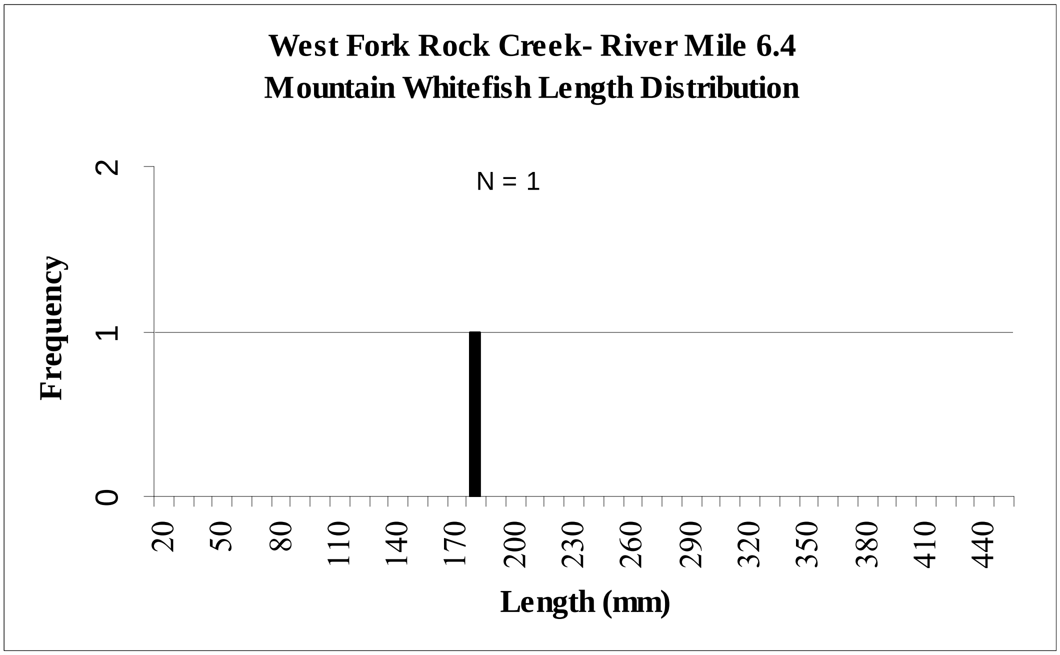

West Fork Rock Creek- River Mile 16.2
Bull Trout Length Distribution
N = 4
Frequency
0
2
4
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

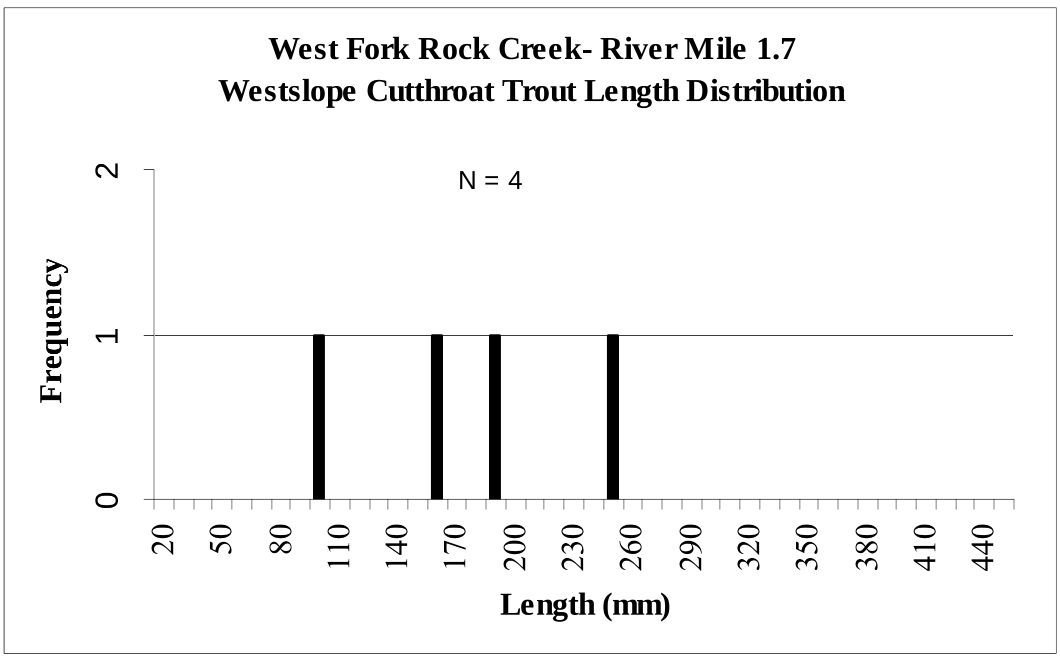

West Fork Rock Creek- River Mile 16.2
Mountain Whitefish Length Distribution
N = 7
Frequency
Length (mm)

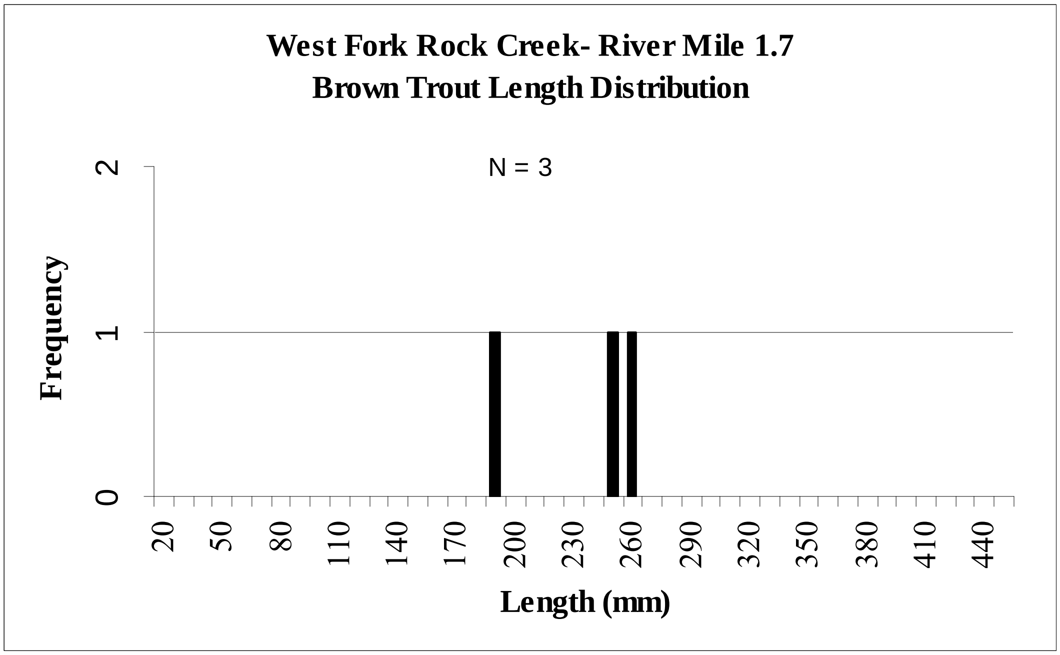

West Fork Rock Creek- River Mile 6.4
Westslope Cutthroat Trout Length Distribution
N = 47
Frequency
Length (mm)


West Fork Rock Creek- River Mile 6.4
Bull Trout Length Distribution
N = 11
Frequency
0
1
2
3
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

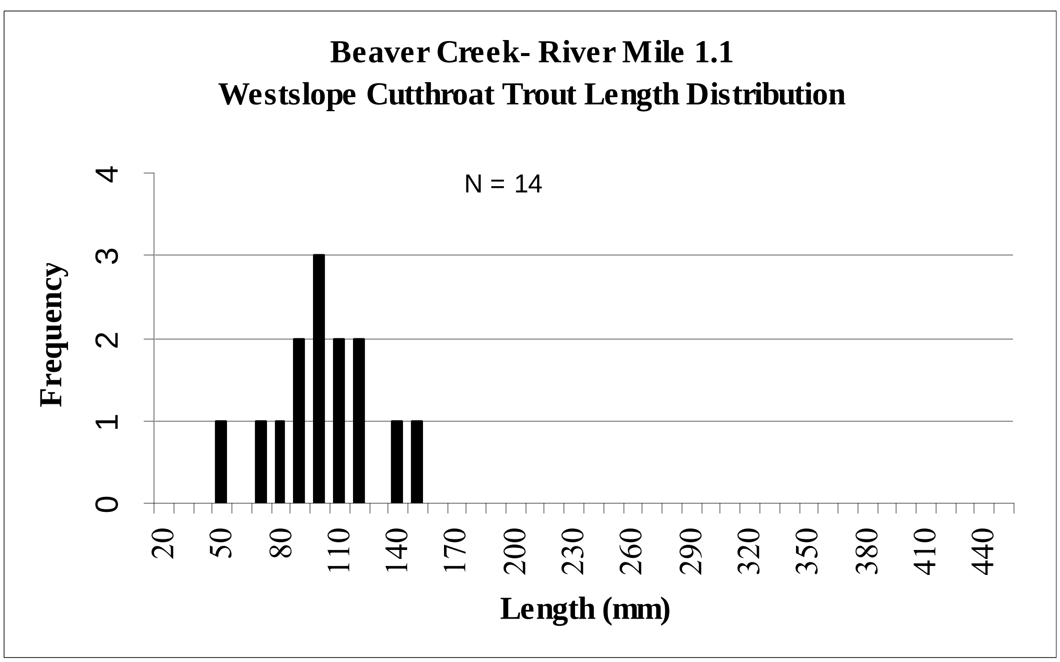

West Fork Rock Creek- River Mile 6.4
Brown Trout Length Distribution
N = 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


West Fork Rock Creek- River Mile 6.4
Mountain Whitefish Length Distribution
N = 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

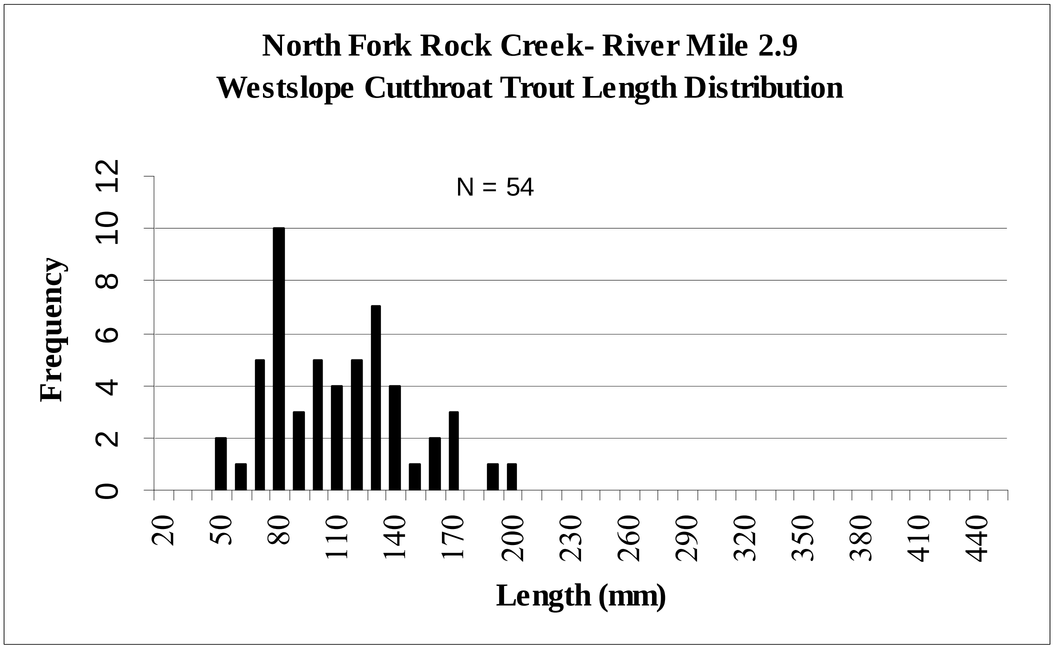

West Fork Rock Creek- River Mile 1.7
Westslope Cutthroat Trout Length Distribution
N = 4
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

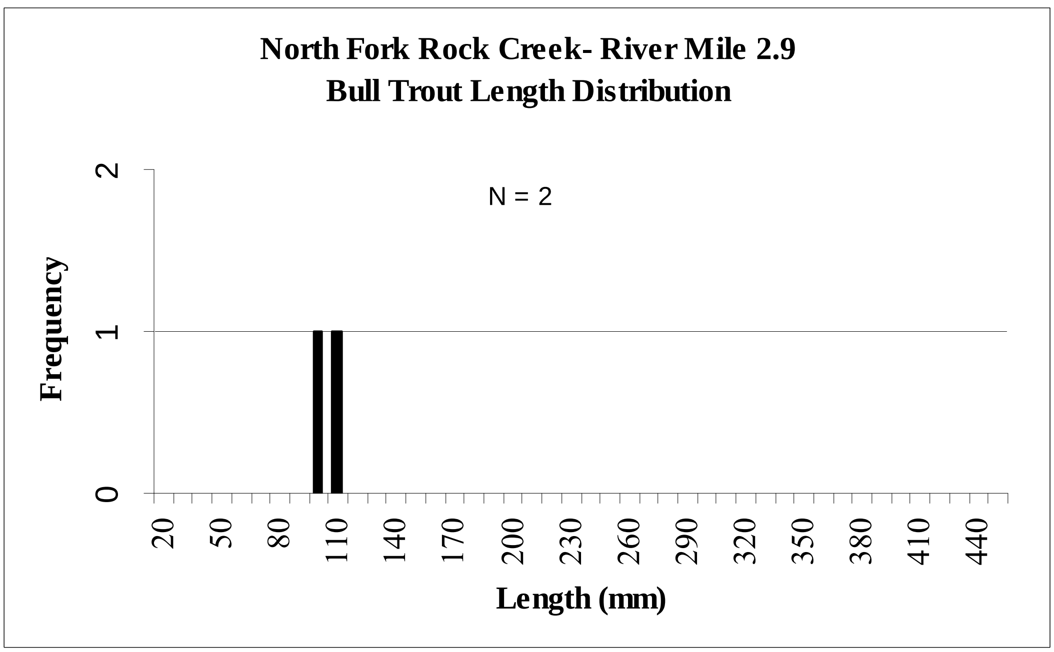


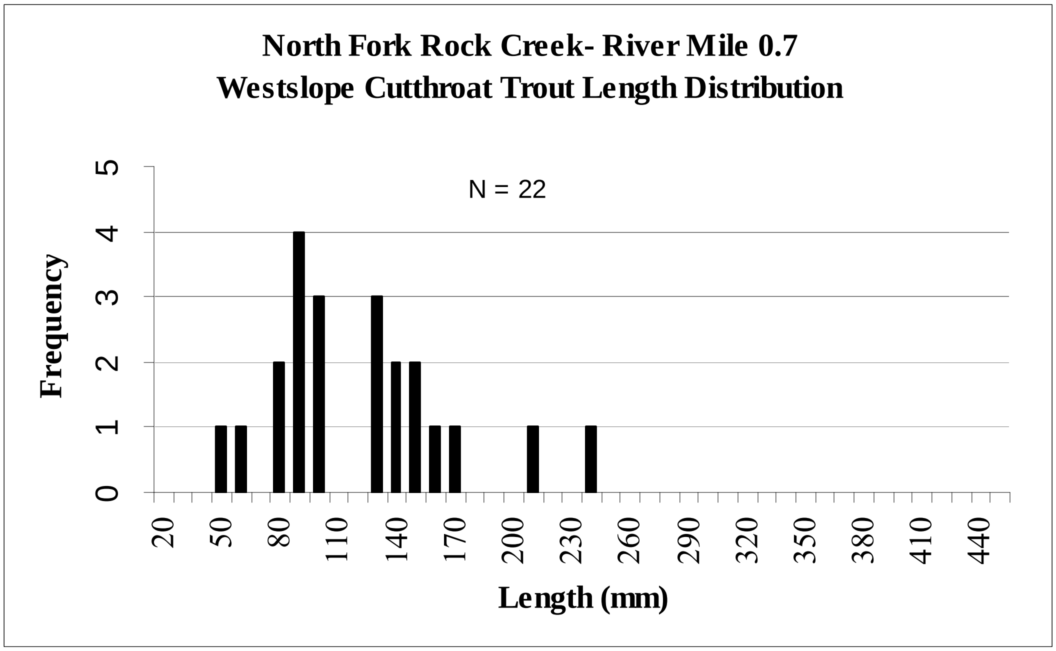
Beaver Creek

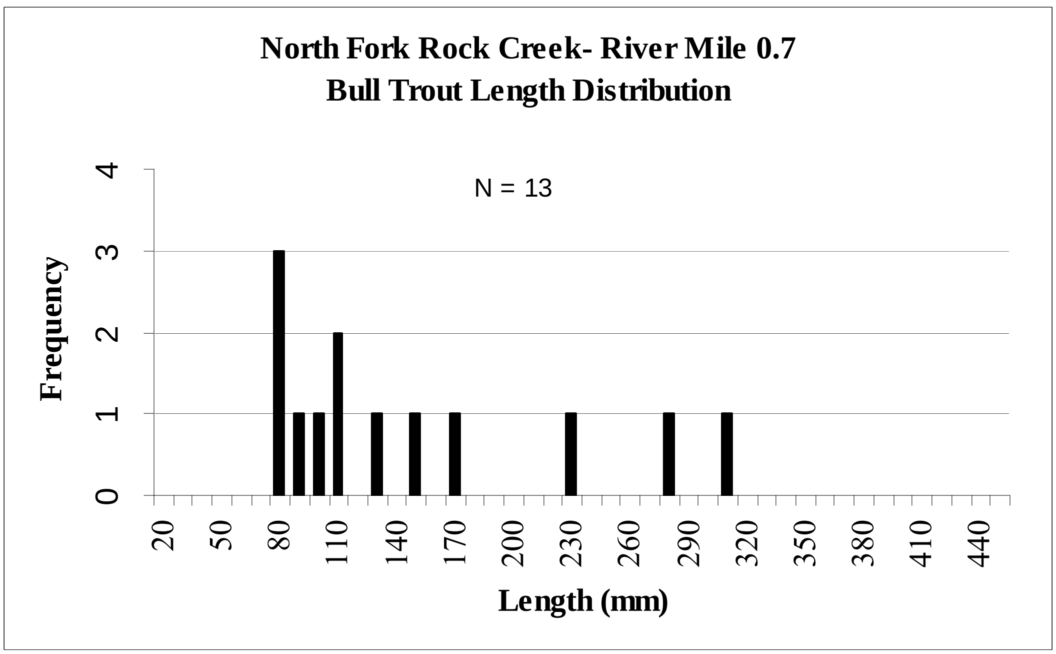


North Fork Rock Creek

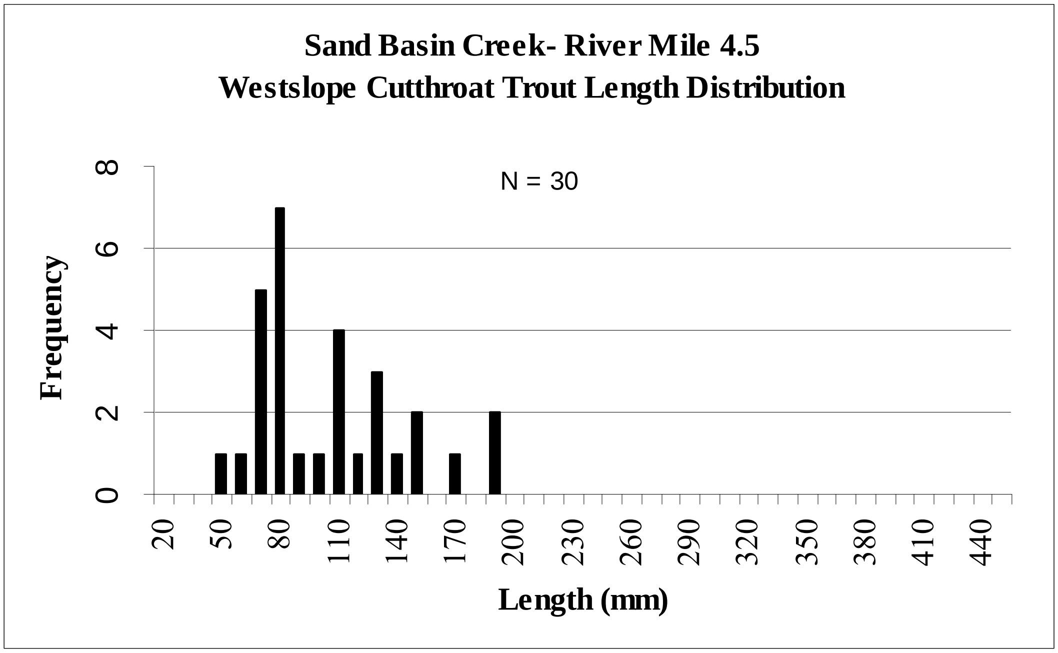


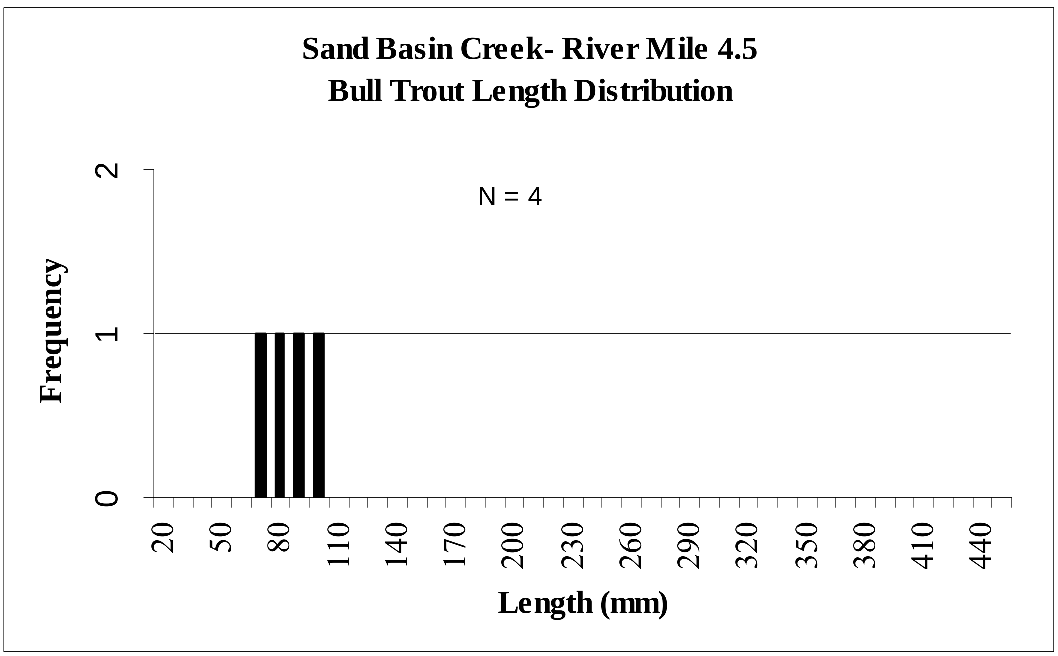


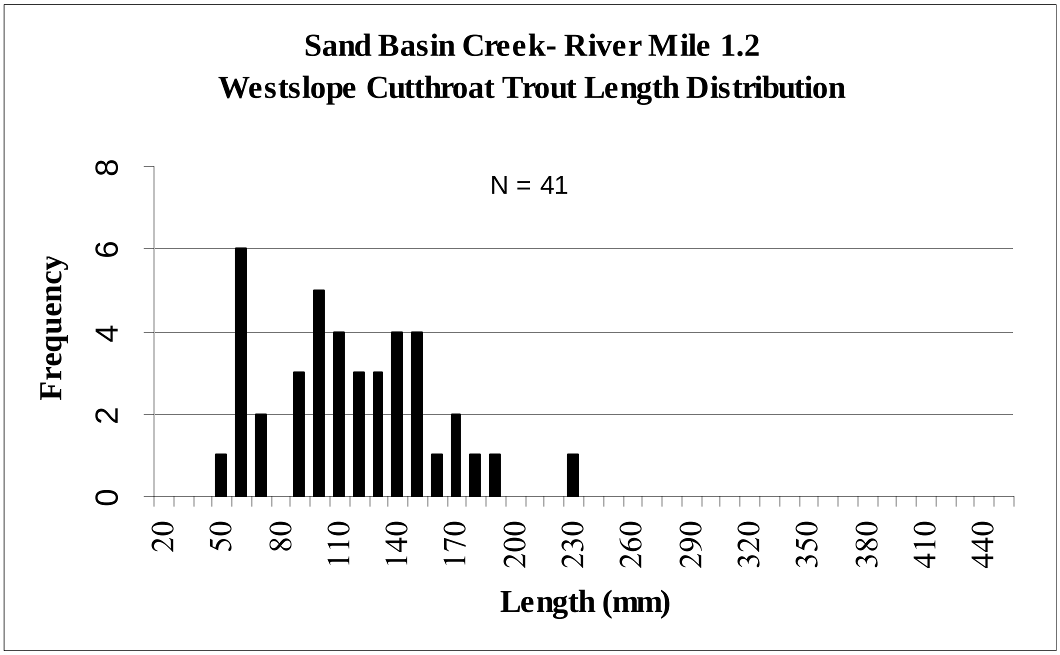

North Fork Rock Creek- River Mile 0.7
Westslope Cutthroat Trout Length Distribution
N = 22
Frequency
0
1
2
3
4
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


North Fork Rock Creek- River Mile 0.7
Bull Trout Length Distribution
N = 13
Frequency
0
1
2
3
4
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

Sand Basin Creek

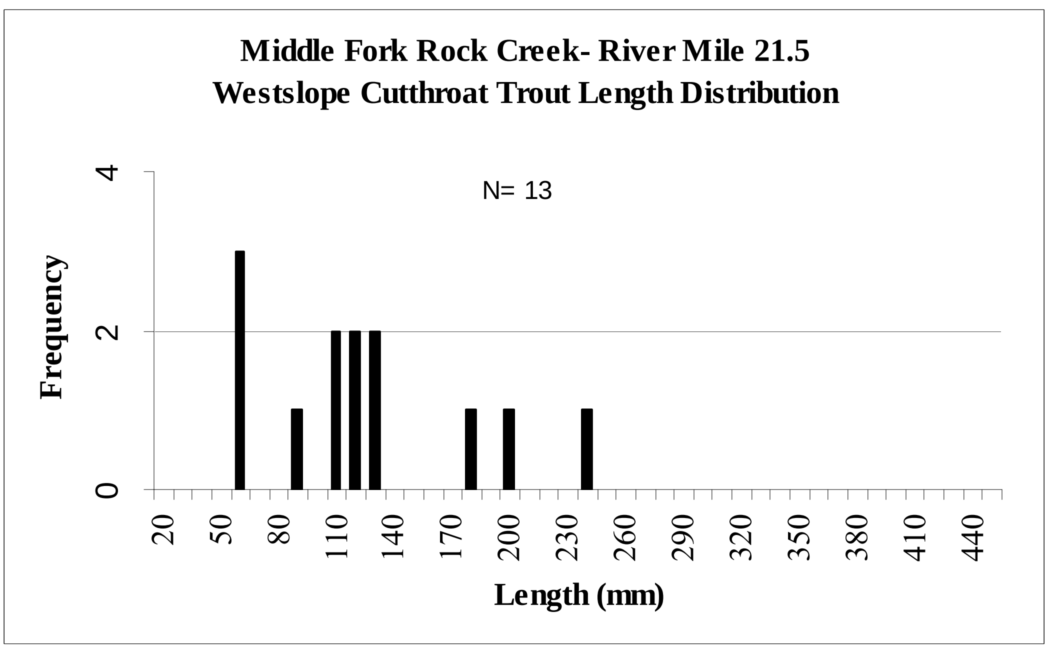


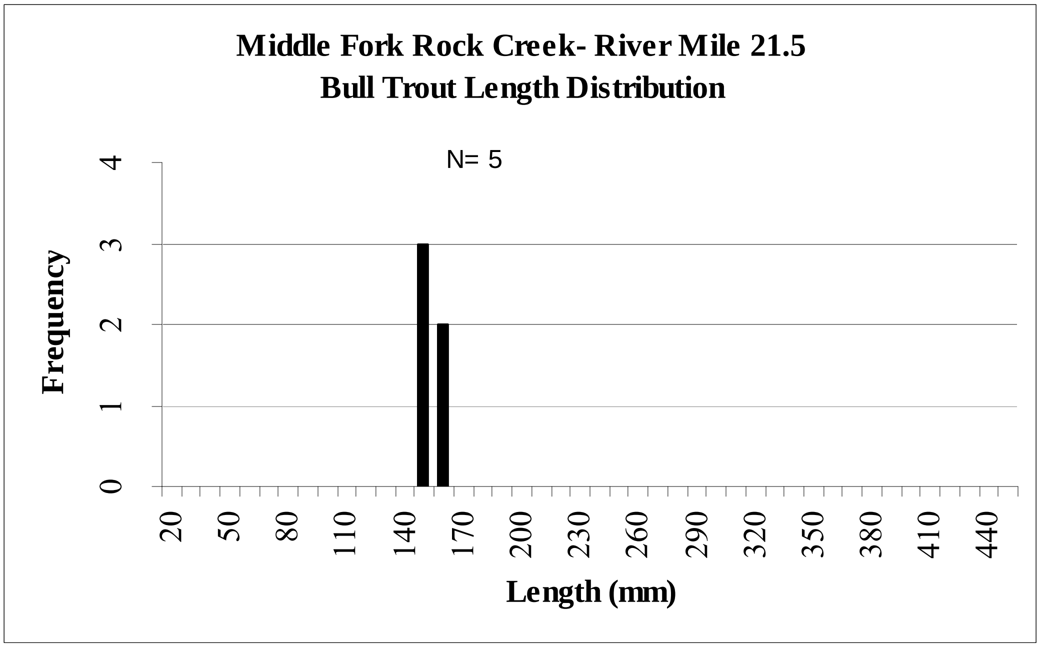


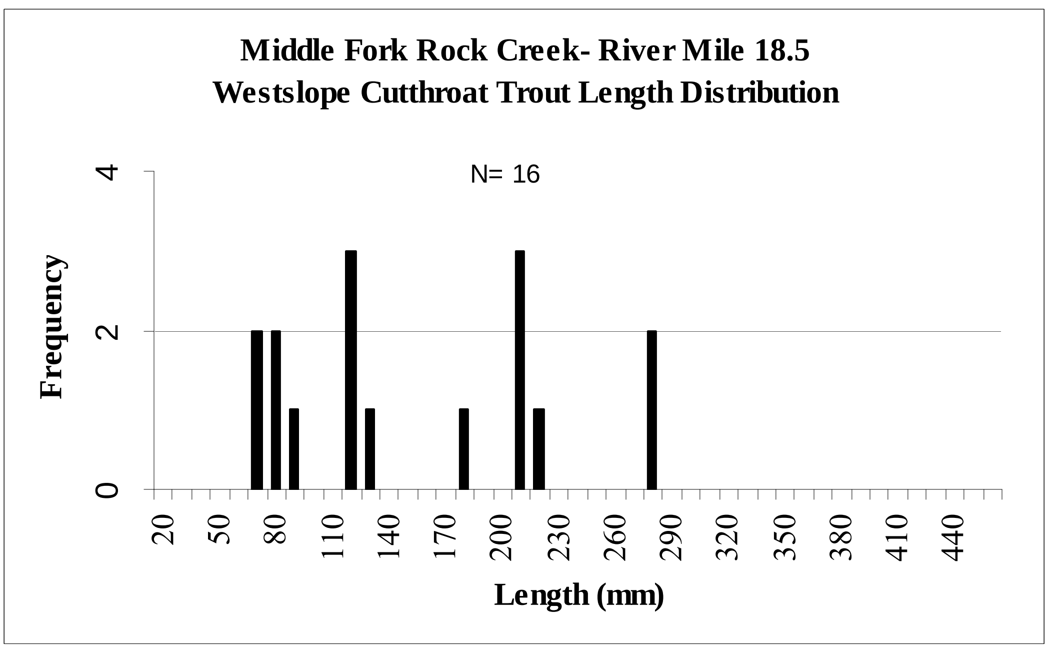


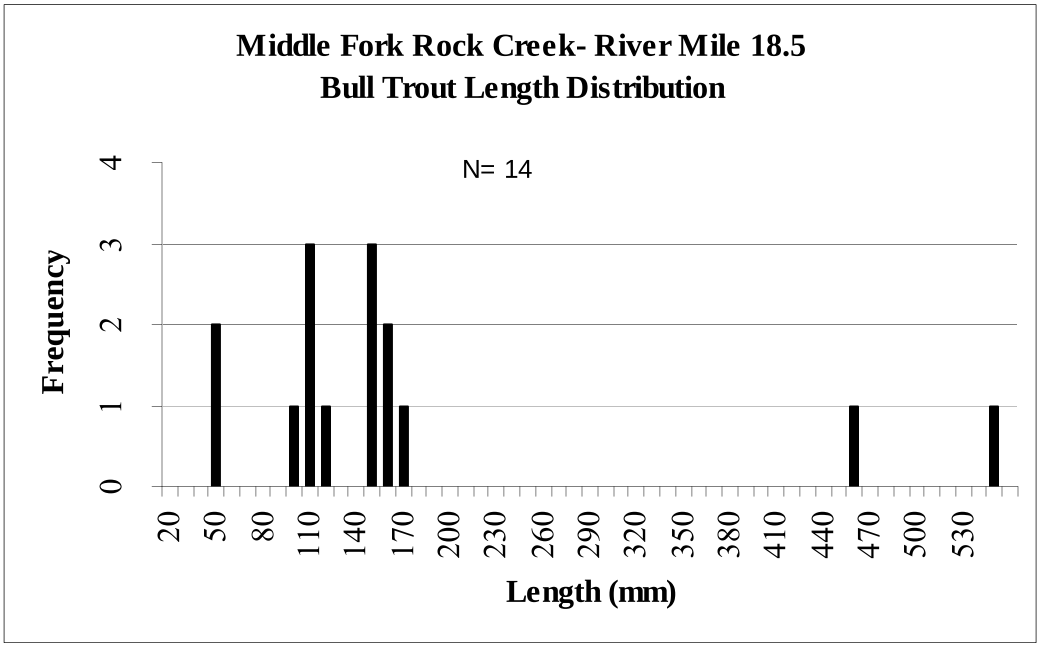
Middle Fork Rock Creek Drainage

Middle Fork Rock Creek

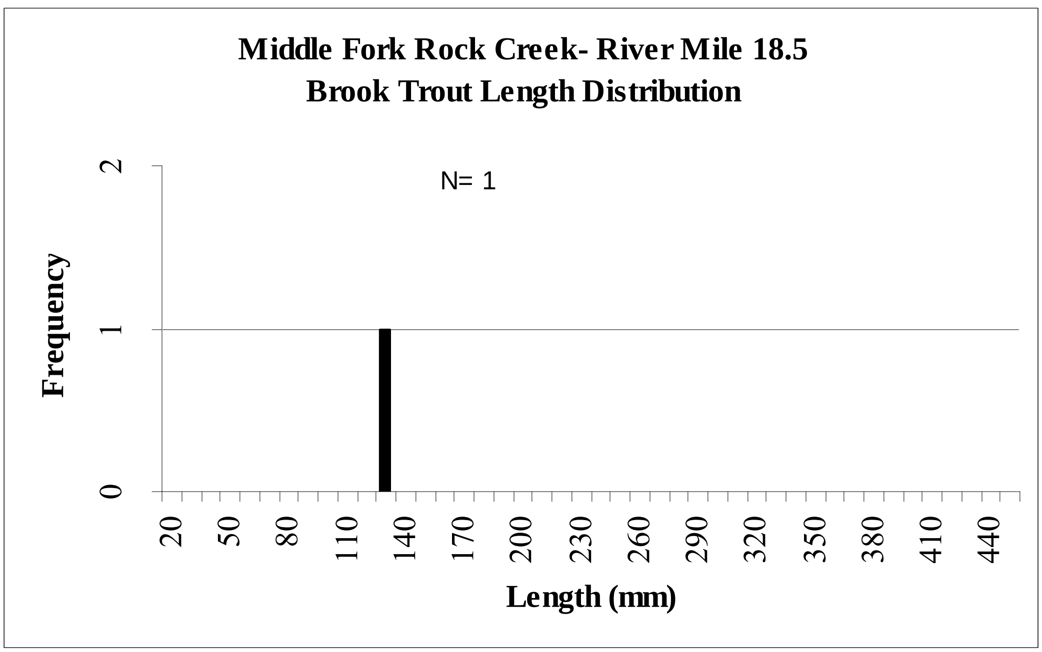



Middle Fork Rock Creek- River Mile 21.5
Bull Trout Length Distribution
N= 5
Frequency
0
1
2
3
4
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

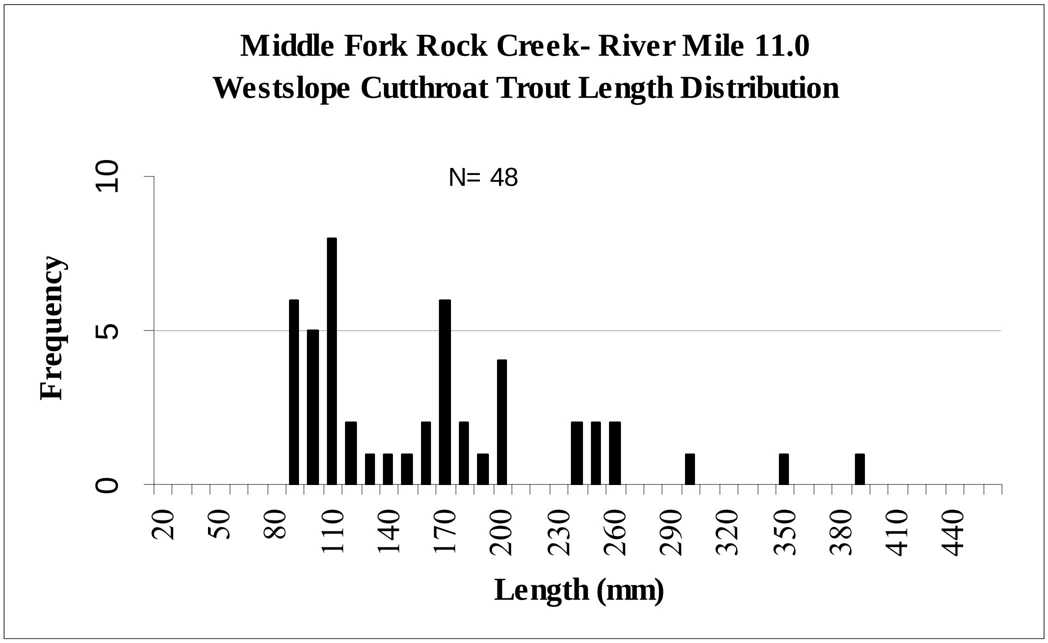

Middle Fork Rock Creek- River Mile 18.5
Westslope Cutthroat Trout Length Distribution
N= 16
Frequency
0
2
4
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

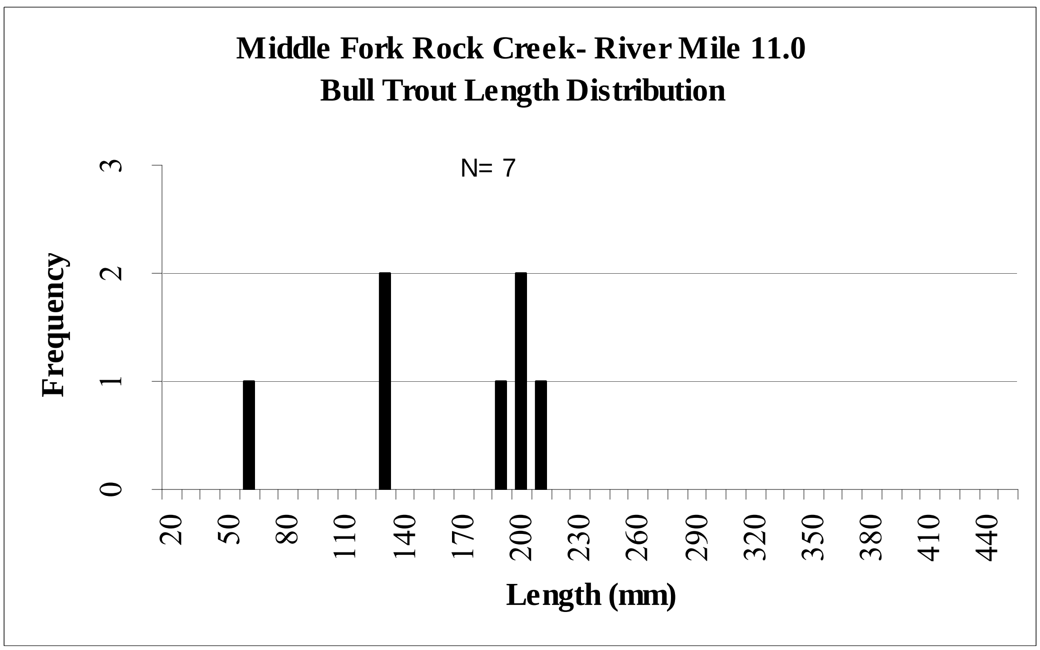


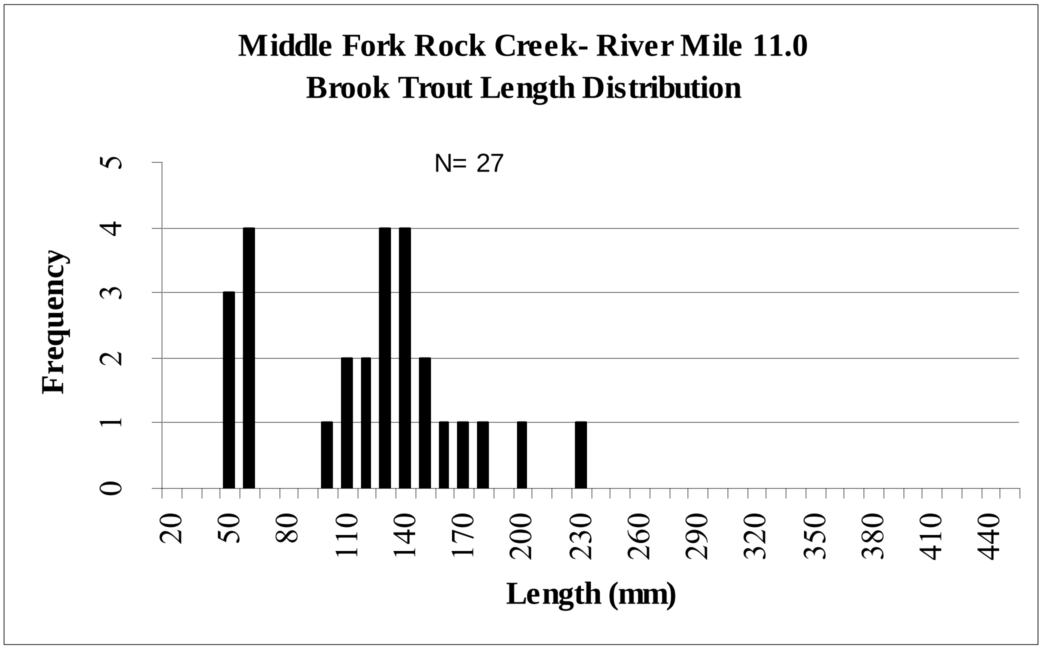
Middle Fork Rock Creek- River Mile 18.5
Bull Trout Length Distribution
N= 14
Frequency
0
1
2
3
4
20 50 80 110 140 170 200 230 260 290 320 350 380 410 440 470 500 530
Length (mm)

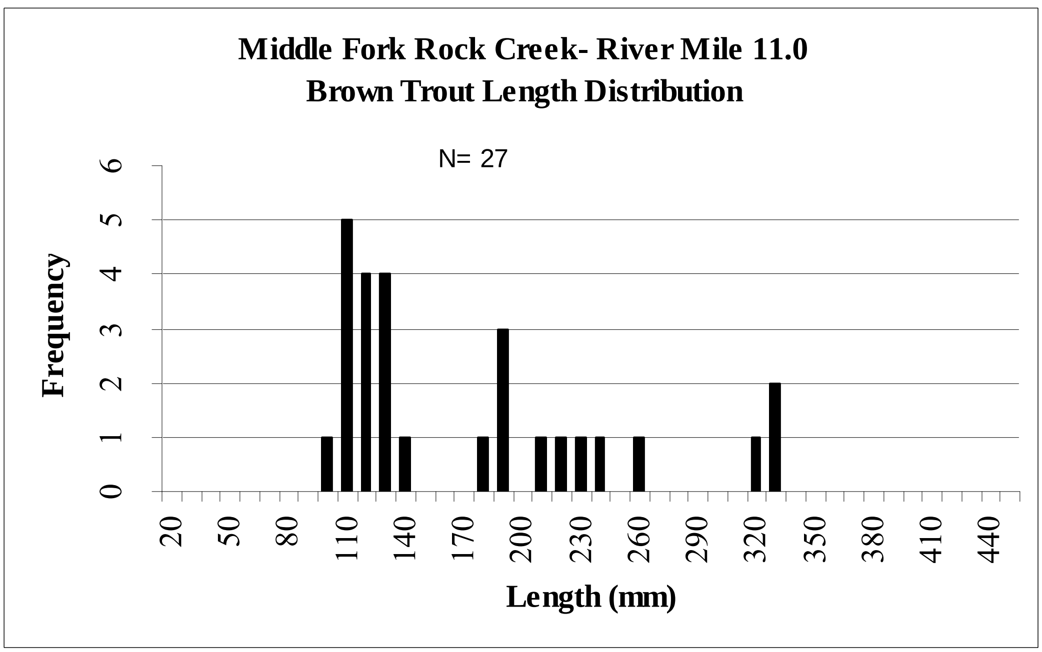


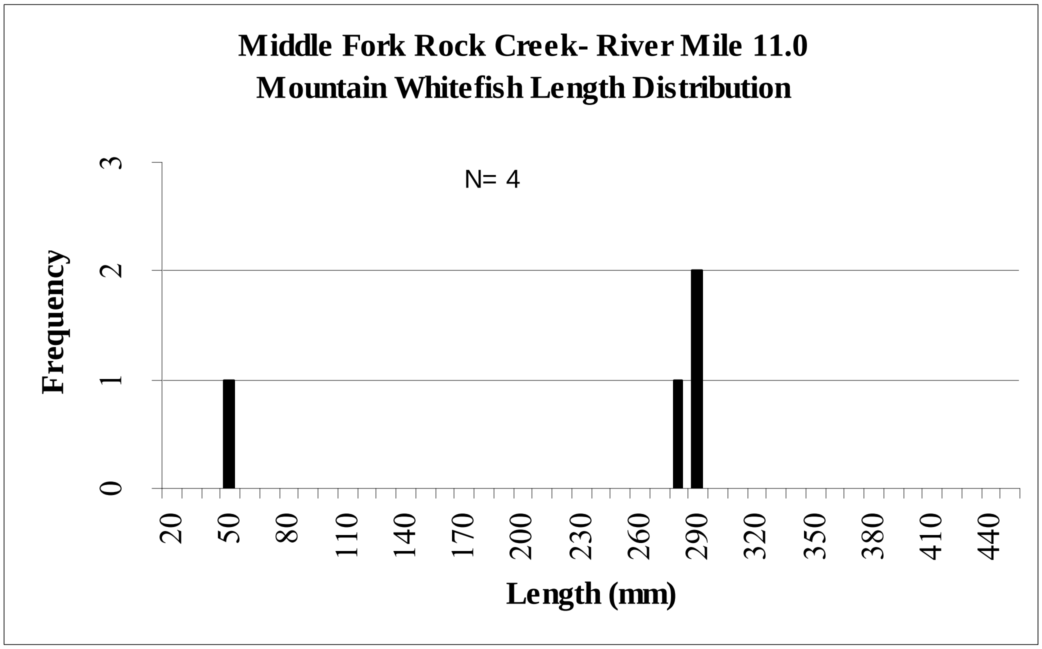
Middle Fork Rock Creek- River Mile 18.5
Brook Trout Length Distribution
N= 1
Frequency
0
1
2
20 50 80 110 140 170 200 230 260 290 320 350 380 410 440
Length (mm)

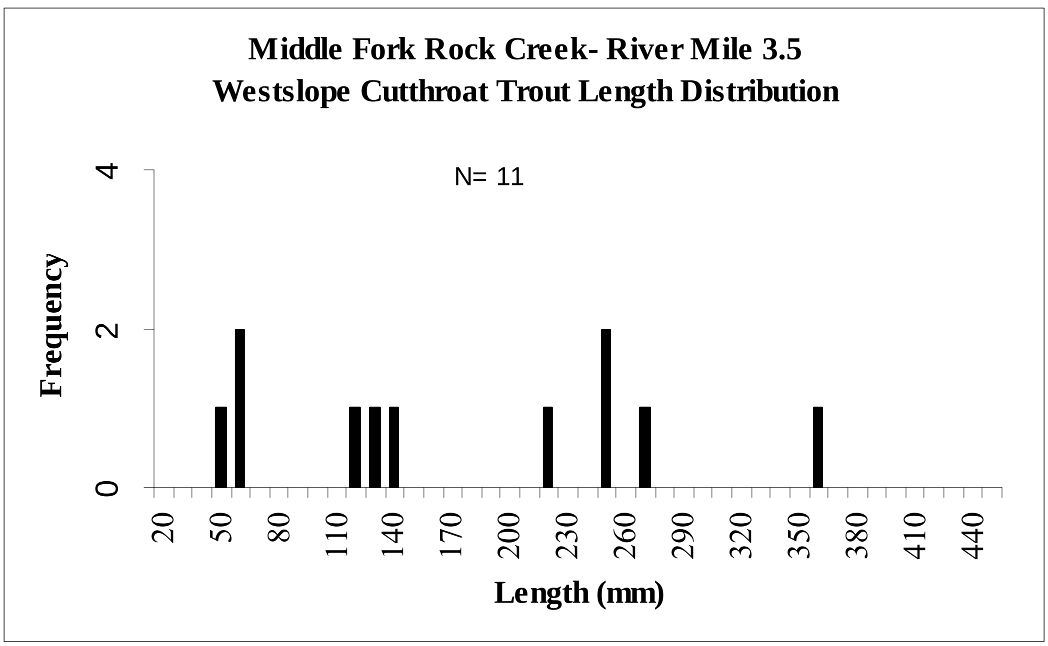

Middle Fork Rock Creek- River Mile 11.0
Westslope Cutthroat Trout Length Distribution
N= 48
Frequency
0
5
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

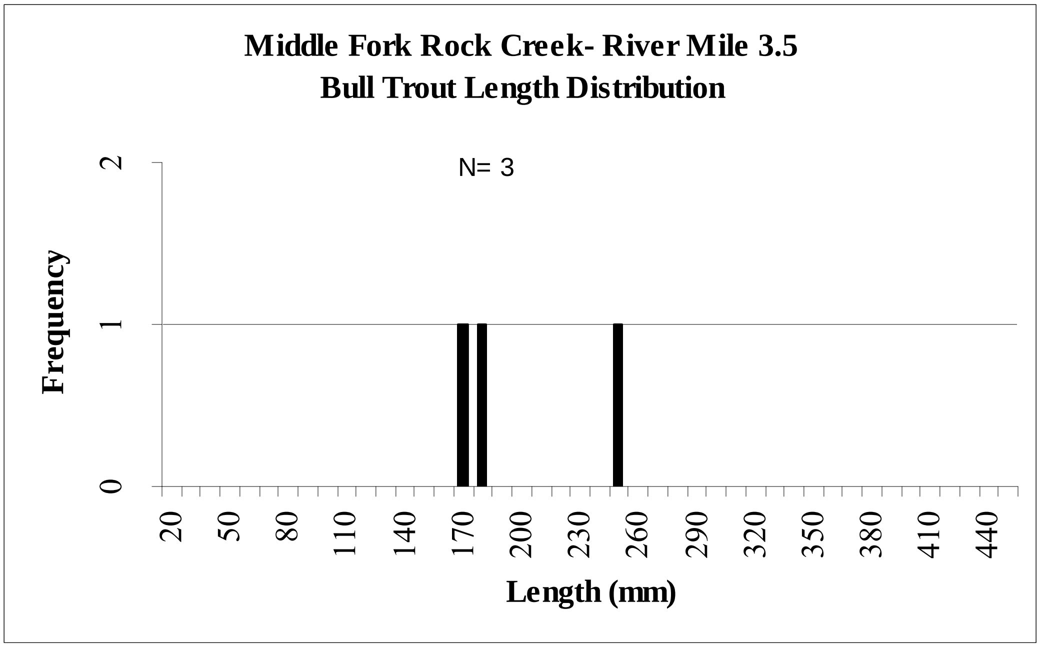

Middle Fork Rock Creek- River Mile 11.0
Bull Trout Length Distribution
N= 7
Frequency
0
1
2
3
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


Middle Fork Rock Creek- River Mile 11.0
Brook Trout Length Distribution
N= 27
Frequency
0
1
2
3
4
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

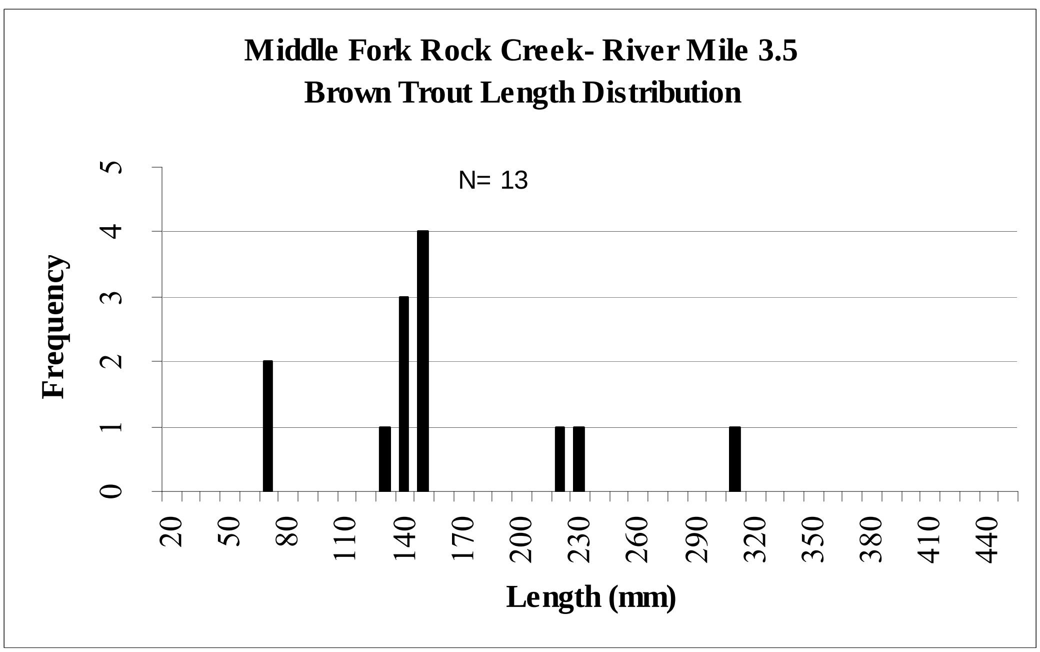

Middle Fork Rock Creek- River Mile 11.0
Brown Trout Length Distribution
N= 27
Frequency
0
1
2
3
4
5
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


Middle Fork Rock Creek- River Mile 11.0
Mountain Whitefish Length Distribution
N= 4
Frequency
0
1
2
3
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

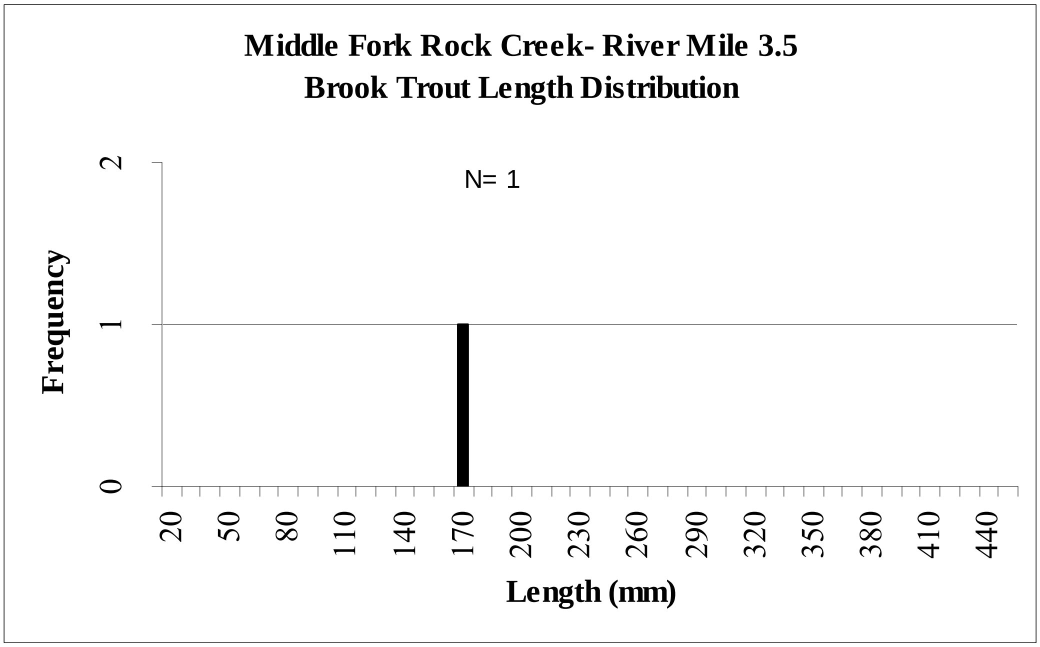

Middle Fork Rock Creek- River Mile 3.5
Westslope Cutthroat Trout Length Distribution
N= 11
Frequency
0
2
4
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

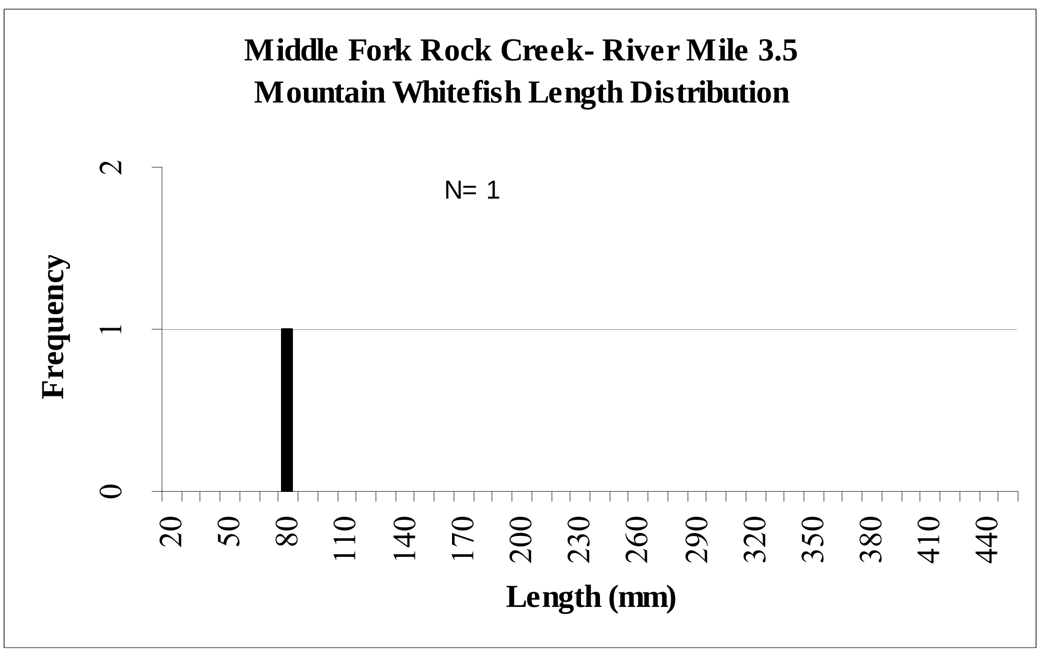


Middle Fork Rock Creek- River Mile 3.5
Bull Trout Length Distribution
N= 3
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

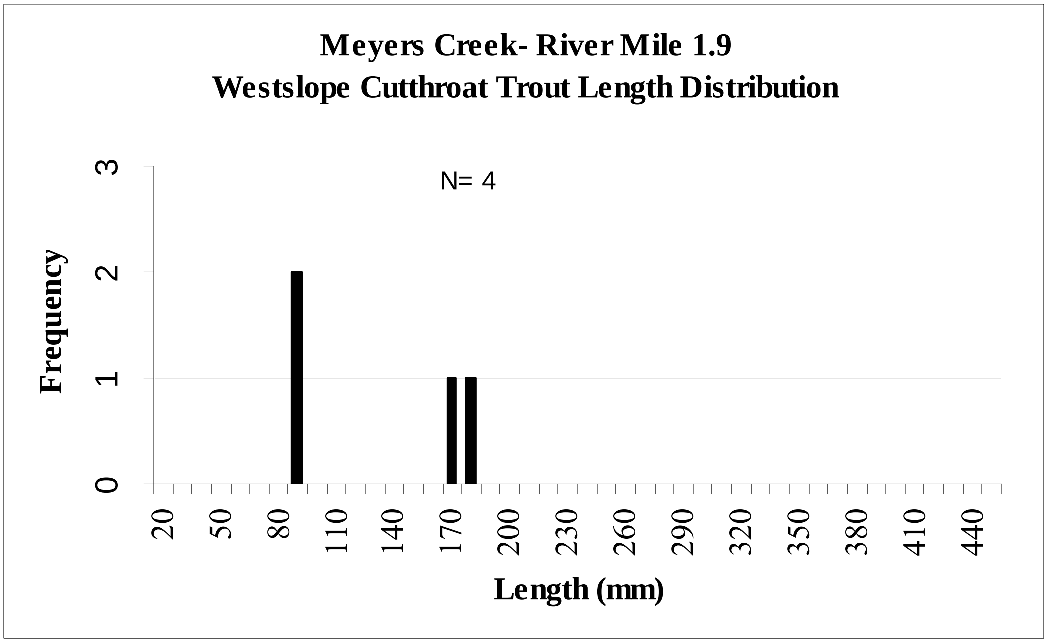


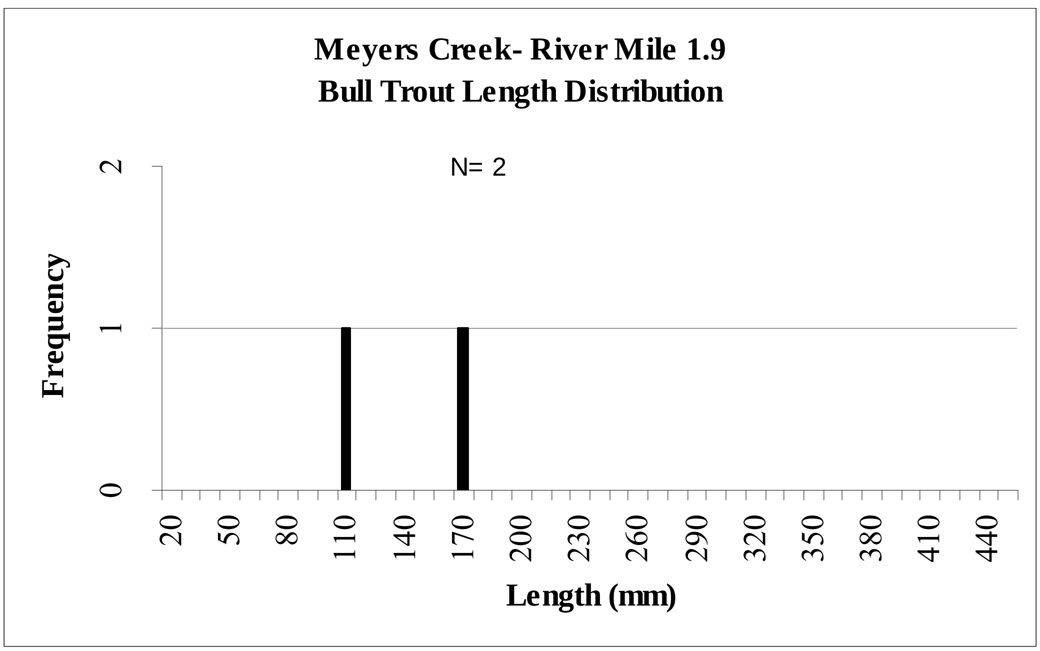
Middle Fork Rock Creek- River Mile 3.5
Brown Trout Length Distribution
N= 13
Frequency
0
1
2
3
4
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

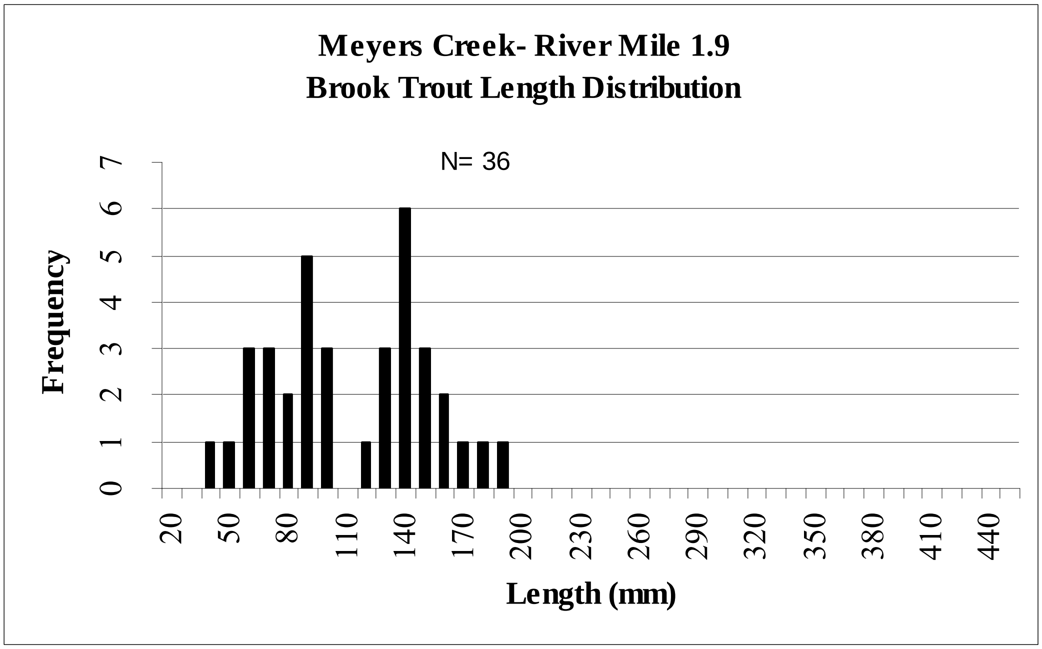

Middle Fork Rock Creek- River Mile 3.5
Brook Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

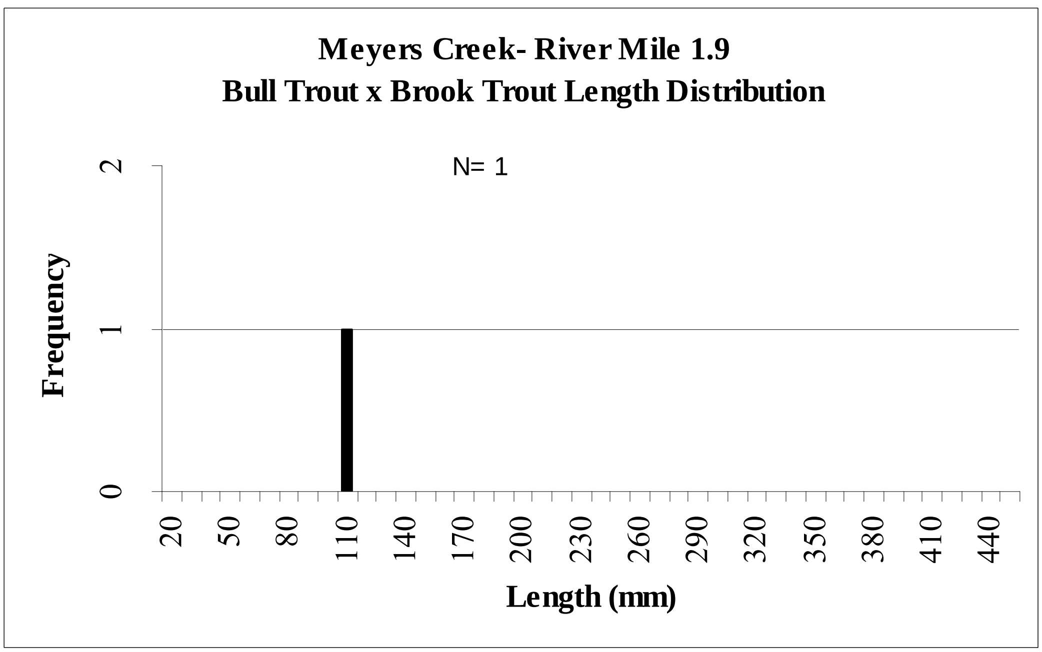

Middle Fork Rock Creek- River Mile 3.5
Mountain Whitefish Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

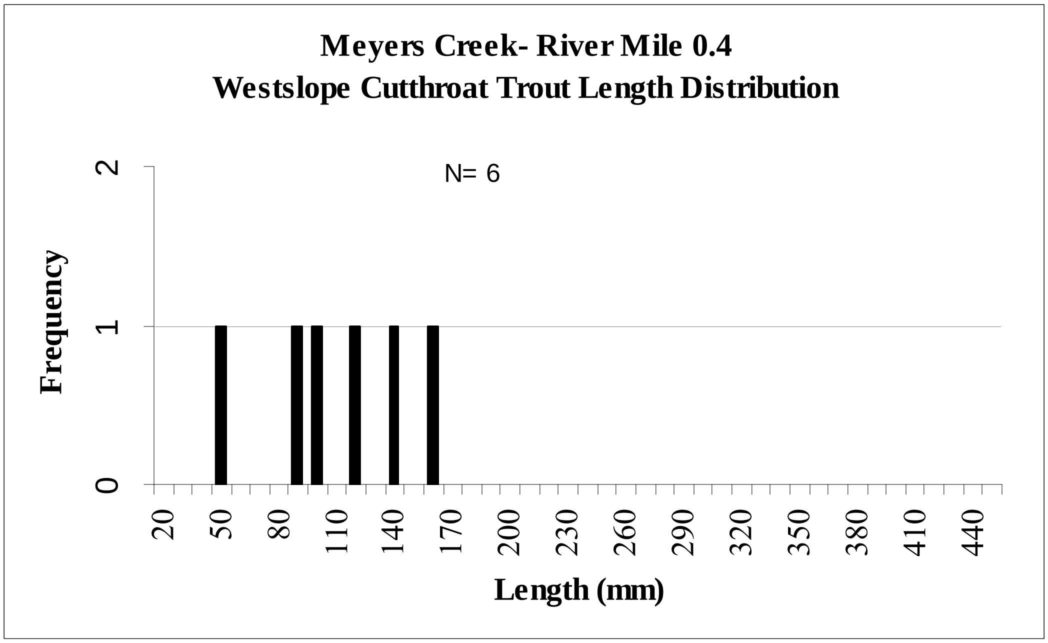
Meyers Creek



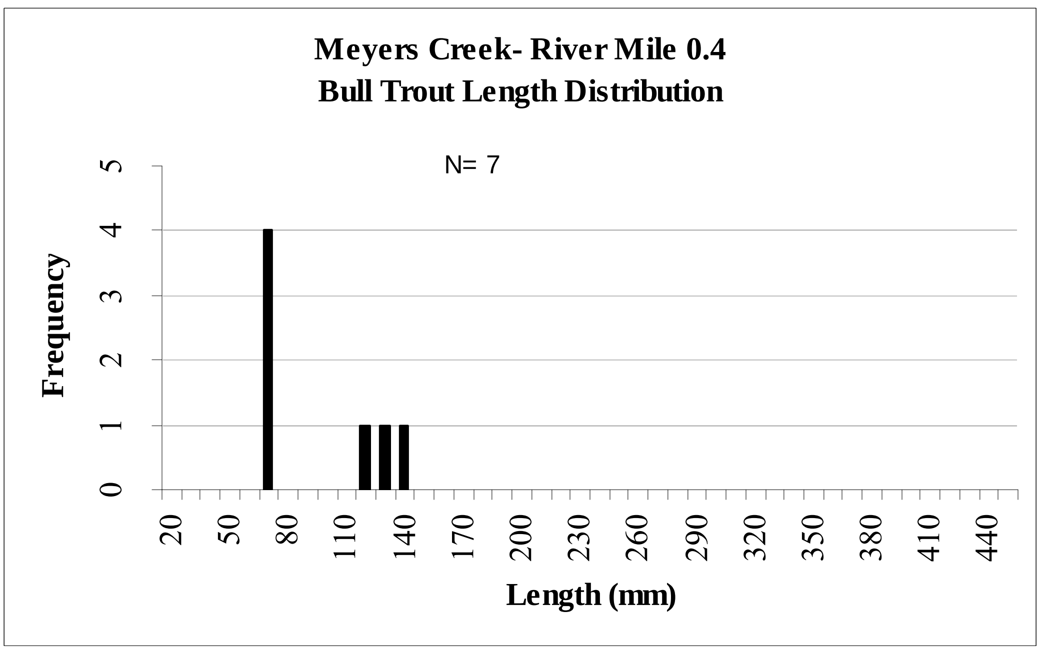



Meyers Creek- River Mile 1.9
Brook Trout Length Distribution
N= 36
Frequency
0
1
2
3
4
5
6
7
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

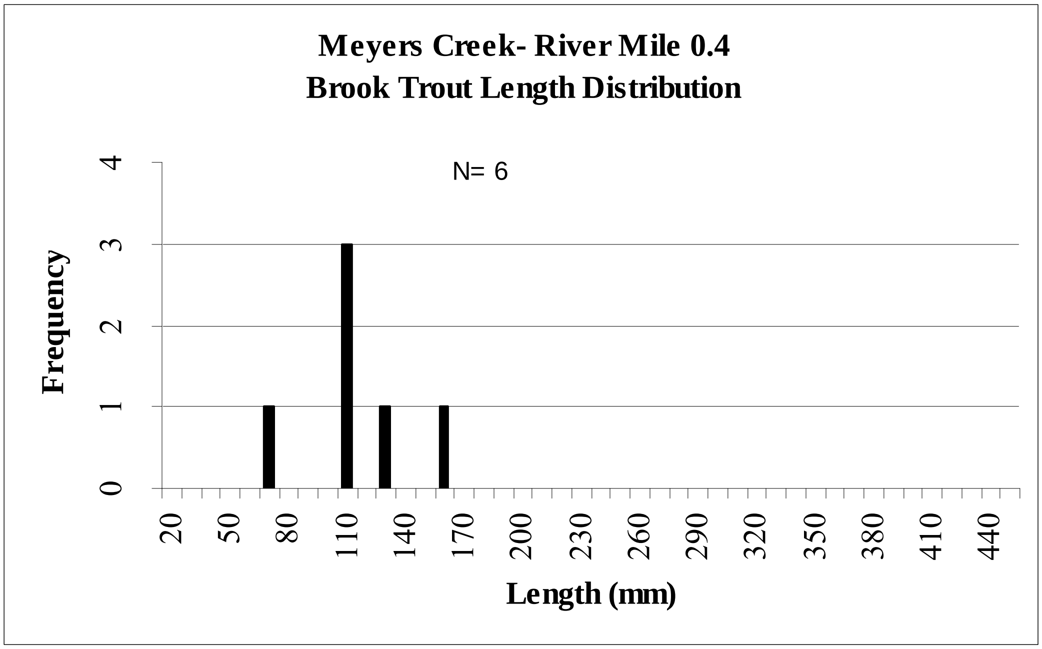

Meyers Creek- River Mile 1.9
Bull Trout x Brook Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)



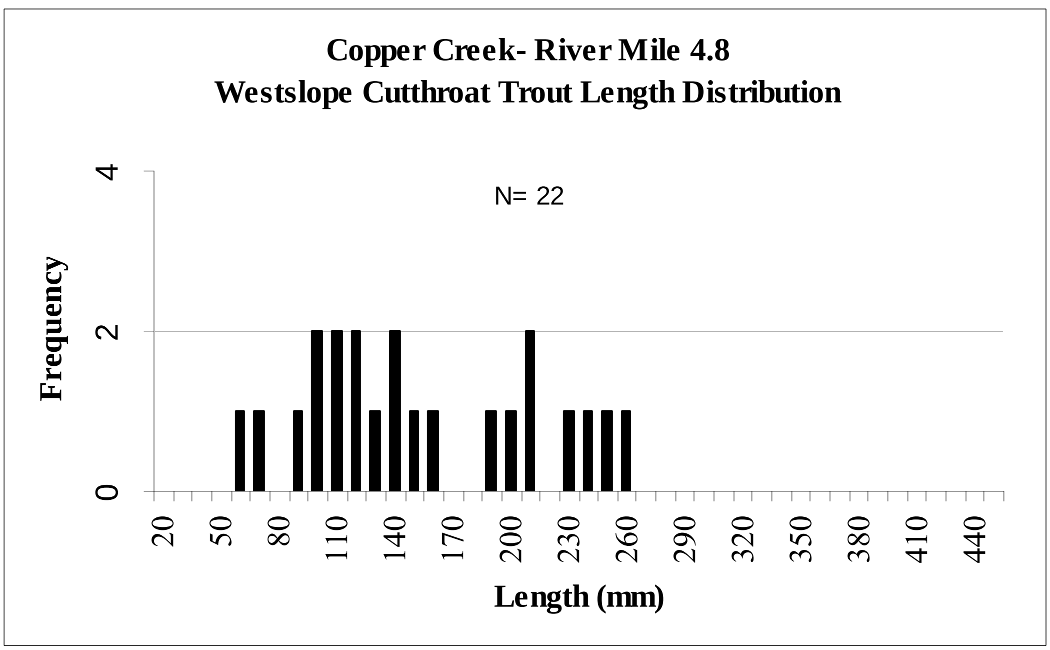
Meyers Creek- River Mile 0.4
Westslope Cutthroat Trout Length Distribution
N= 6
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

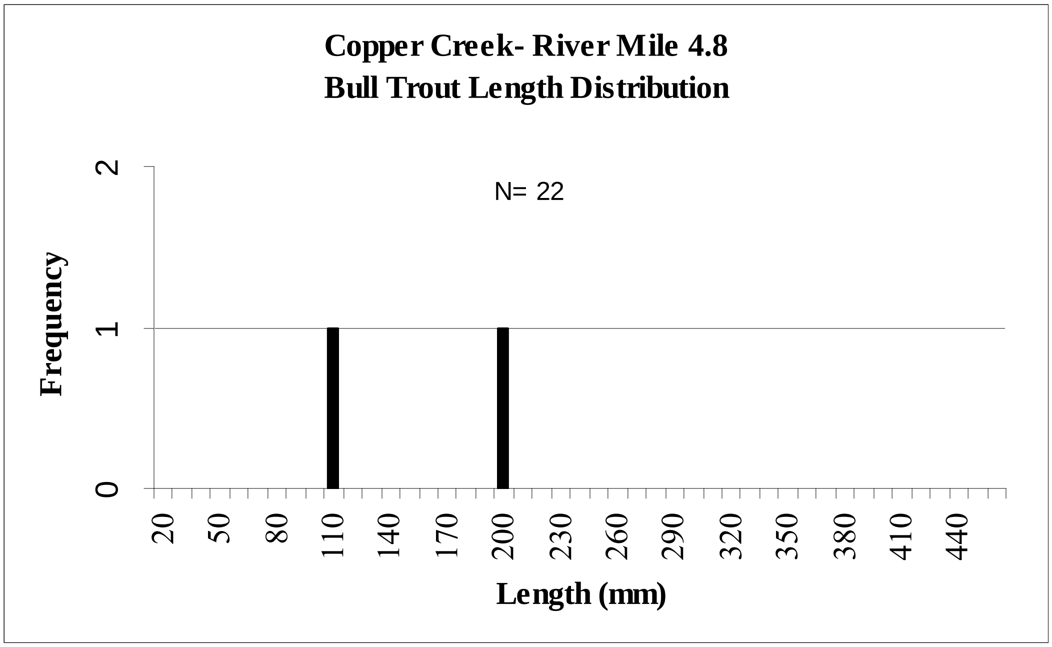


Meyers Creek- River Mile 0.4
Bull Trout Length Distribution
N= 7
Frequency
0
1
2
3
4
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

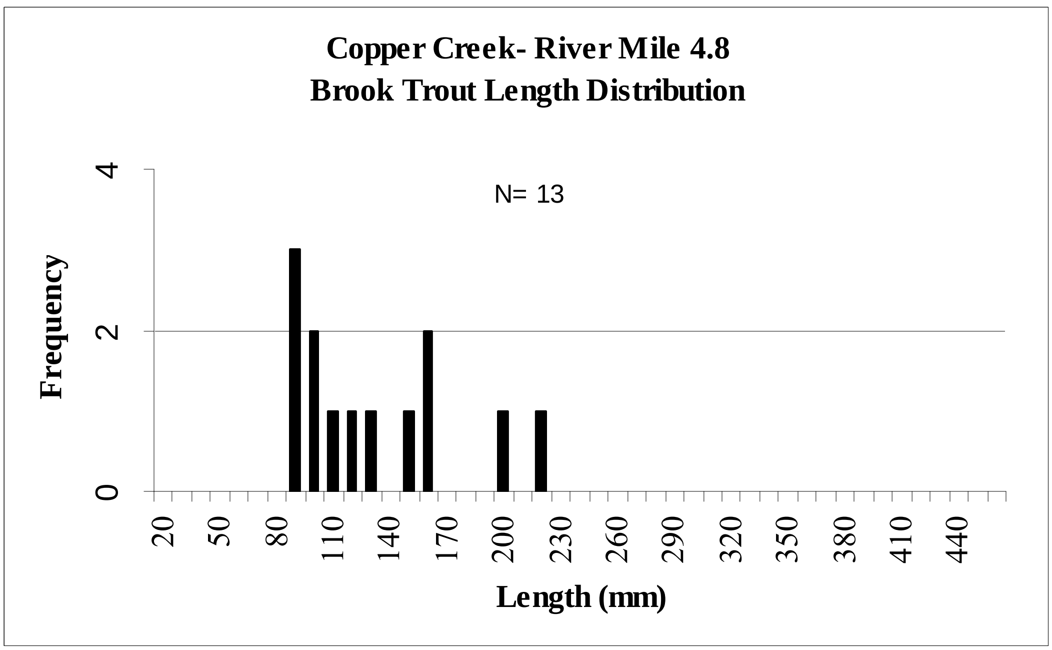


Copper Creek

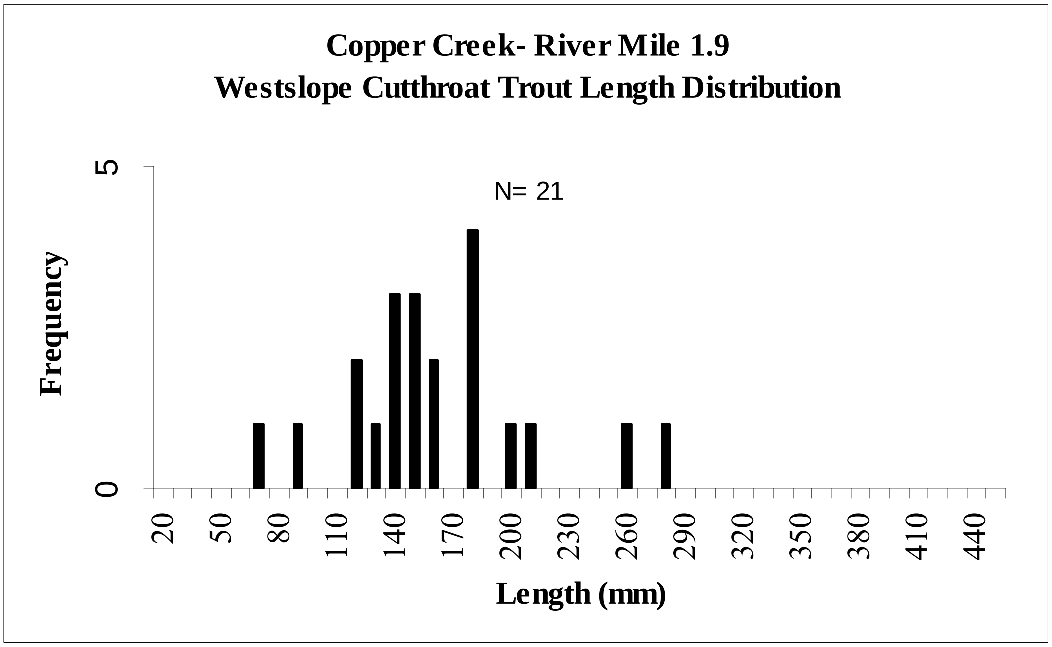


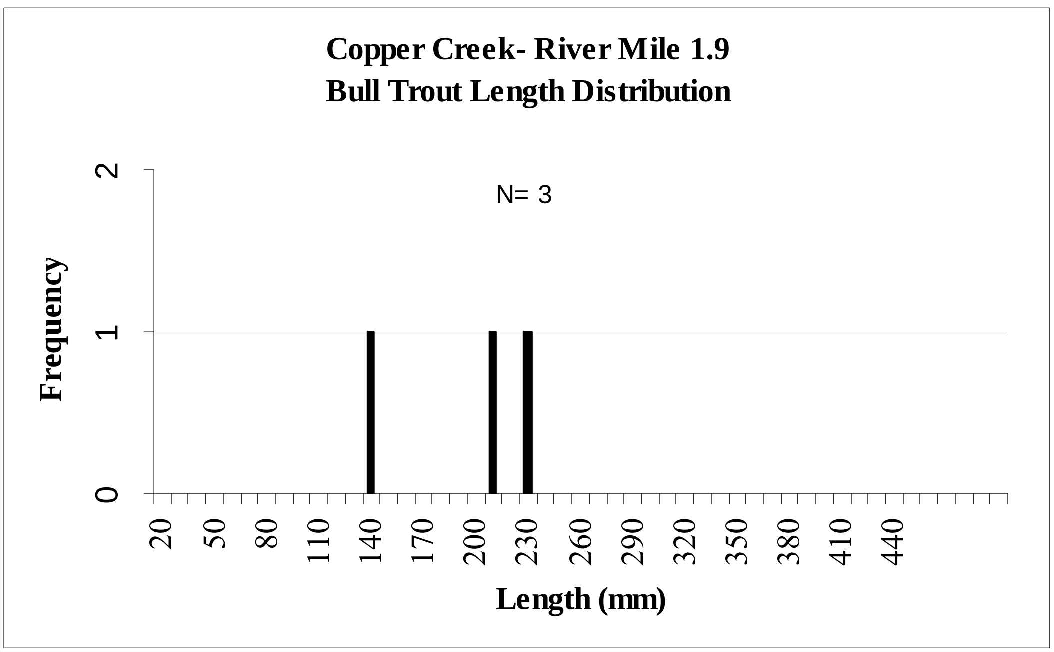


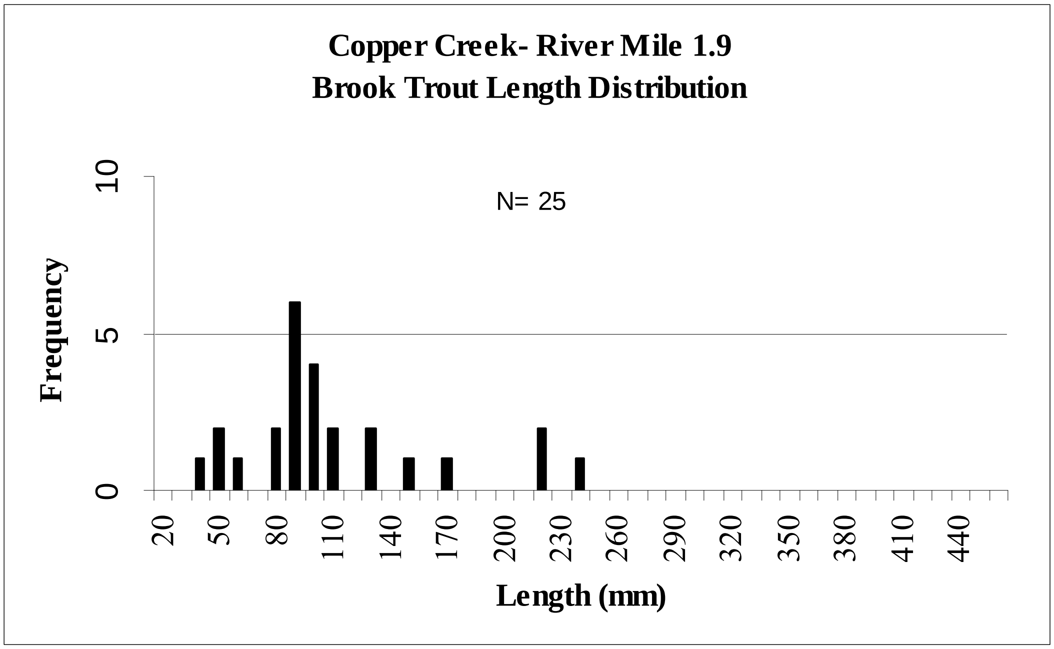
Copper Creek- River Mile 4.8
Bull Trout Length Distribution
N= 22
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

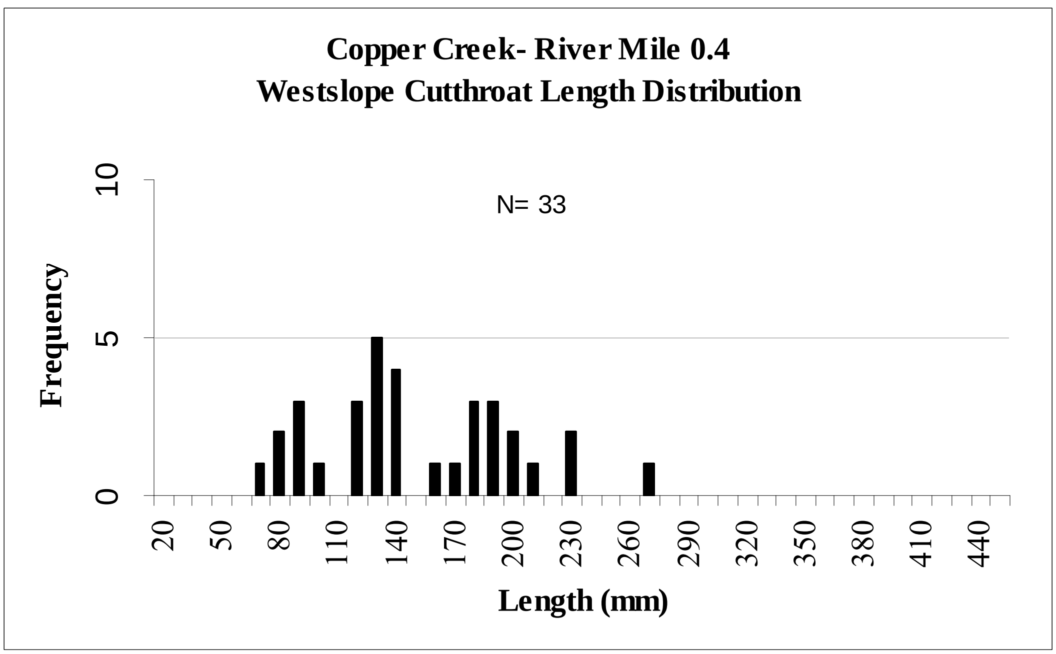


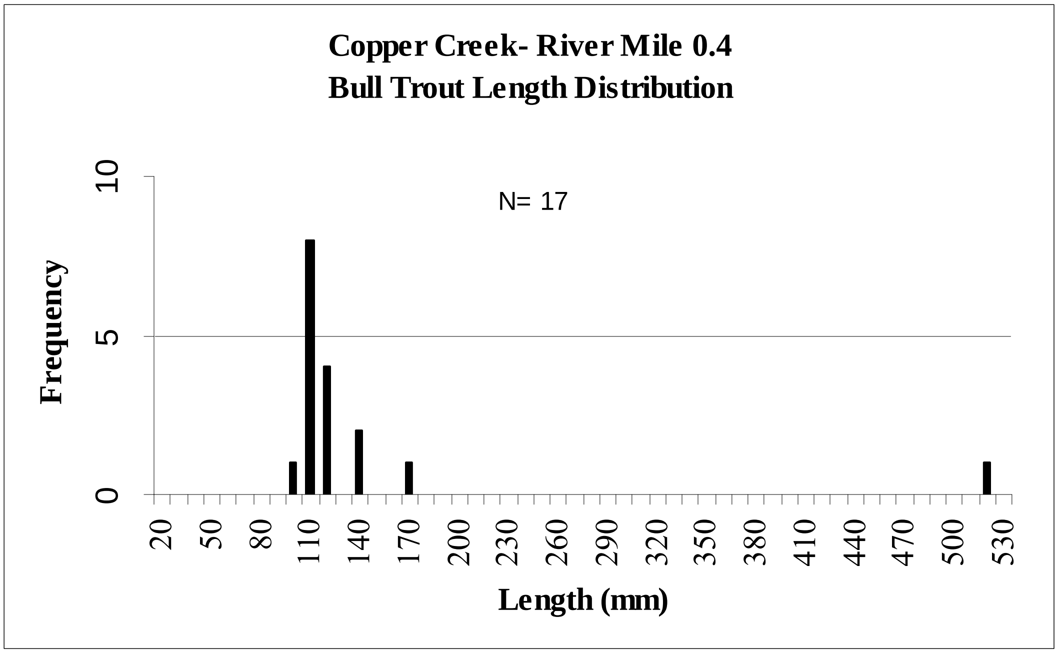
Copper Creek- River Mile 4.8
Brook Trout Length Distribution
N= 13
Frequency
0
2
4
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

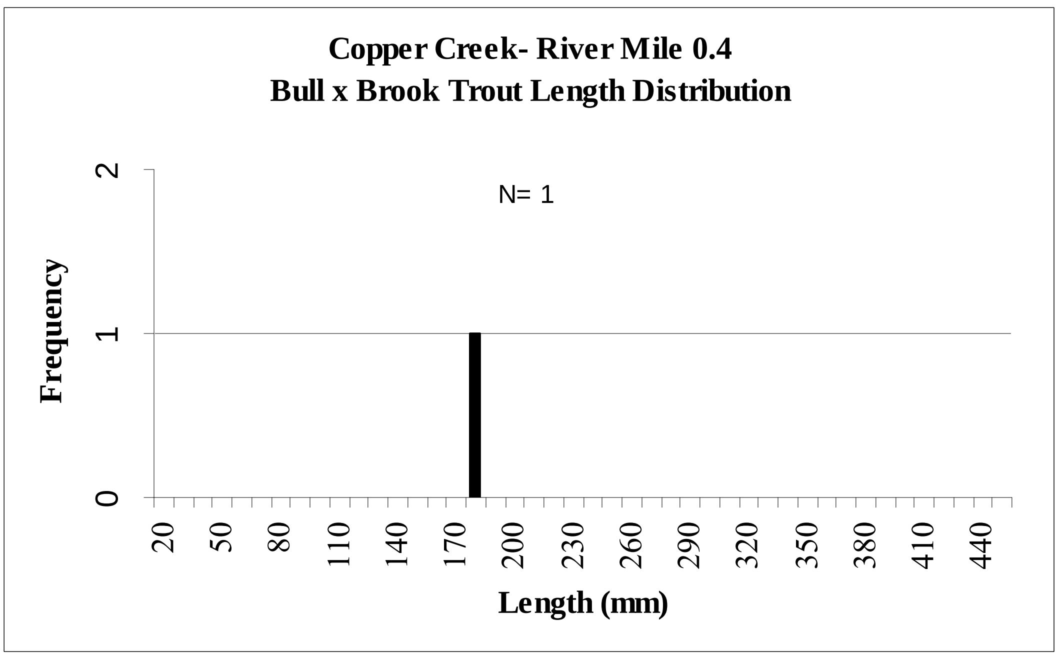

Copper Creek- River Mile 1.9
Westslope Cutthroat Trout Length Distribution
N= 21
Frequency
0
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

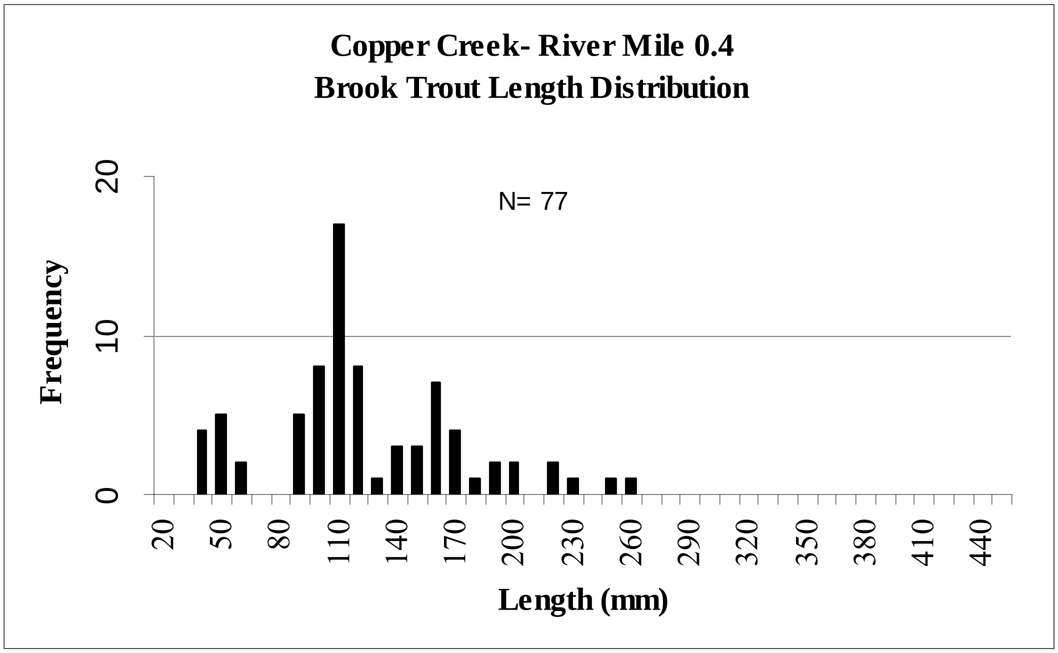

Copper Creek- River Mile 1.9
Bull Trout Length Distribution
N= 3
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

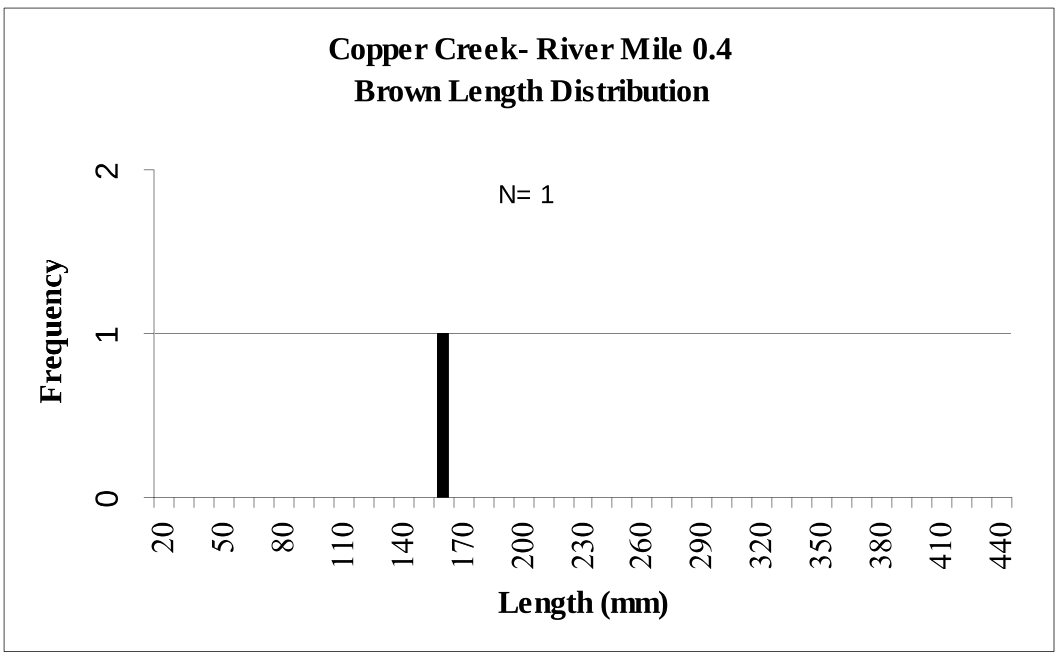

Copper Creek- River Mile 1.9
Brook Trout Length Distribution
N= 25
Frequency
0
5
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


Copper Creek- River Mile 0.4
Westslope Cutthroat Length Distribution
N= 33
Frequency
0
5
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

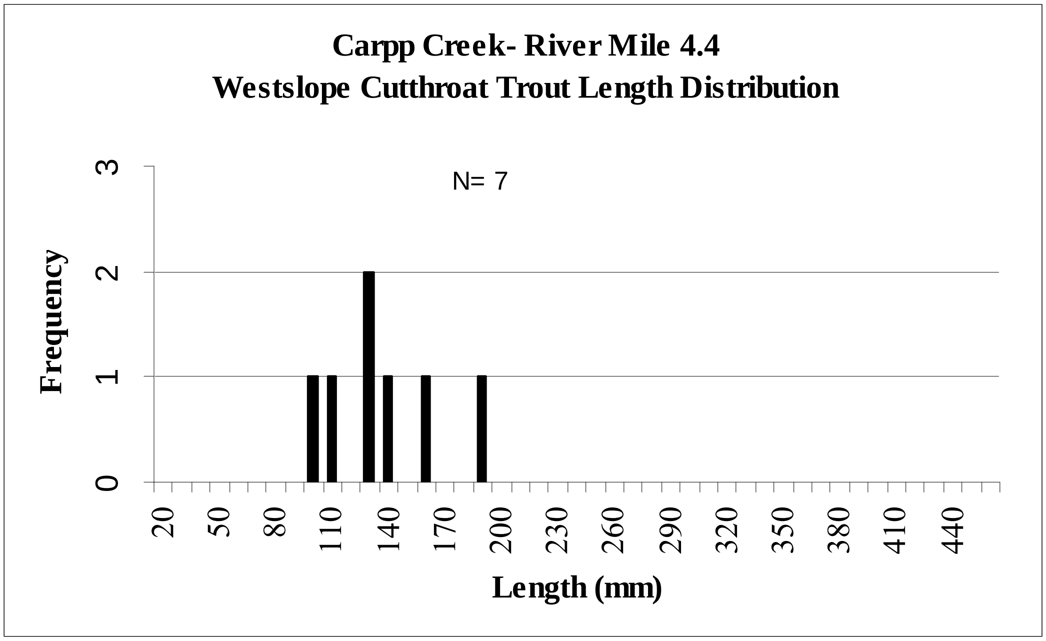

Copper Creek- River Mile 0.4
Bull Trout Length Distribution
N= 17
Frequency
0
5
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

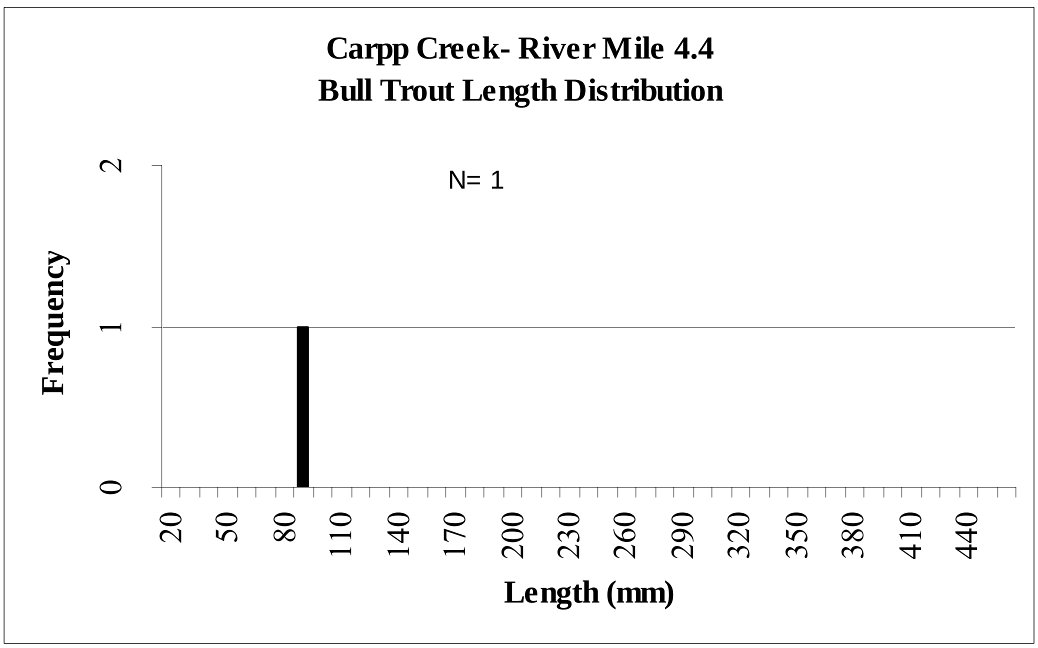

Copper Creek- River Mile 0.4
Bull x Brook Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

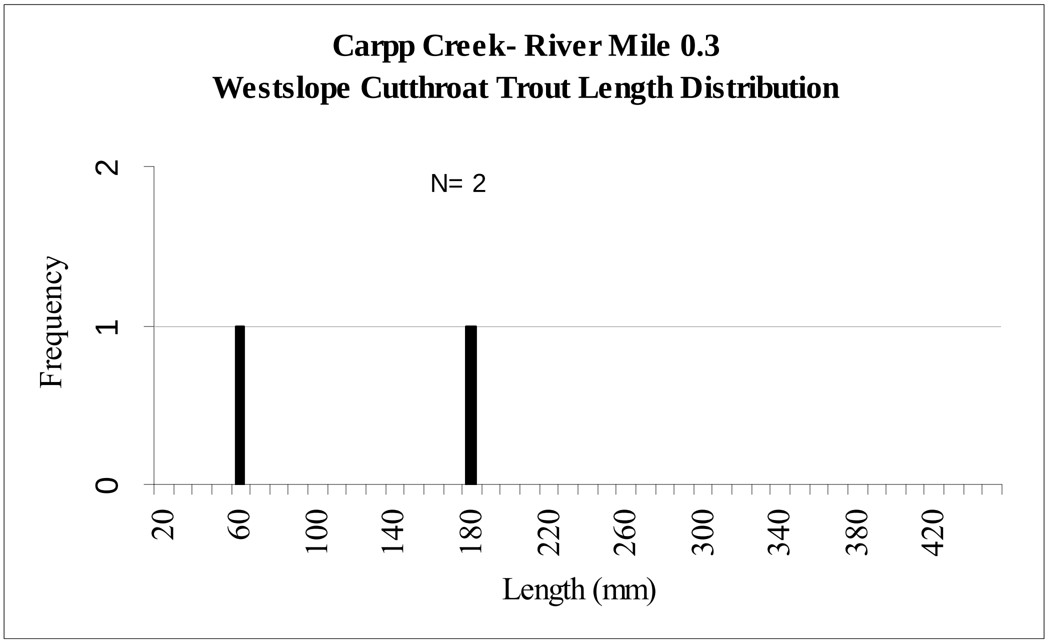

Copper Creek- River Mile 0.4
Brook Trout Length Distribution
N= 77
Frequency
0
10
20
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

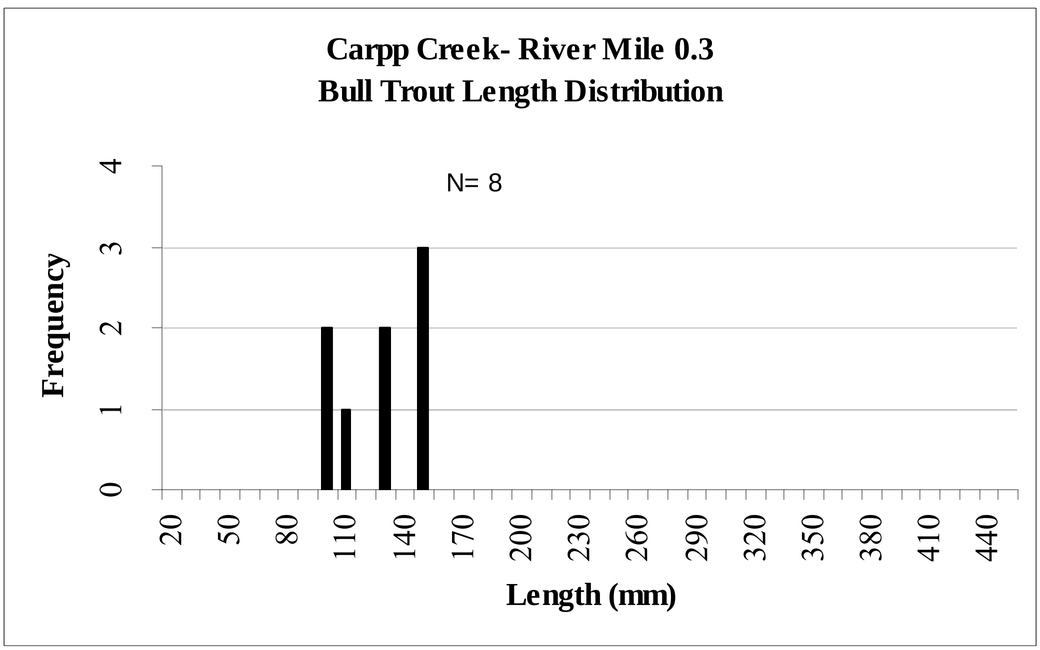

Copper Creek- River Mile 0.4
Brown Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

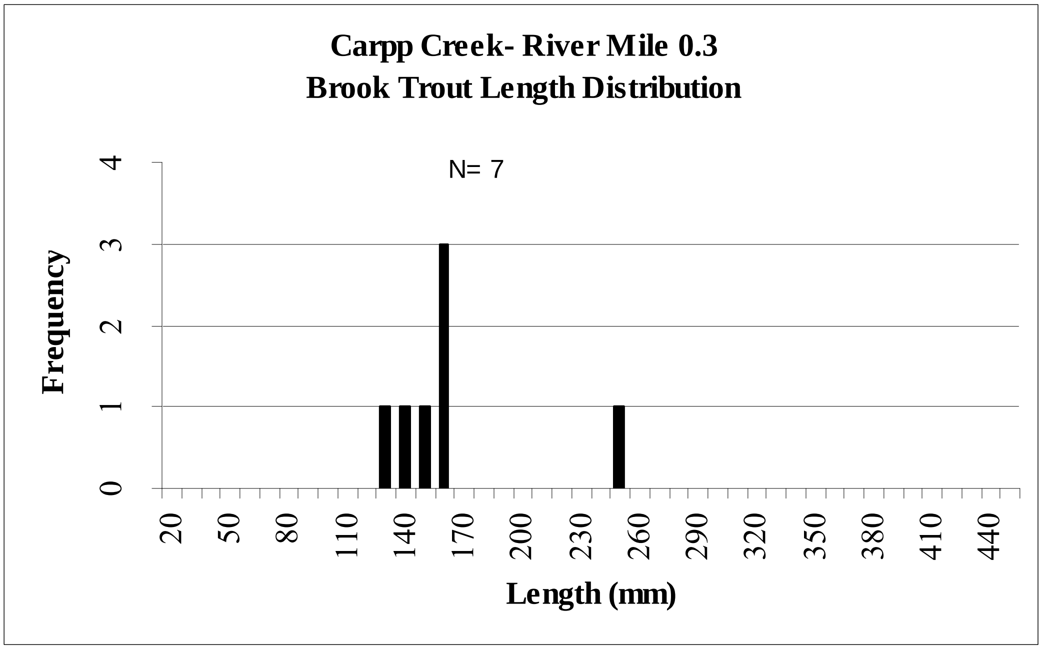
Carpp Creek


Carpp Creek- River Mile 4.4
Westslope Cutthroat Trout Length Distribution
N= 7
Frequency
0
1
2
3
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


Carpp Creek- River Mile 4.4
Bull Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

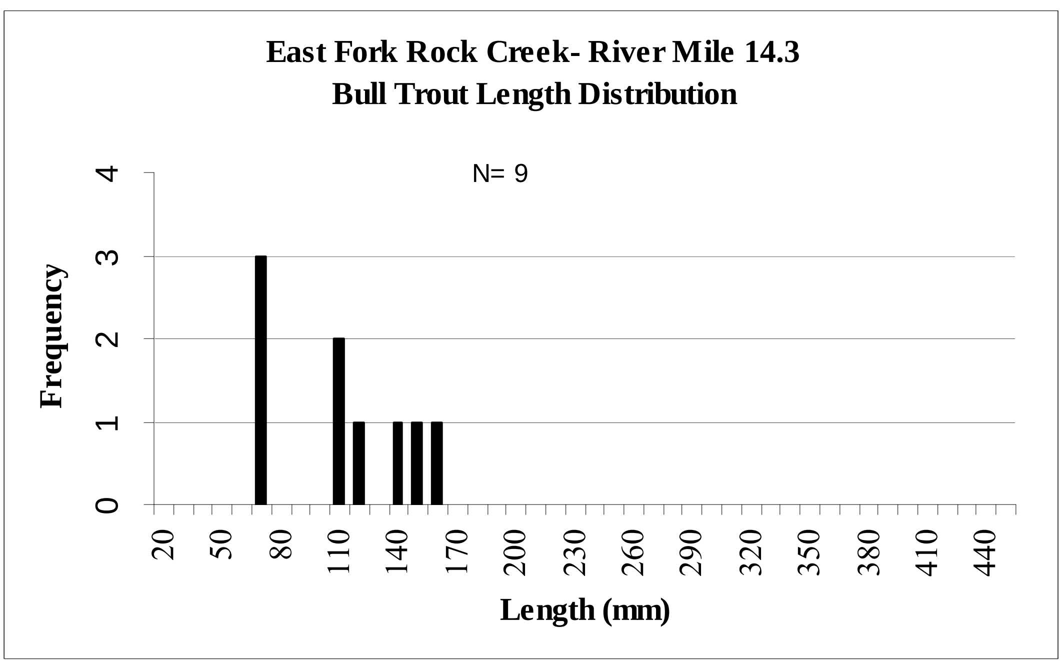

Carpp Creek- River Mile 0.3
Westslope Cutthroat Trout Length Distribution
N= 2
Frequency
0
1
2
20
60
100
140
180
220
260
300
340
380
420
Length (mm)

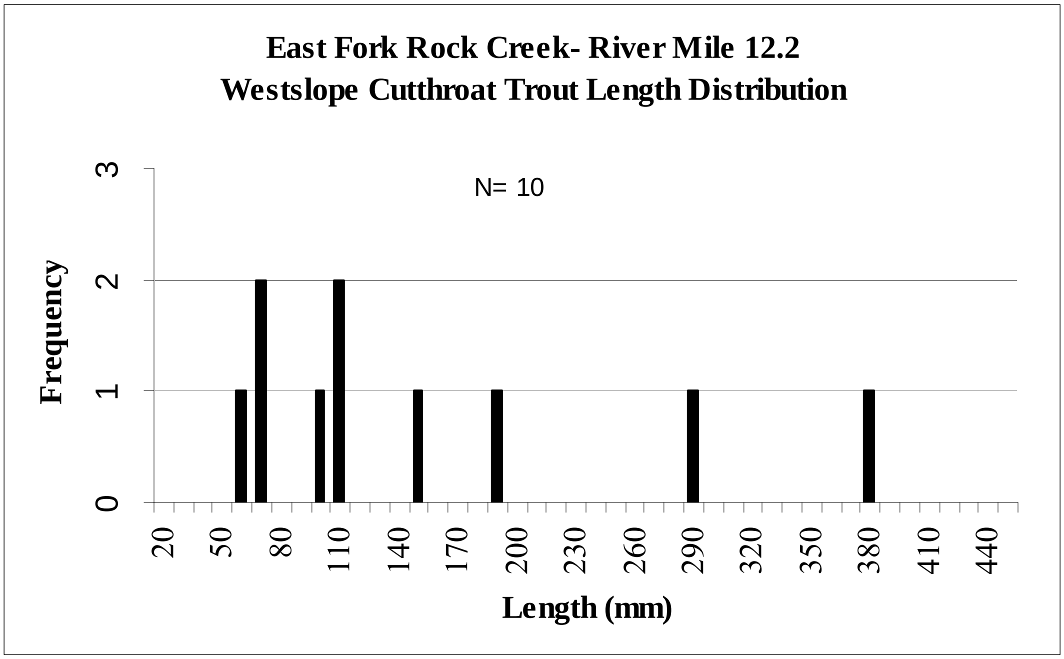

Carpp Creek- River Mile 0.3
Bull Trout Length Distribution
N= 8
Frequency
0
1
2
3
4
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

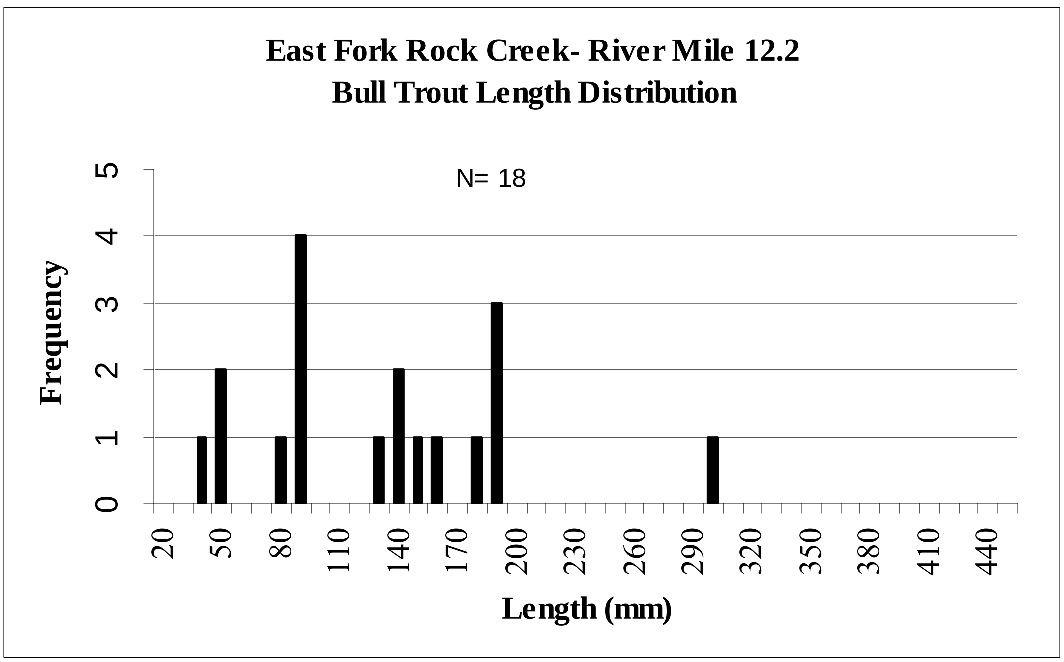


East Fork Rock Creek Drainage

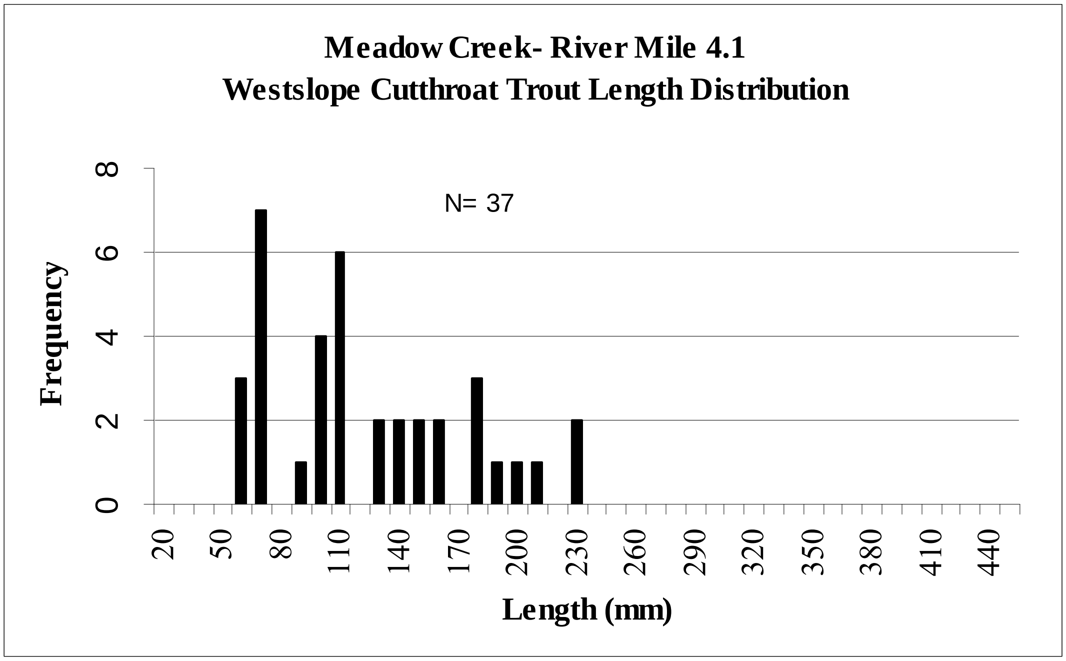
East Fork Rock Creek

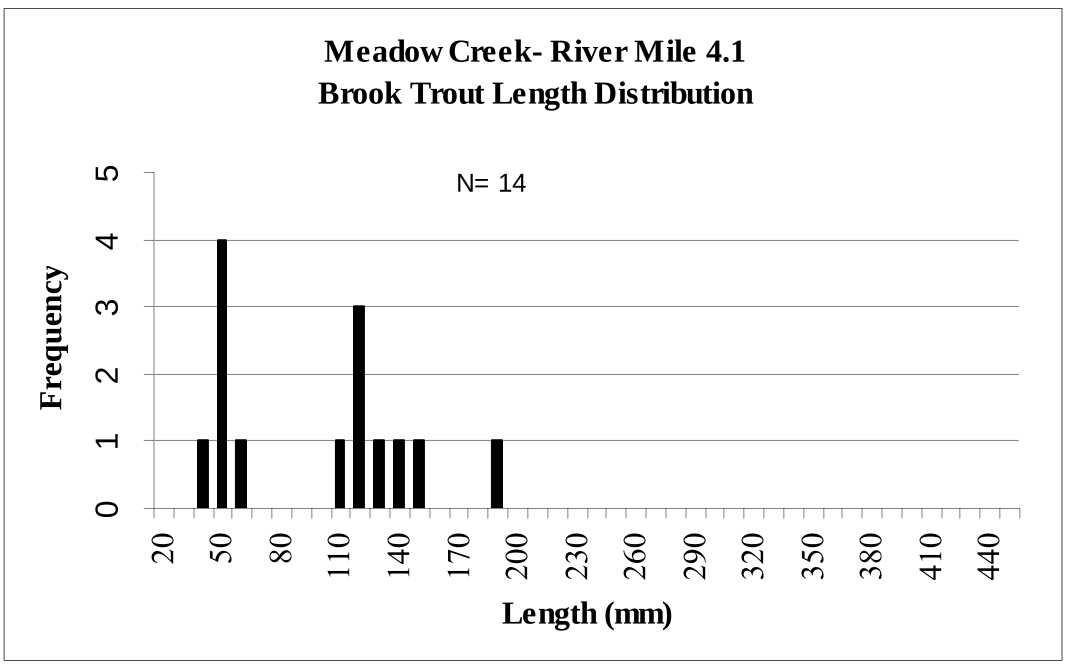


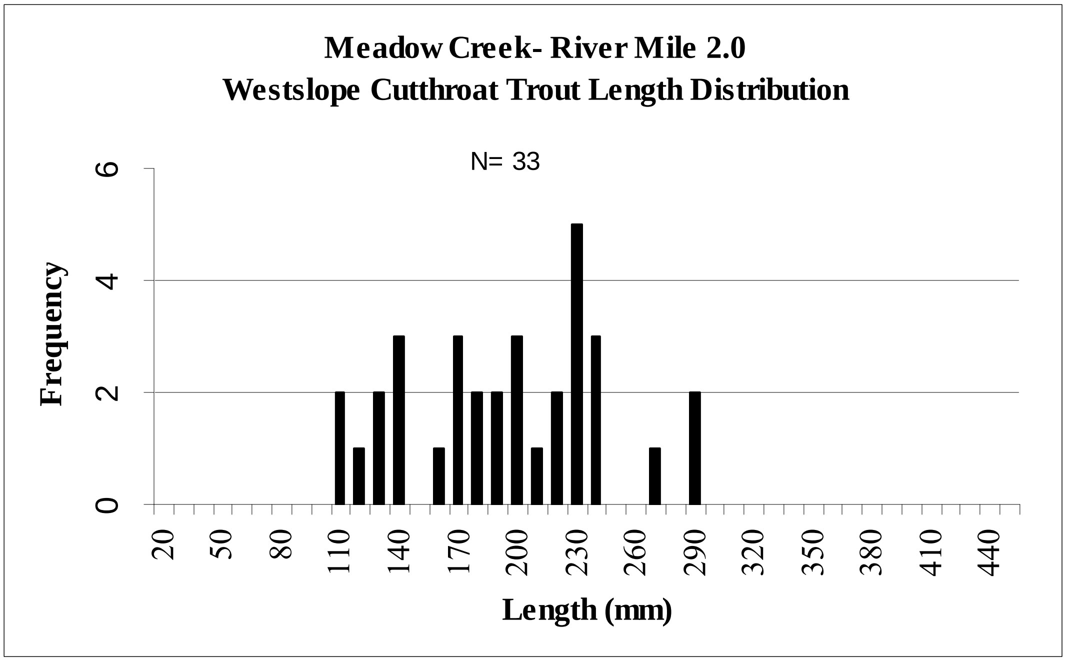

East Fork Rock Creek- River Mile 12.2
Westslope Cutthroat Trout Length Distribution
N= 10
Frequency
0
1
2
3
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


East Fork Rock Creek- River Mile 12.2
Bull Trout Length Distribution
N= 18
Frequency
0
1
2
3
4
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

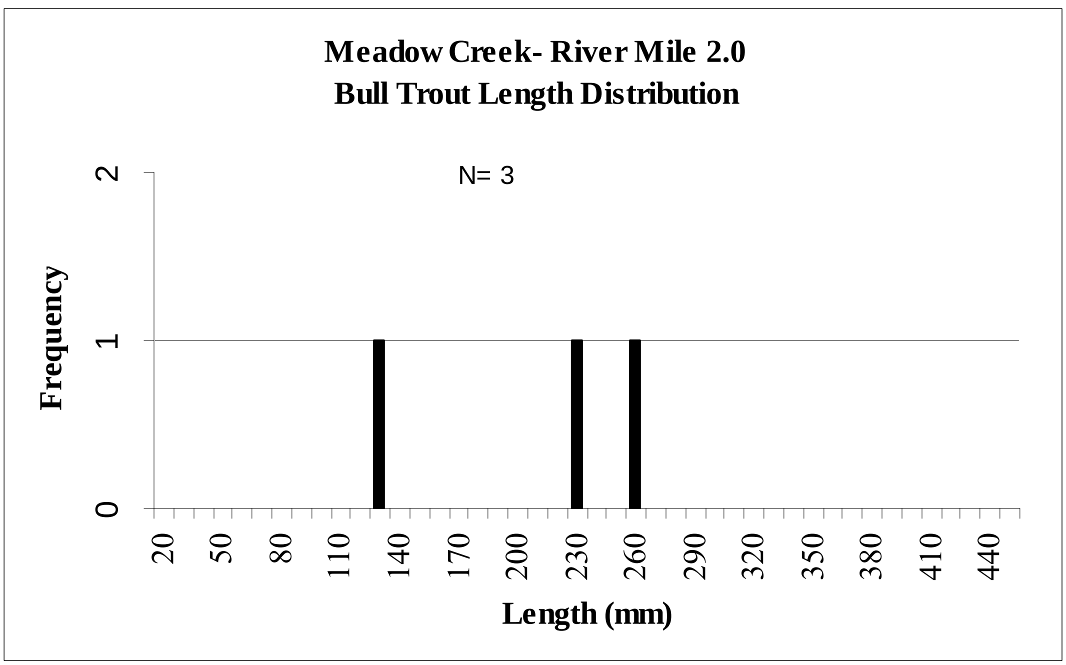
Meadow Creek



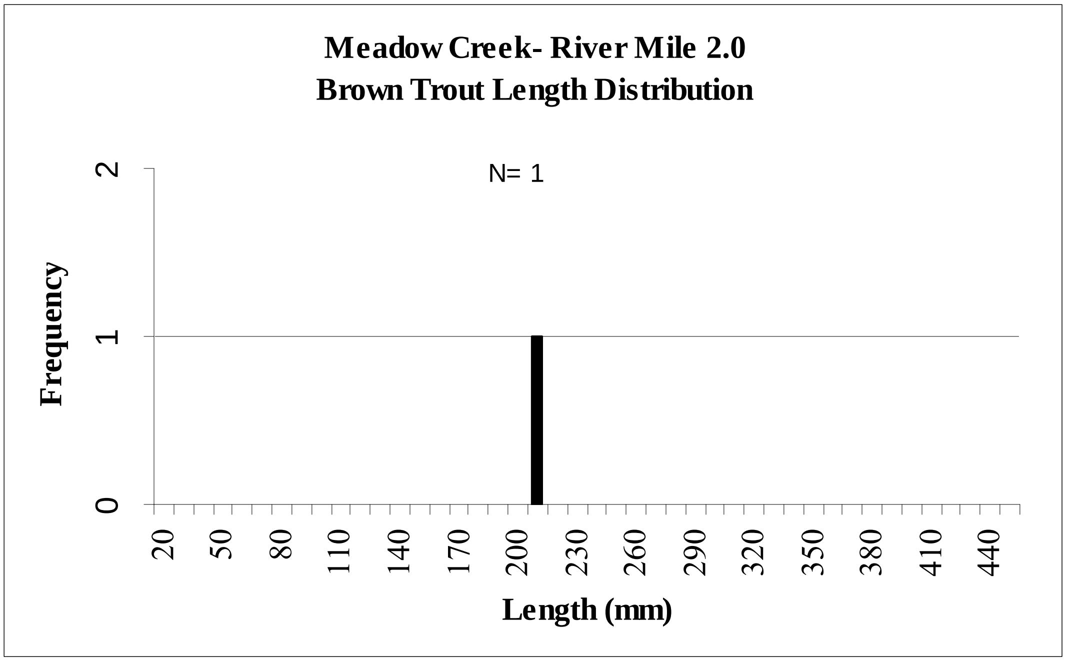


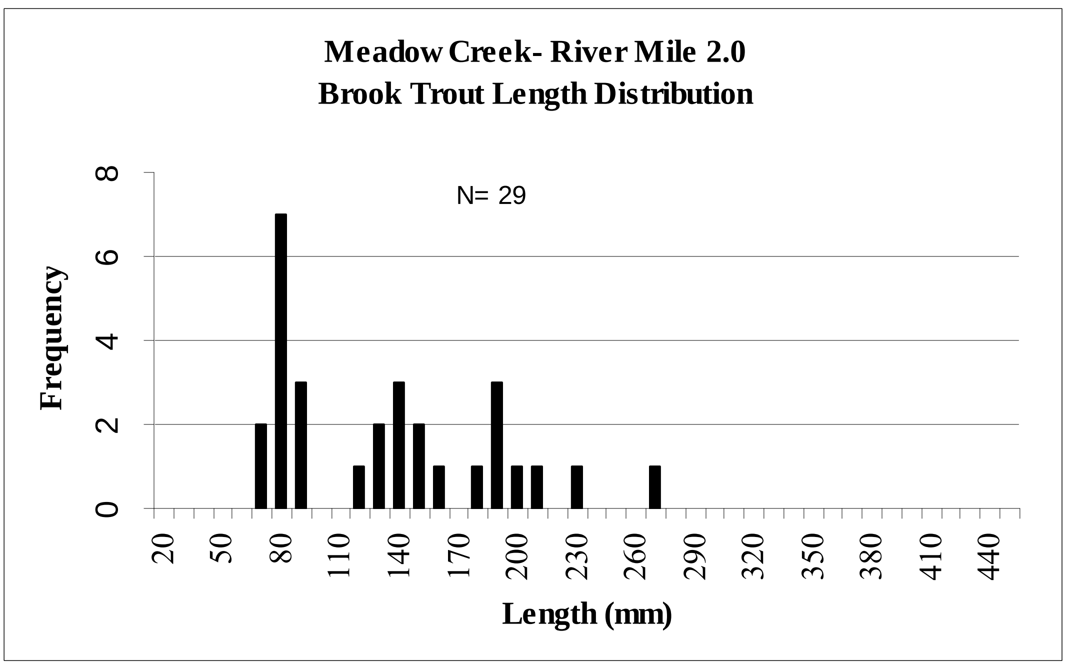


Meadow Creek- River Mile 2.0
Westslope Cutthroat Trout Length Distribution
N= 33
Frequency
0
2
4
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)



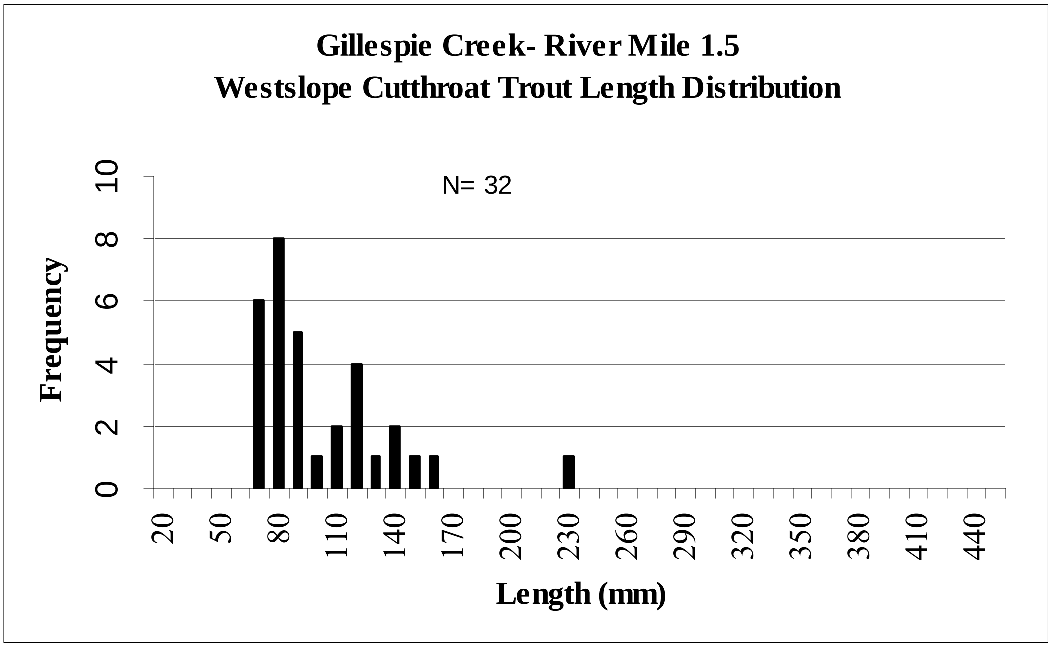
Meadow Creek- River Mile 2.0
Bull Trout Length Distribution
N= 3
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

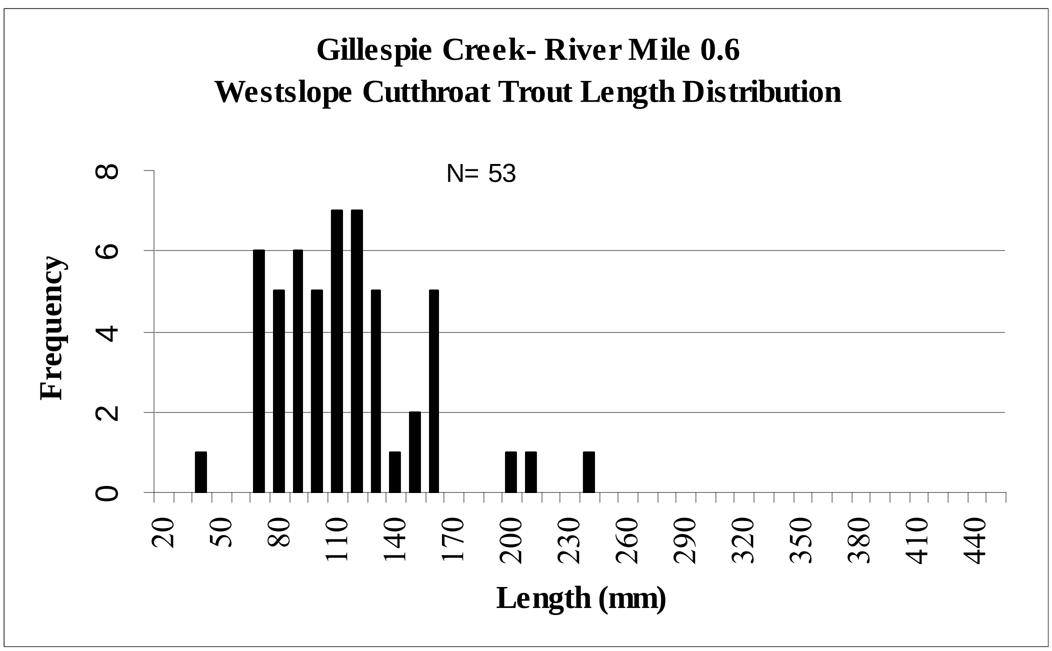

Meadow Creek- River Mile 2.0
Brown Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)


Meadow Creek- River Mile 2.0
Brook Trout Length Distribution
N= 29
Frequency
0
2
4
6
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

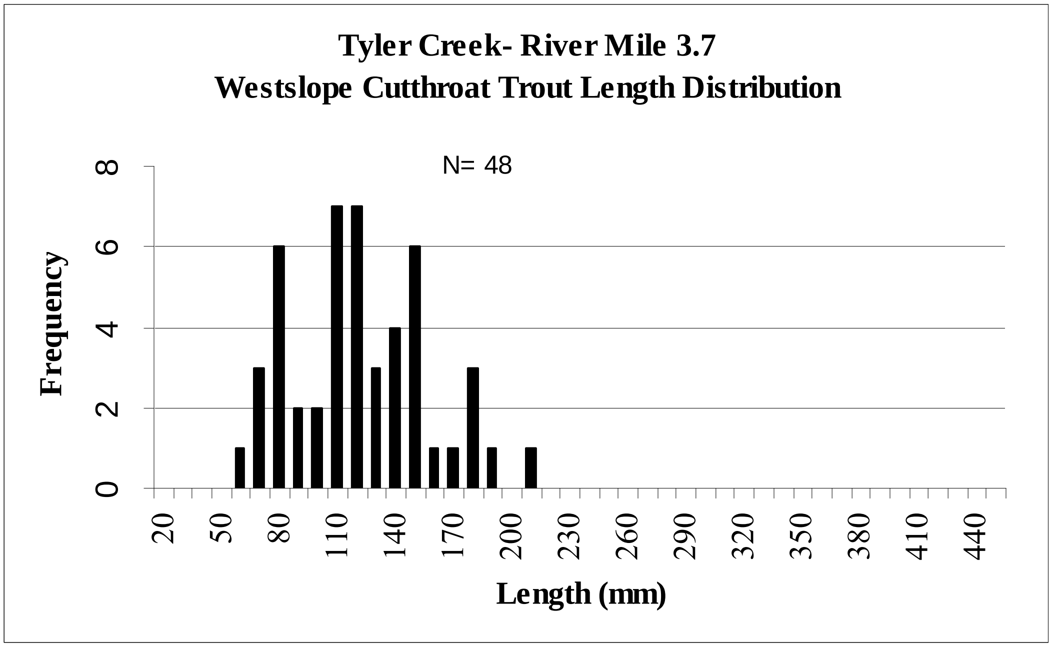
Clark Fork River Drainage

Gillespie Creek

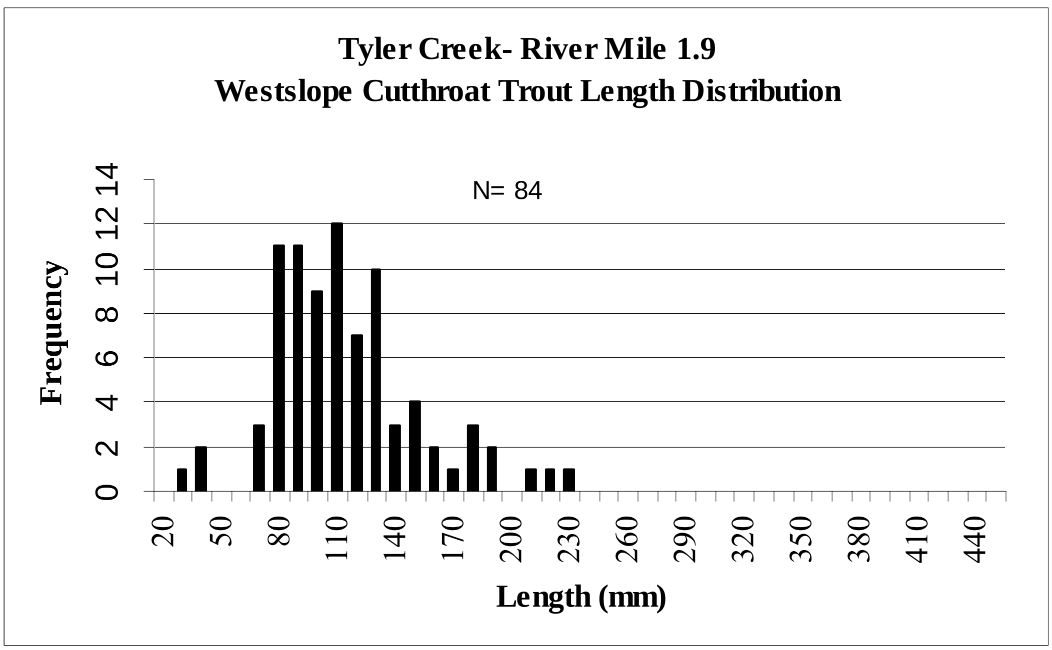




Tyler Creek

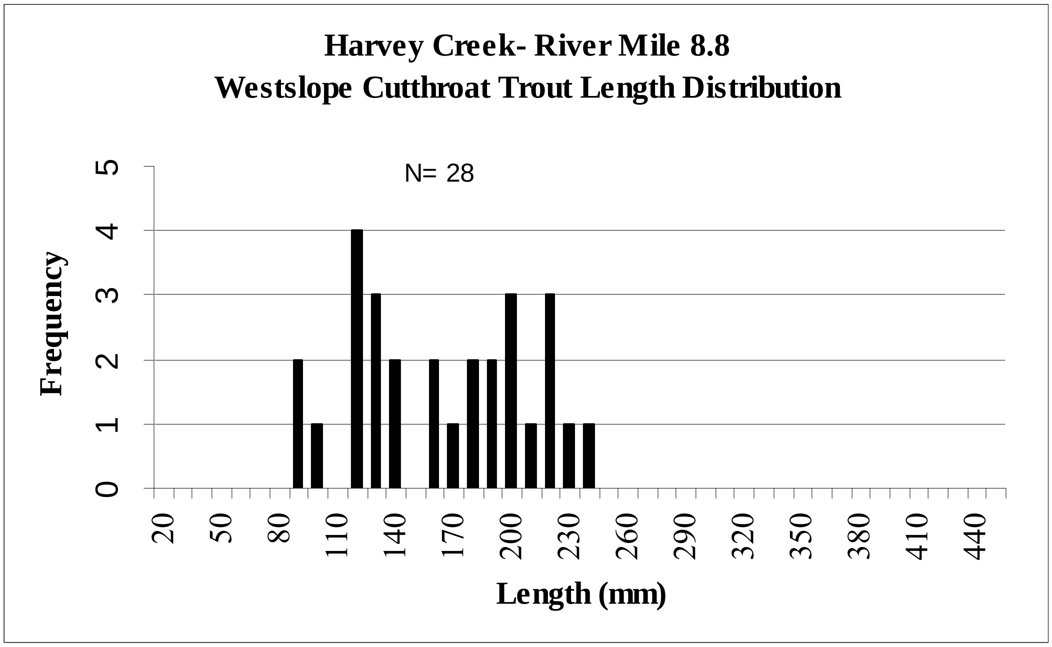


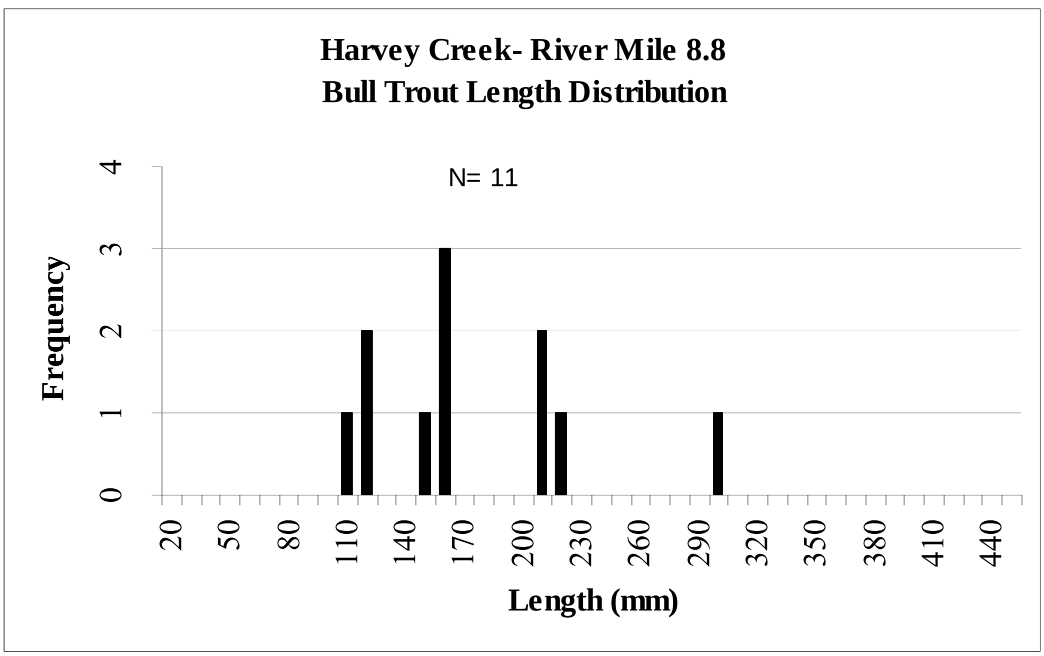
Tyler Creek- River Mile 3.7
Westslope Cutthroat Trout Length Distribution
N= 48
Frequency
0
2
4
6
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

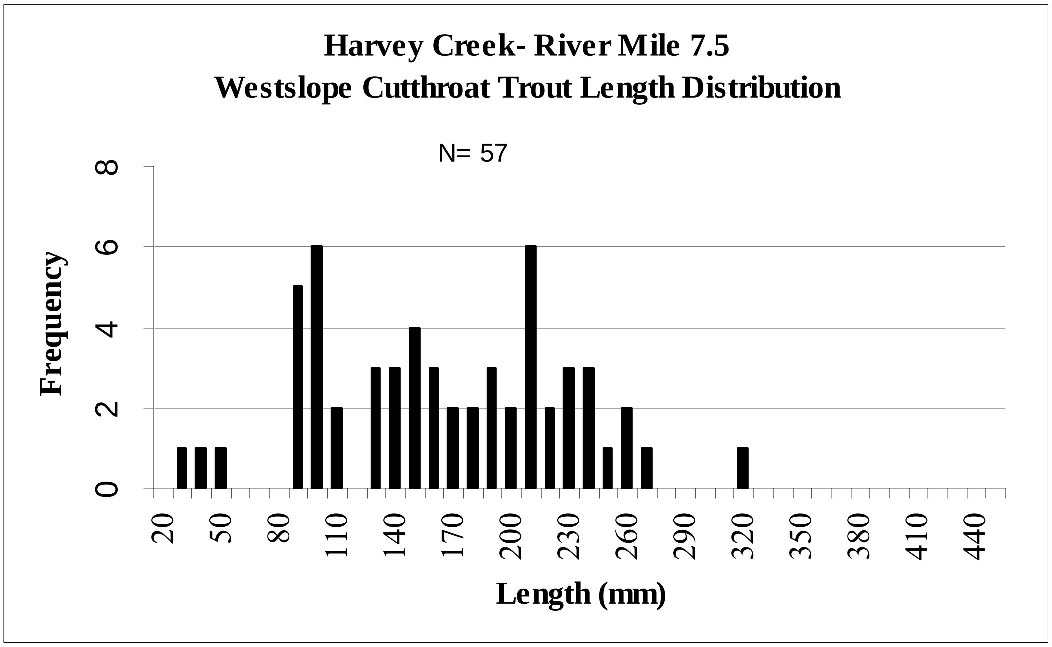


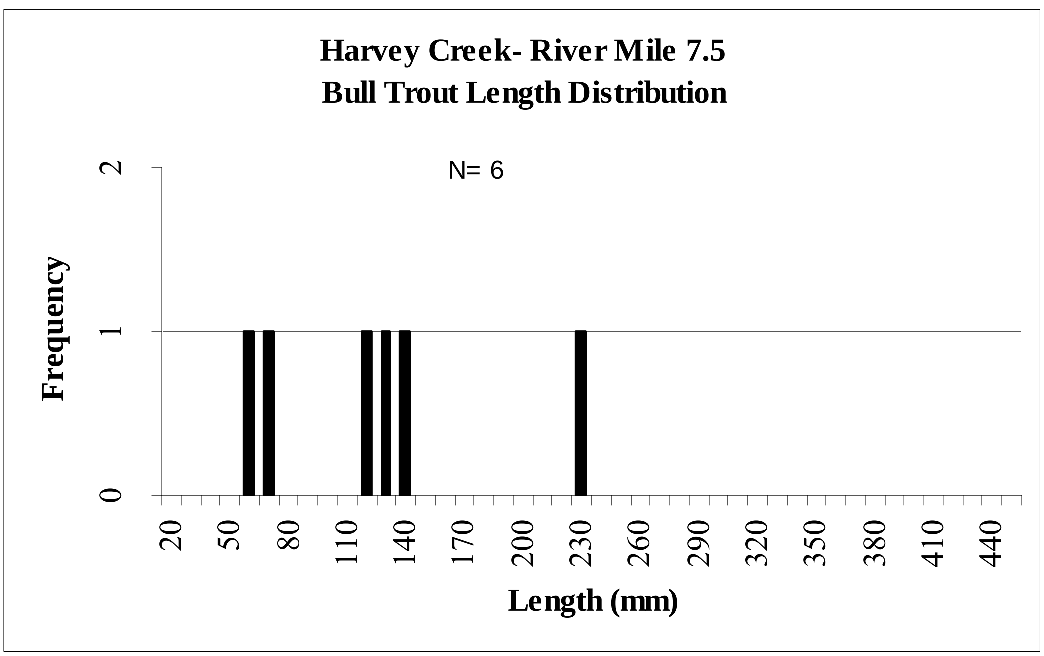
Tyler Creek- River Mile 1.9
Westslope Cutthroat Trout Length Distribution
N= 84
Frequency
0
2
4
6
8
10
12
14
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

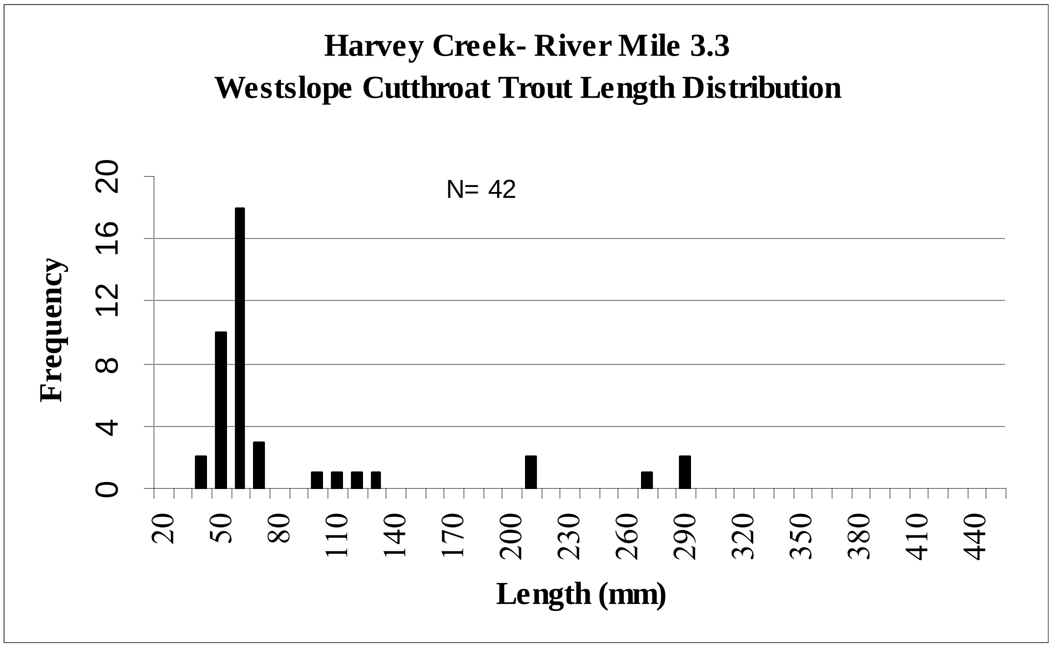
Harvey Creek



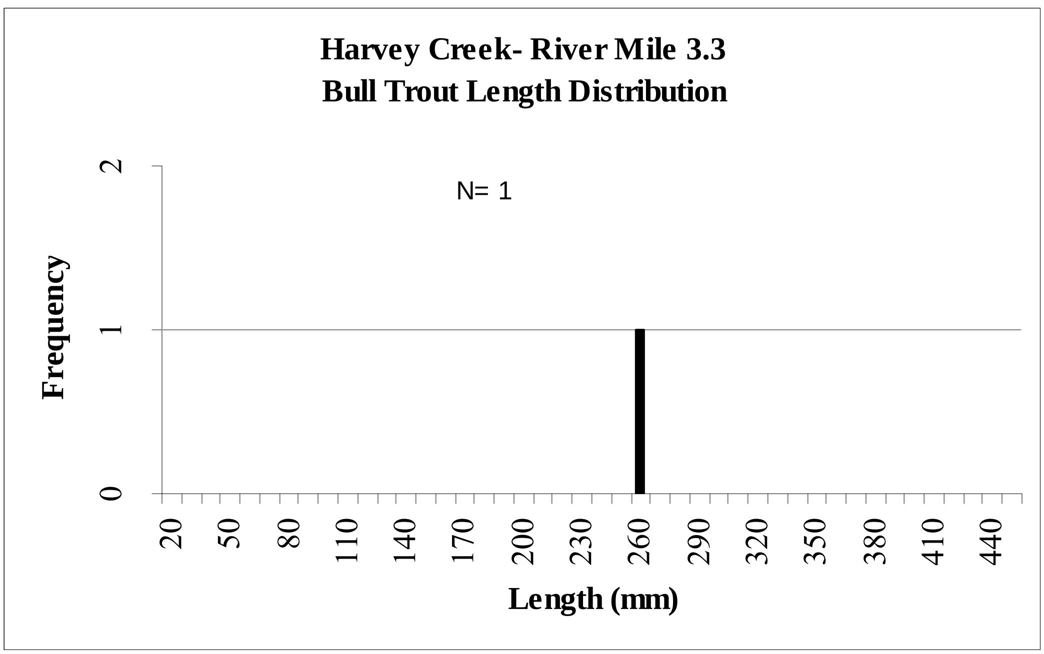



Harvey Creek- River Mile 7.5
Westslope Cutthroat Trout Length Distribution
N= 57
Frequency
0
2
4
6
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

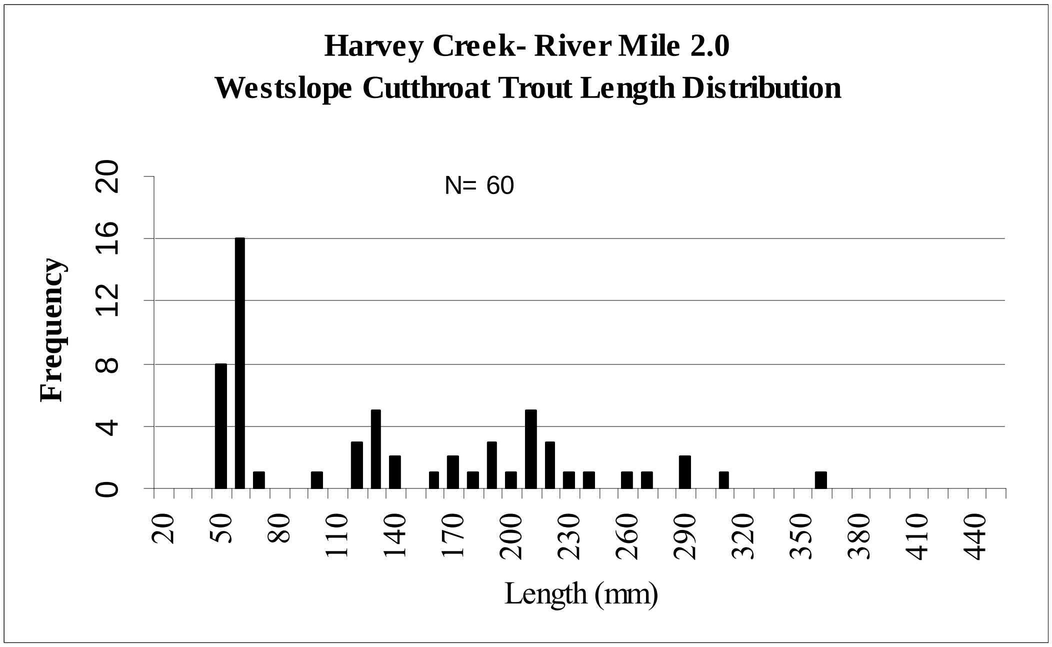

Harvey Creek- River Mile 7.5
Bull Trout Length Distribution
N= 6
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

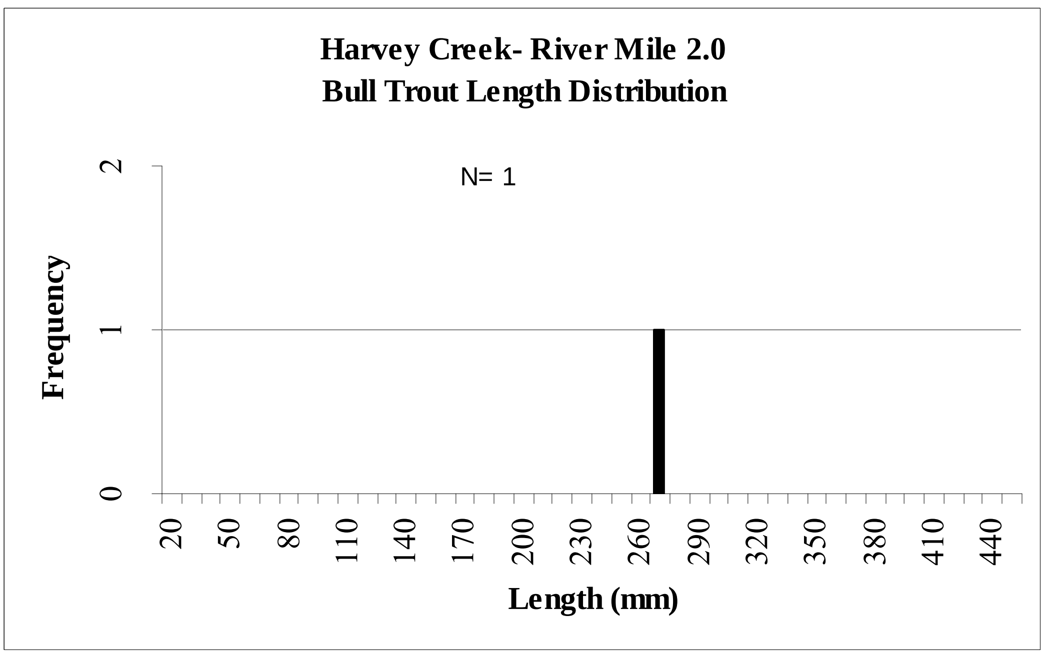


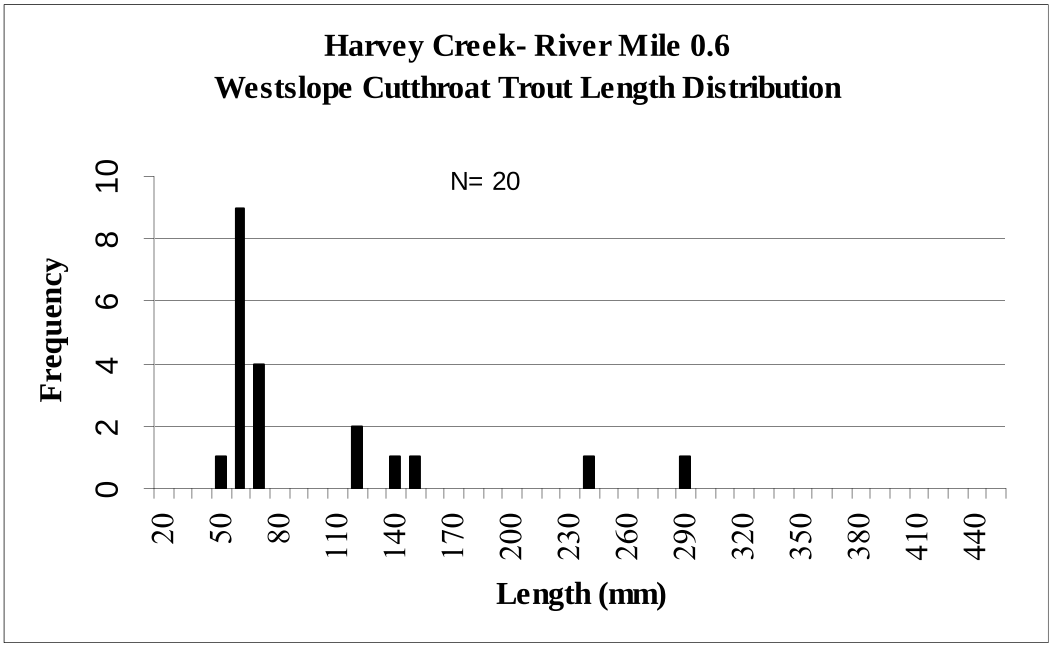
Harvey Creek- River Mile 3.3
Westslope Cutthroat Trout Length Distribution
N= 42
Frequency
0
4
8
12
16
20
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)



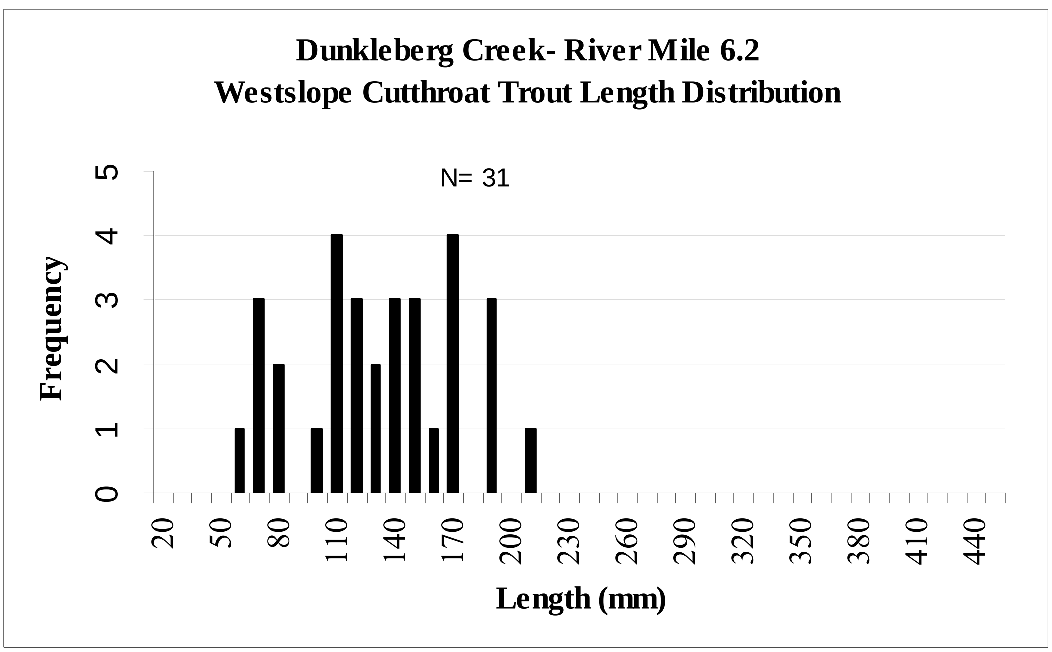
Harvey Creek- River Mile 3.3
Bull Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

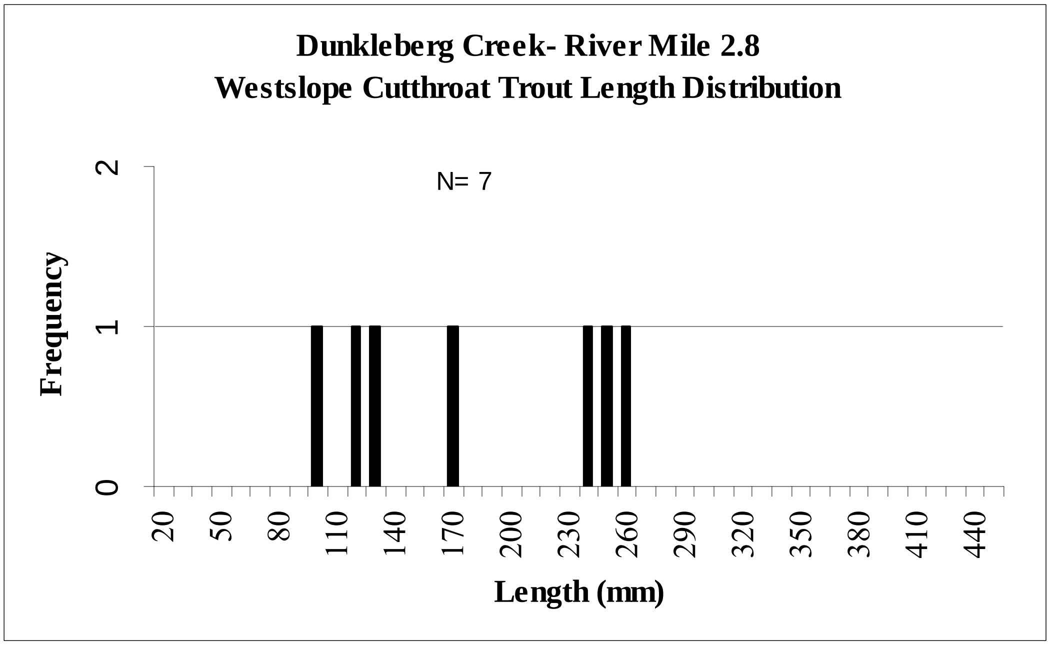

Harvey Creek- River Mile 2.0
Westslope Cutthroat Trout Length Distribution
N= 60
Frequency
0
4
8
12
16
20
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

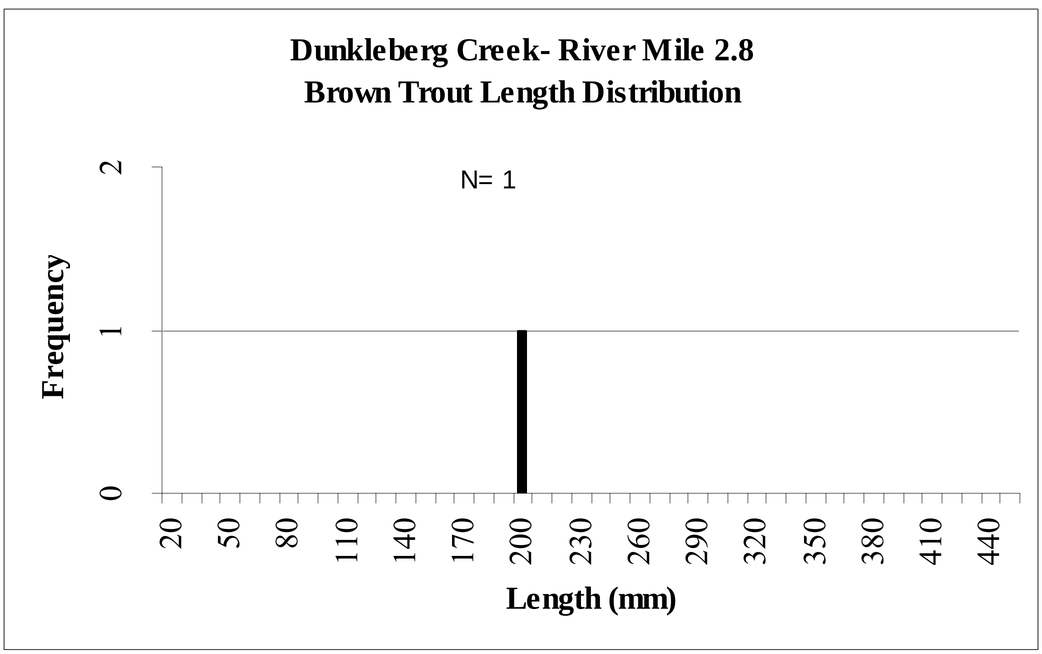

Harvey Creek- River Mile 2.0
Bull Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)



Dunkleberg Creek

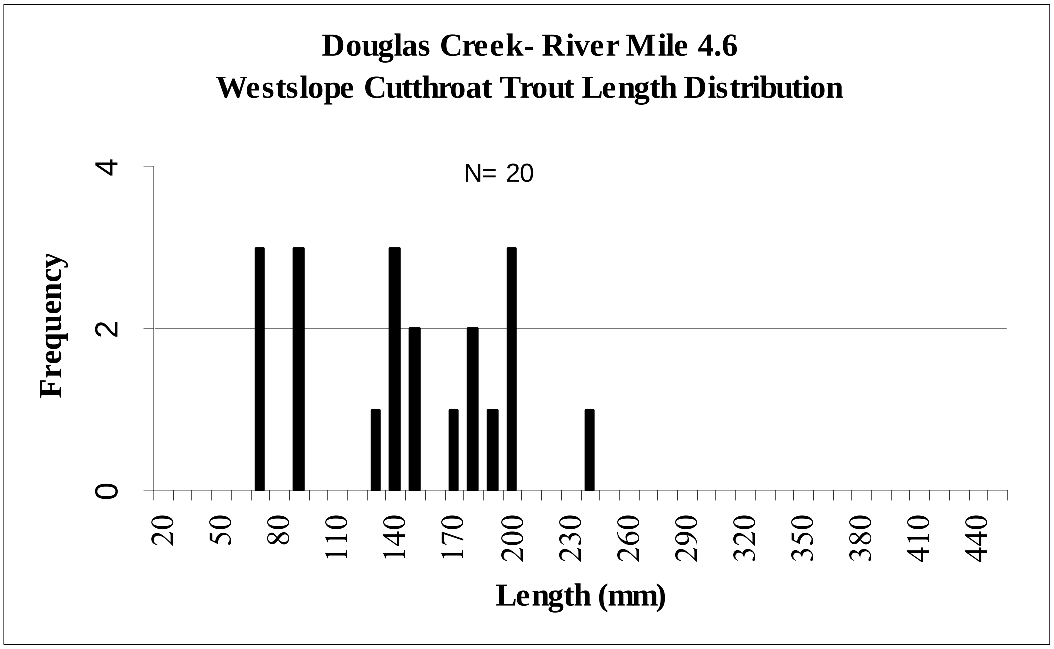


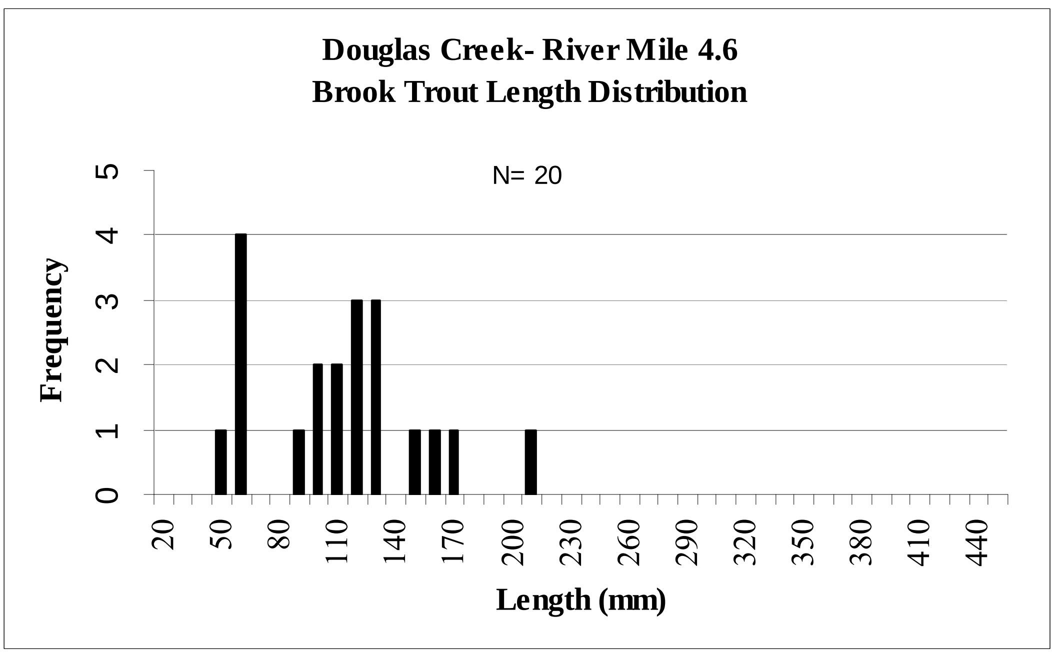

Dunkleberg Creek- River Mile 2.8
Westslope Cutthroat Trout Length Distribution
N= 7
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

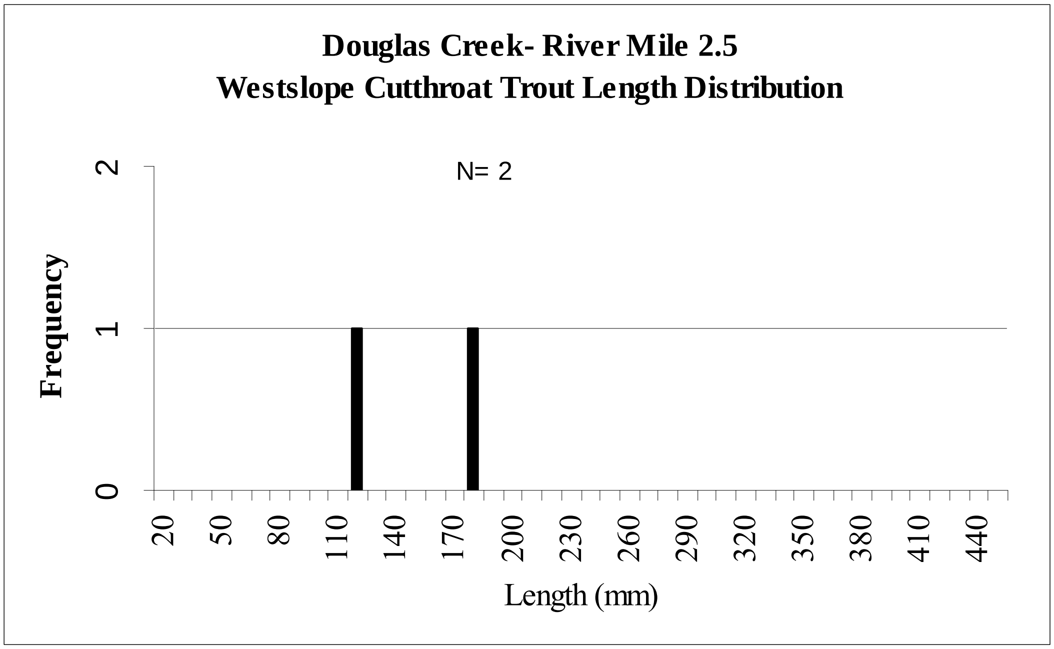

Dunkleberg Creek- River Mile 2.8
Brown Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

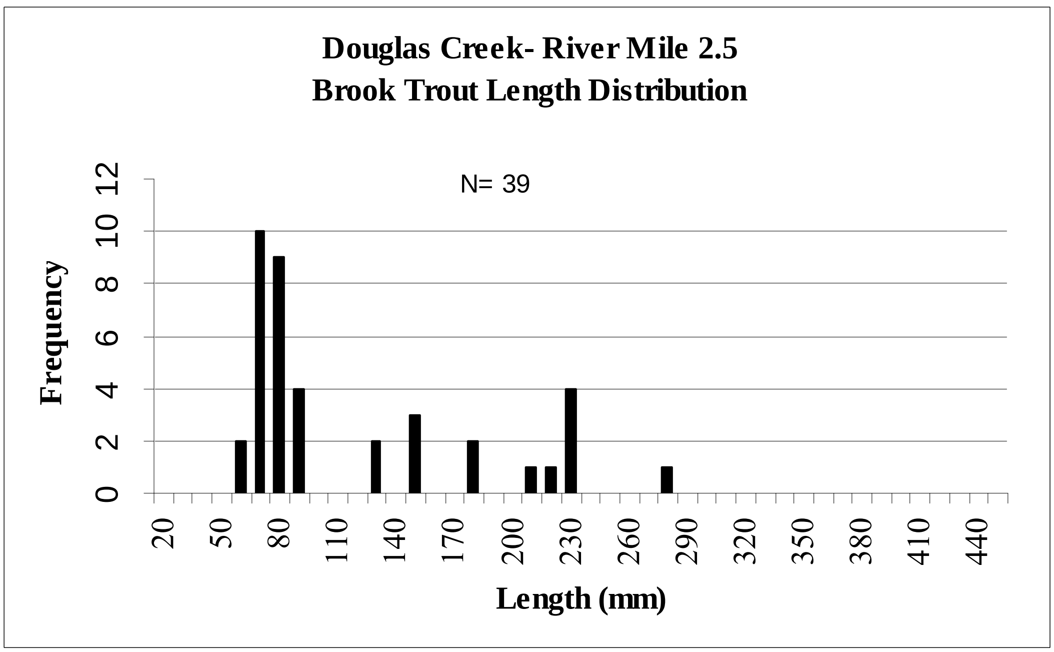
Flint Creek Drainage

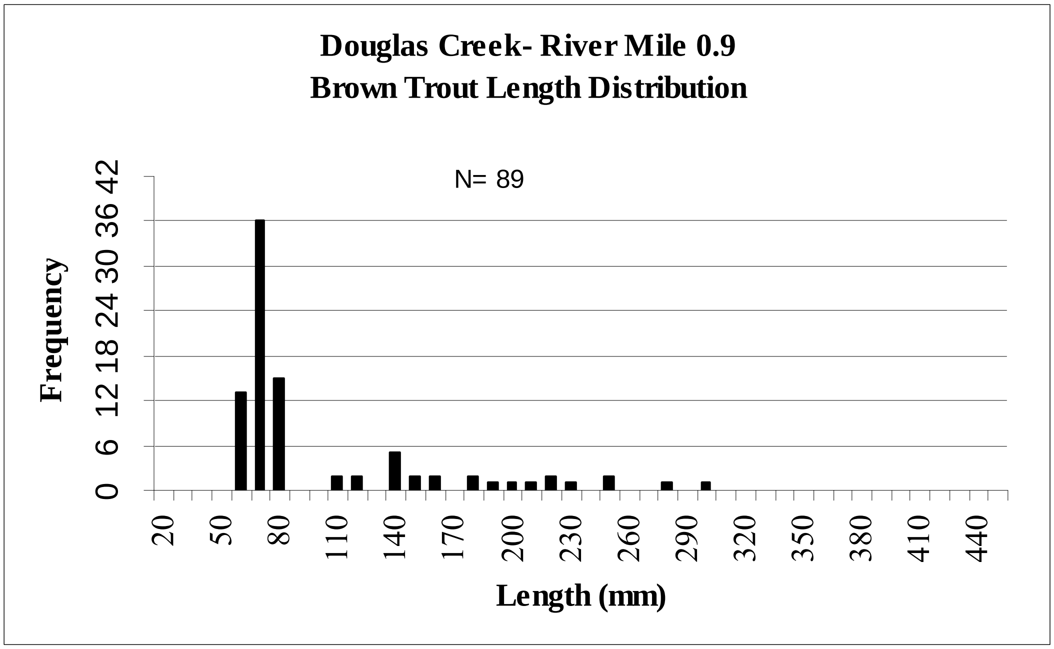
Douglas Creek



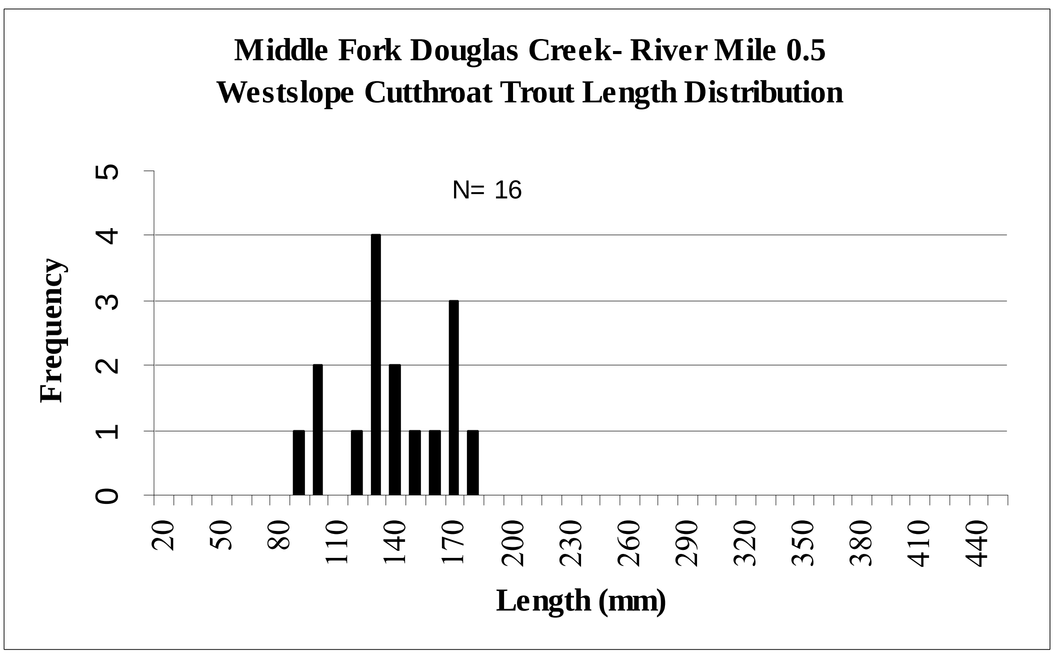



Douglas Creek- River Mile 2.5
Westslope Cutthroat Trout Length Distribution
N= 2
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

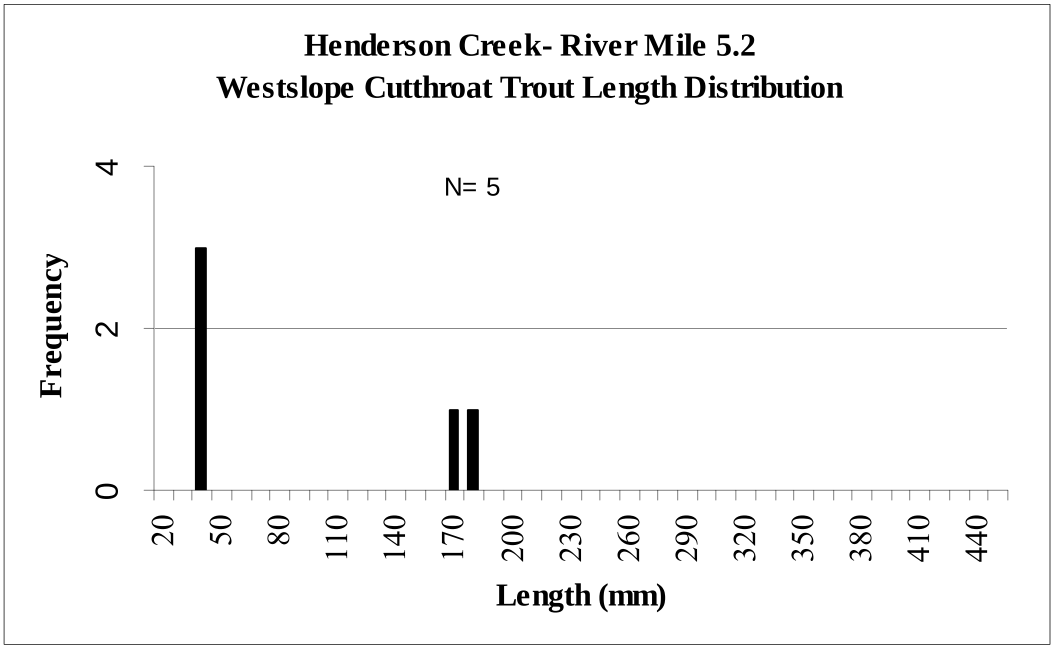

Douglas Creek- River Mile 2.5
Brook Trout Length Distribution
N= 39
Frequency
0
2
4
6
8
10
12
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

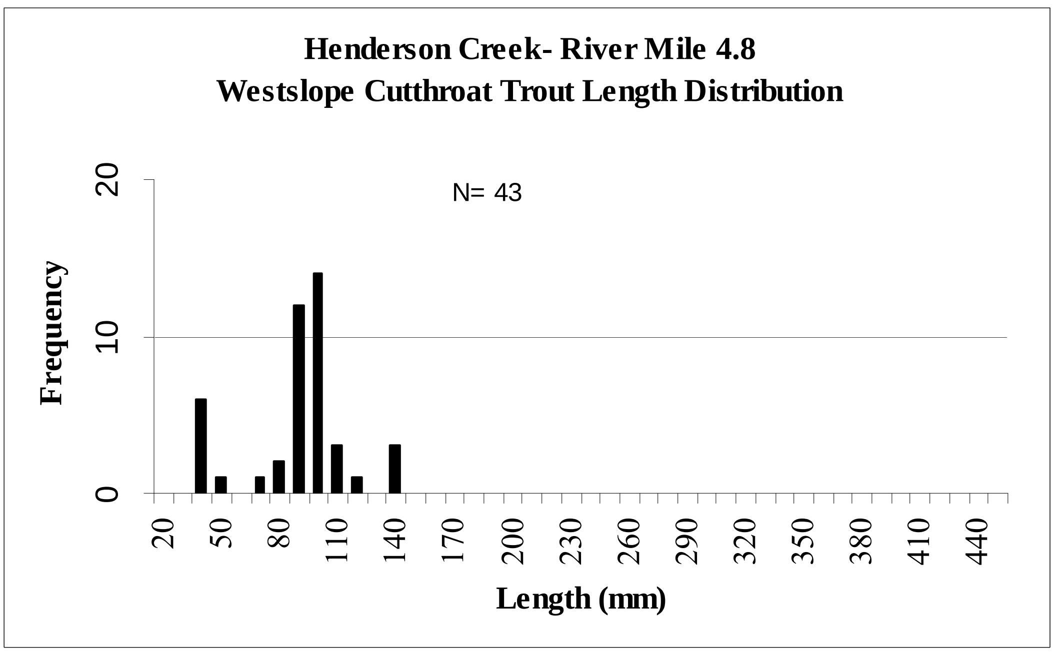


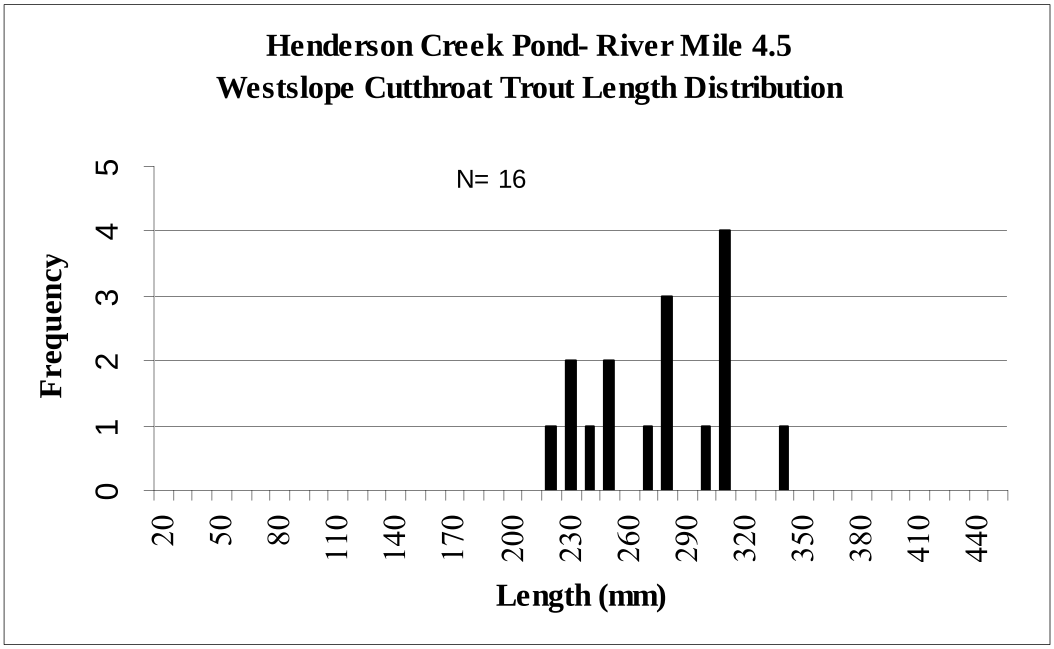
Middle Fork Douglas Creek



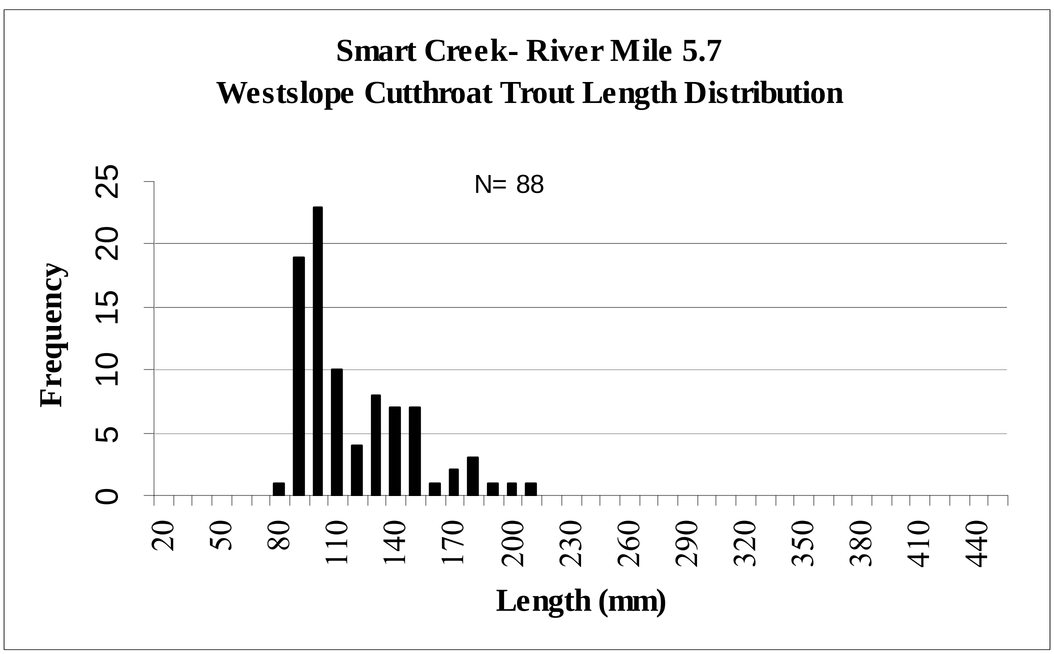
Henderson Creek

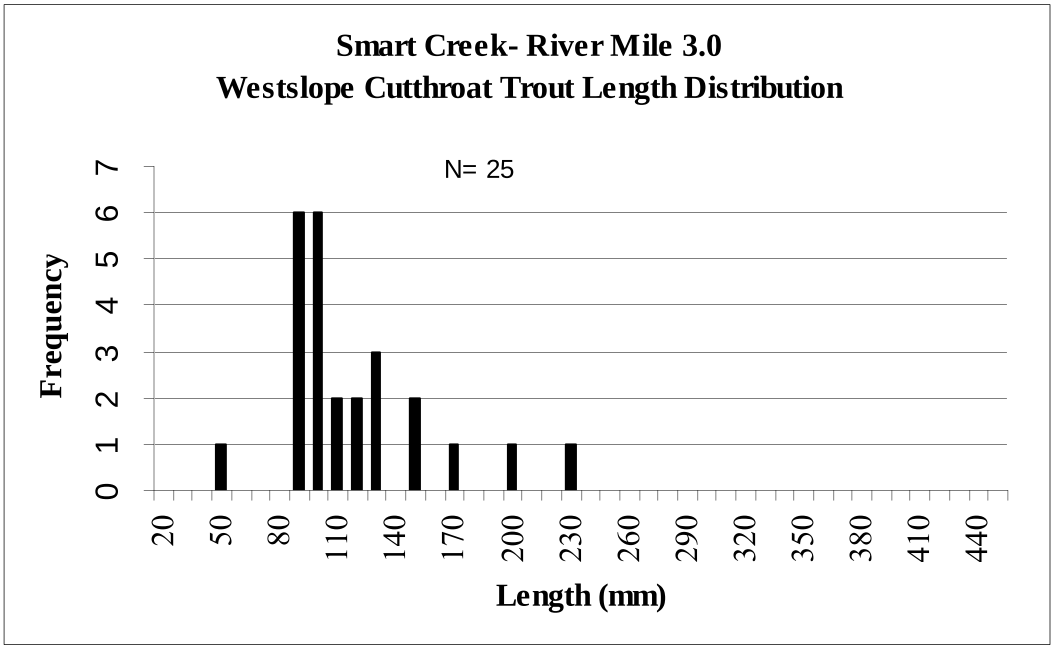




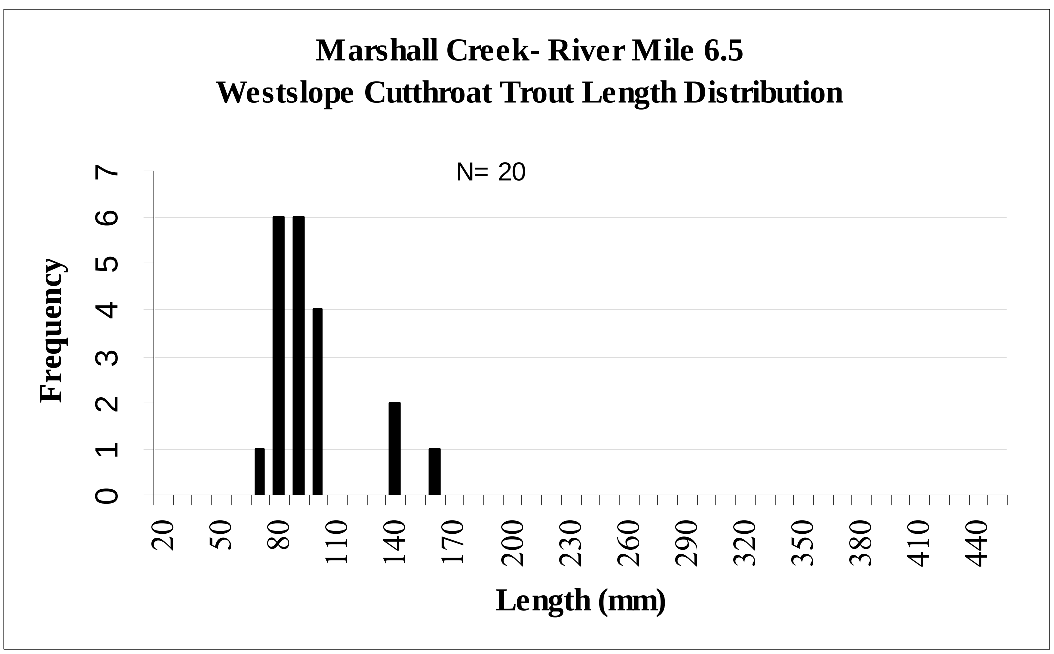

Henderson Creek Pond- River Mile 4.5
Westslope Cutthroat Trout Length Distribution
N= 16
Frequency
0
1
2
3
4
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

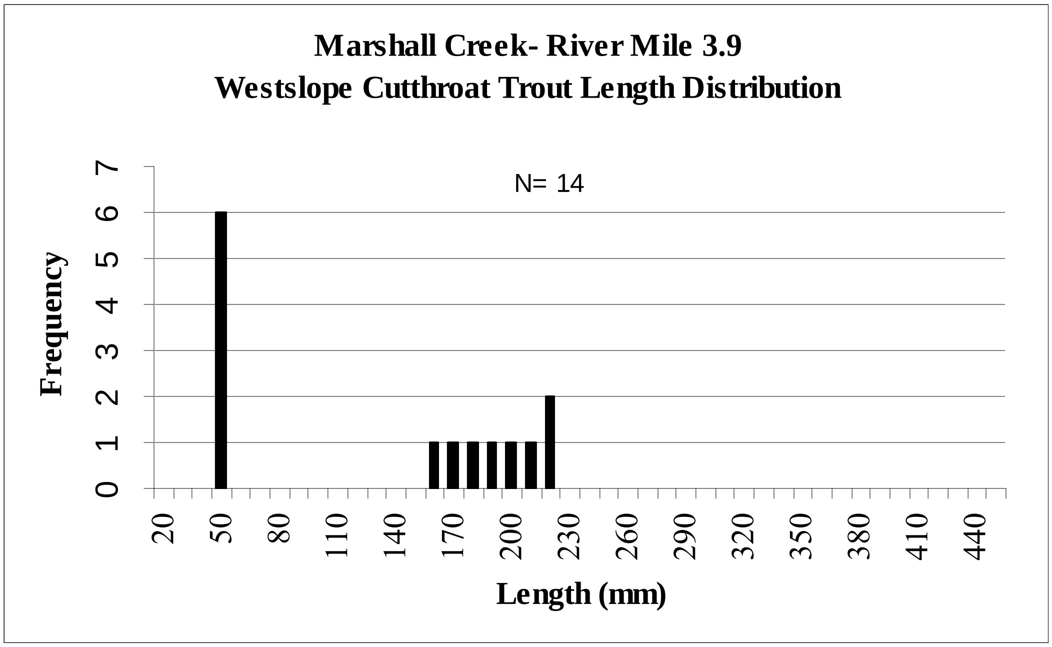
Smart Creek

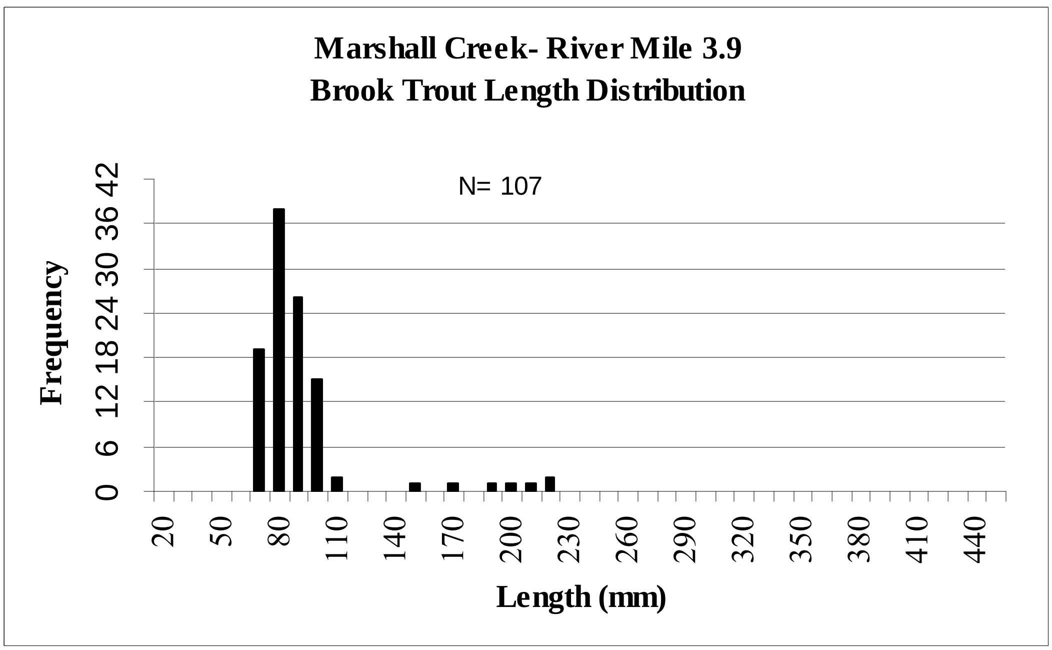

Smart Creek- River Mile 5.7
Westslope Cutthroat Trout Length Distribution
N= 88
Frequency
0
5
10
15
20
25
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)



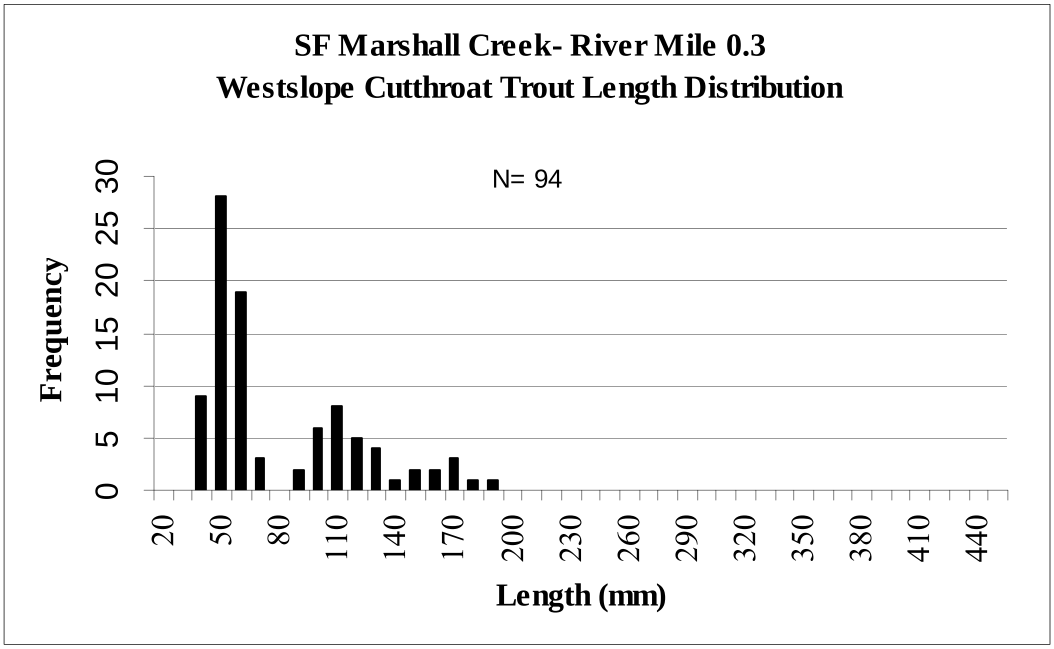
Marshall Creek



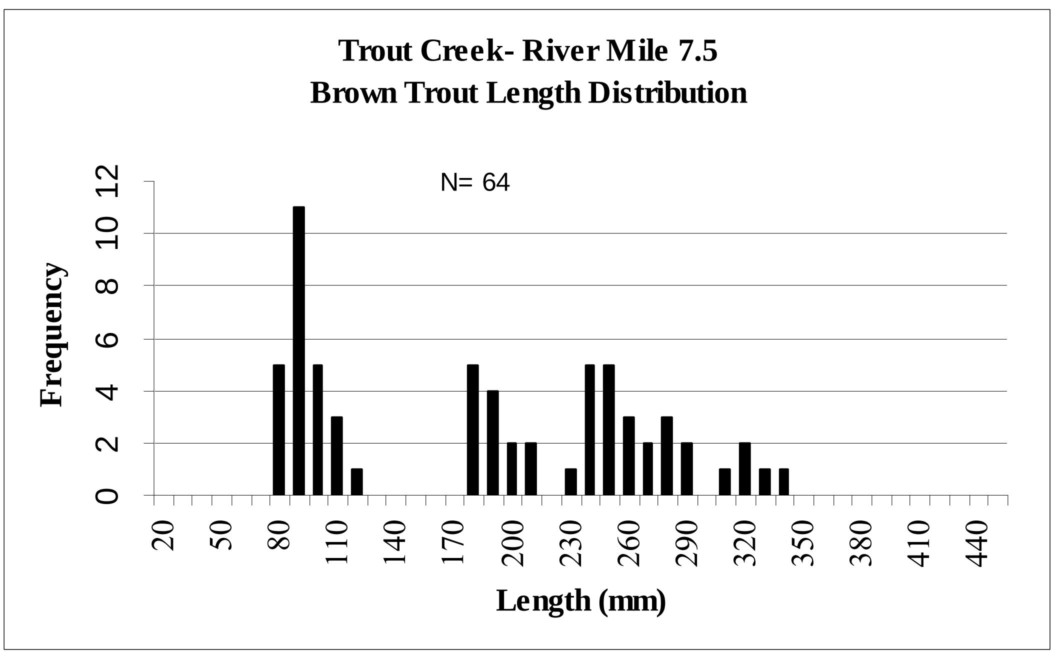

Marshall Creek- River Mile 3.9
Westslope Cutthroat Trout Length Distribution
N= 14
Frequency
0 1 2 3 4 5 6 7
20 50 80 110 140 170 200 230 260 290 320 350 380 410 440
Length (mm)

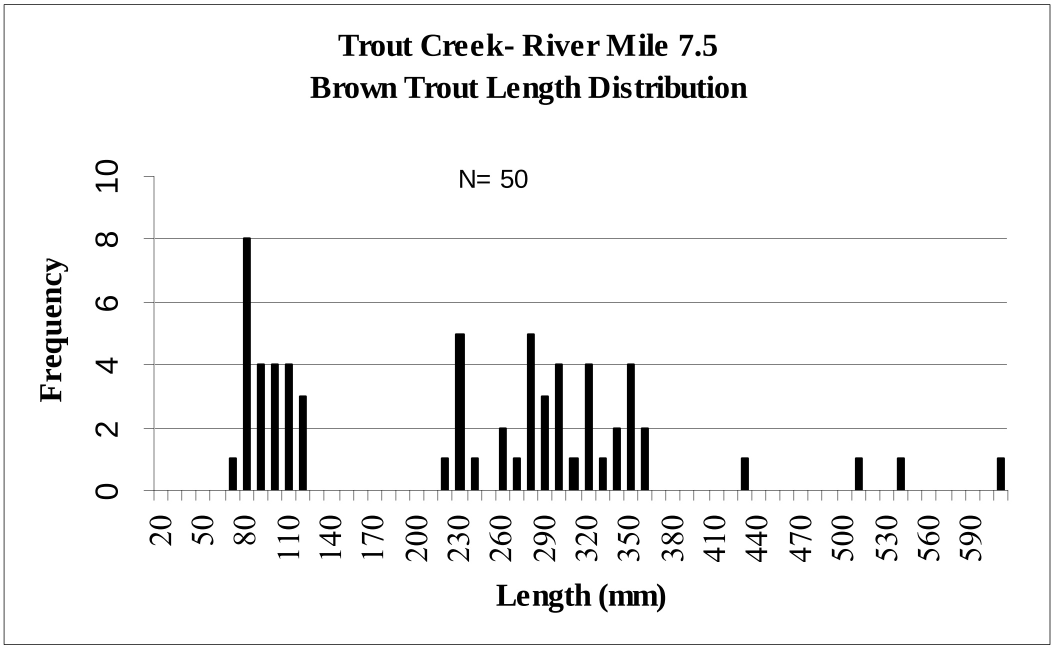

Marshall Creek- River Mile 3.9
Brook Trout Length Distribution
N= 107
Frequency
0 6 12 18 24 30 36 42
20 50 80 110 140 170 200 230 260 290 320 350 380 410 440
Length (mm)

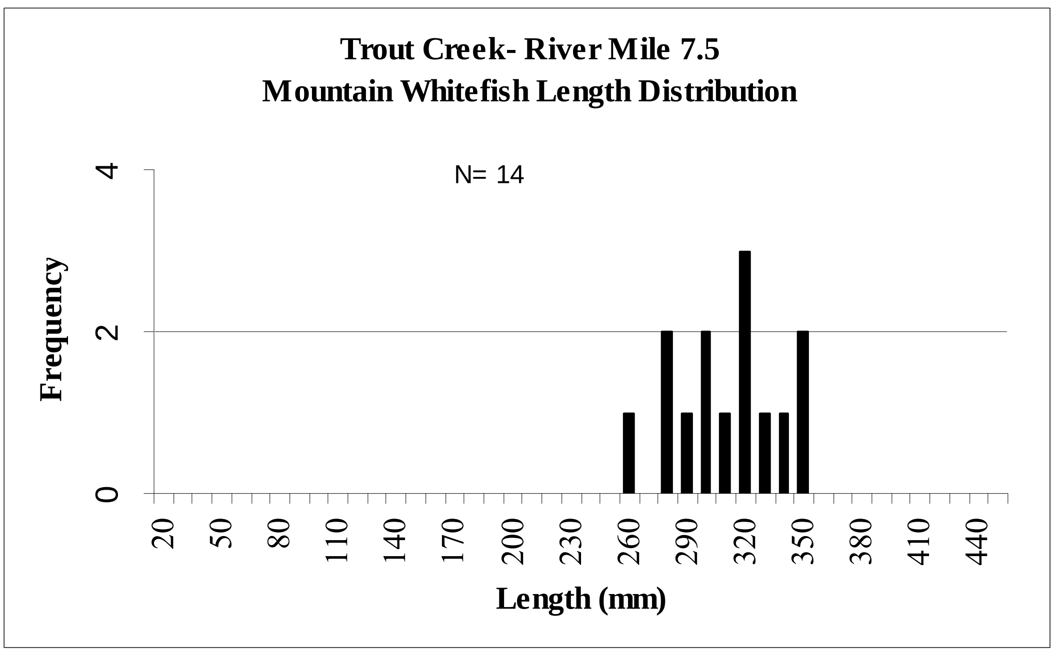
South Fork Marshall Creek



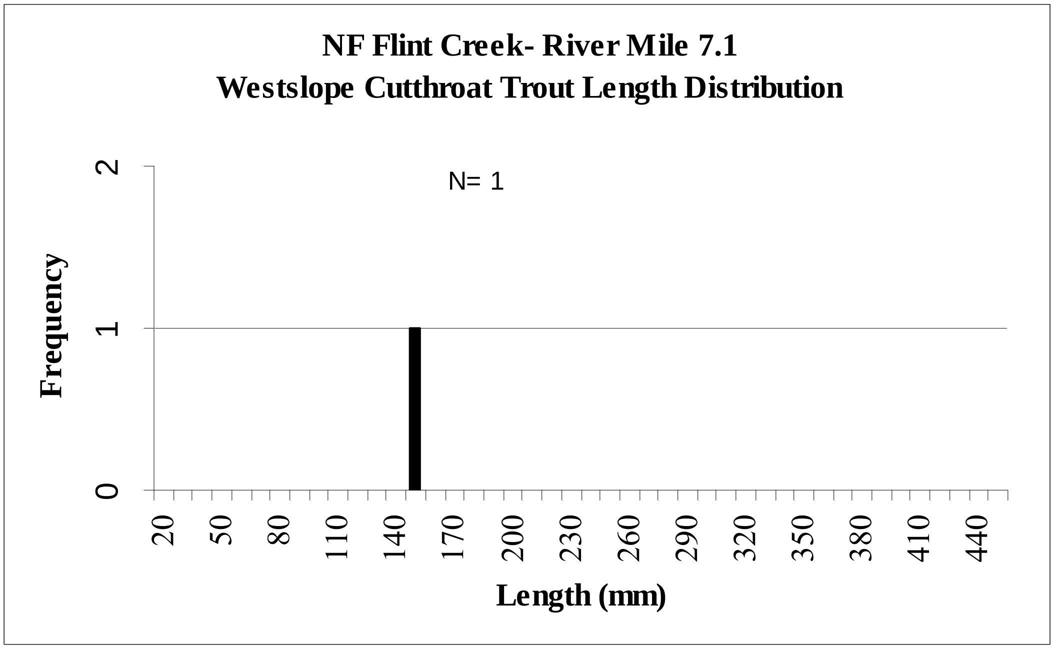
Trout Creek

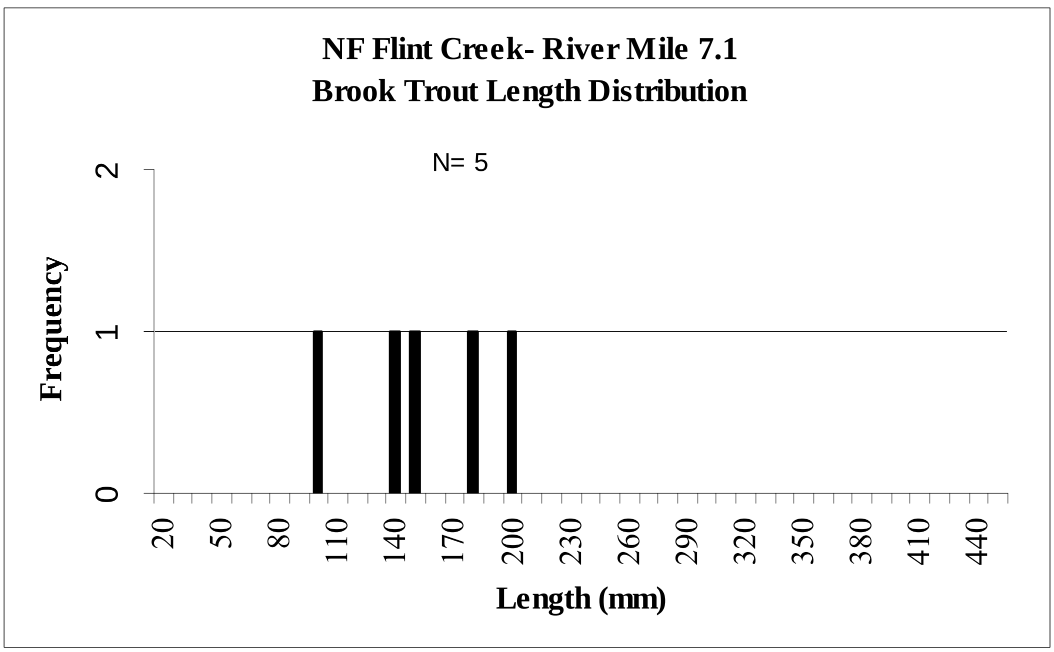


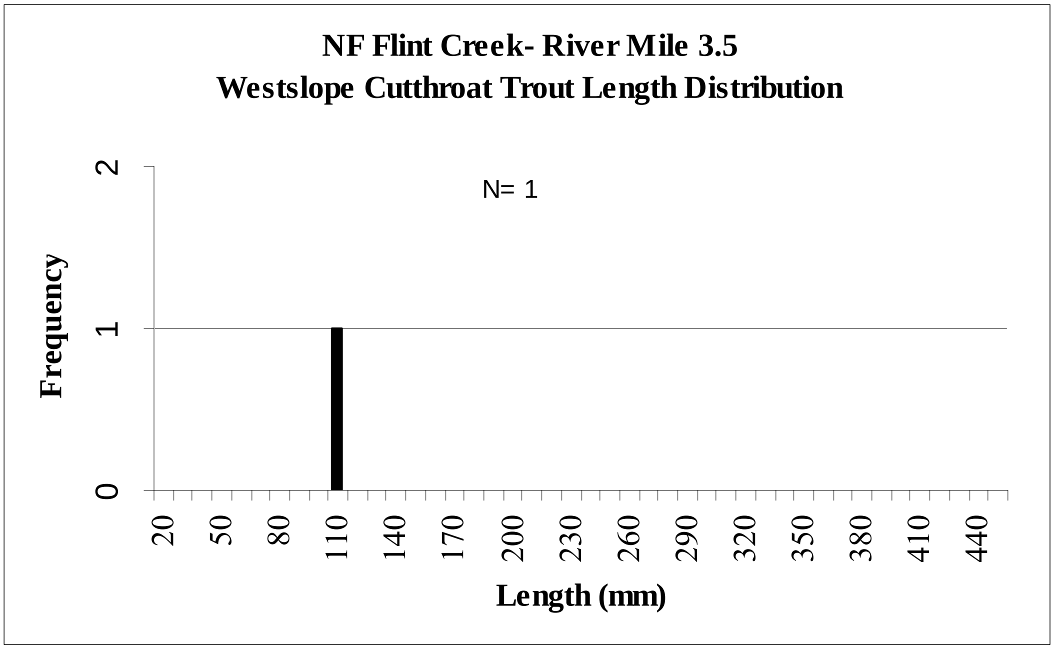

Trout Creek- River Mile 7.5
Brown Trout Length Distribution
N= 50
Frequency
0
2
4
6
8
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
560
590
Length (mm)

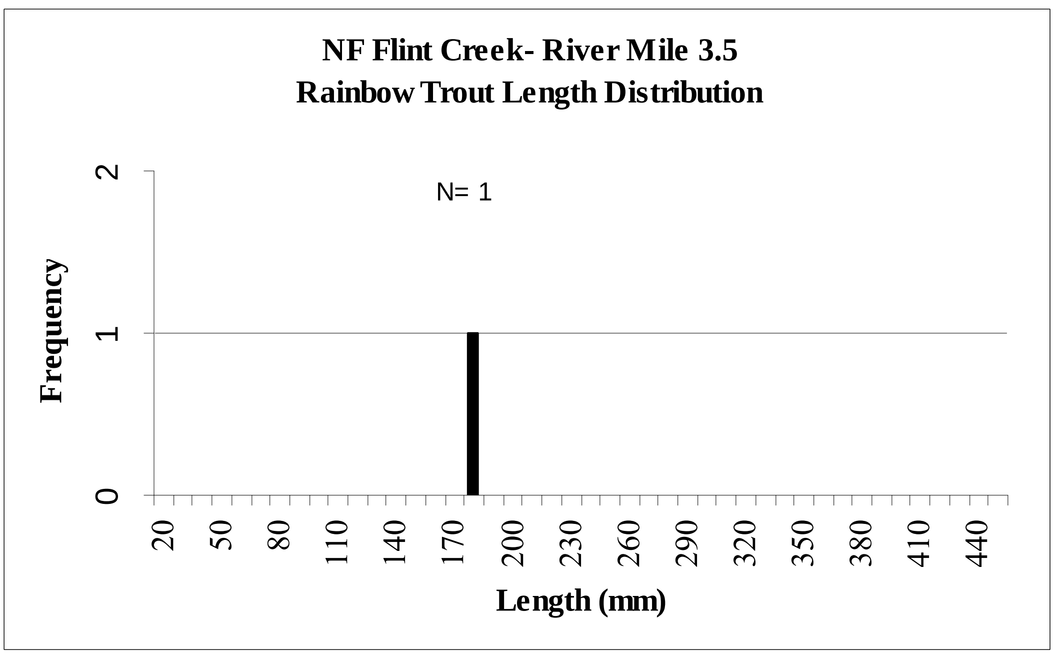

Trout Creek- River Mile 7.5
Mountain Whitefish Length Distribution
N= 14
Frequency
0
2
4
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

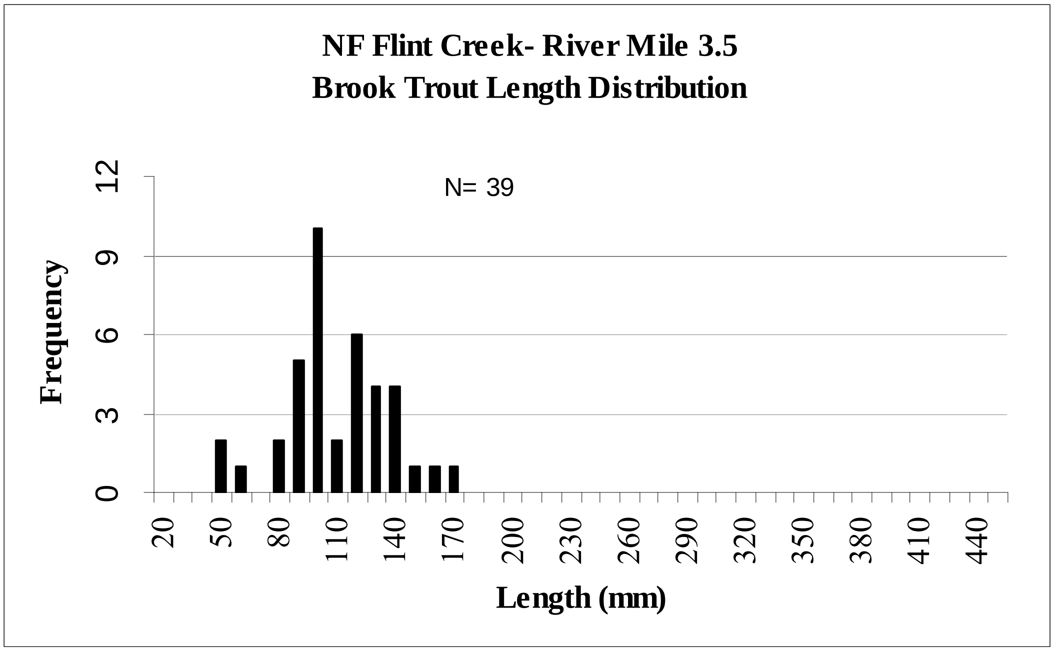
North Fork Flint Creek





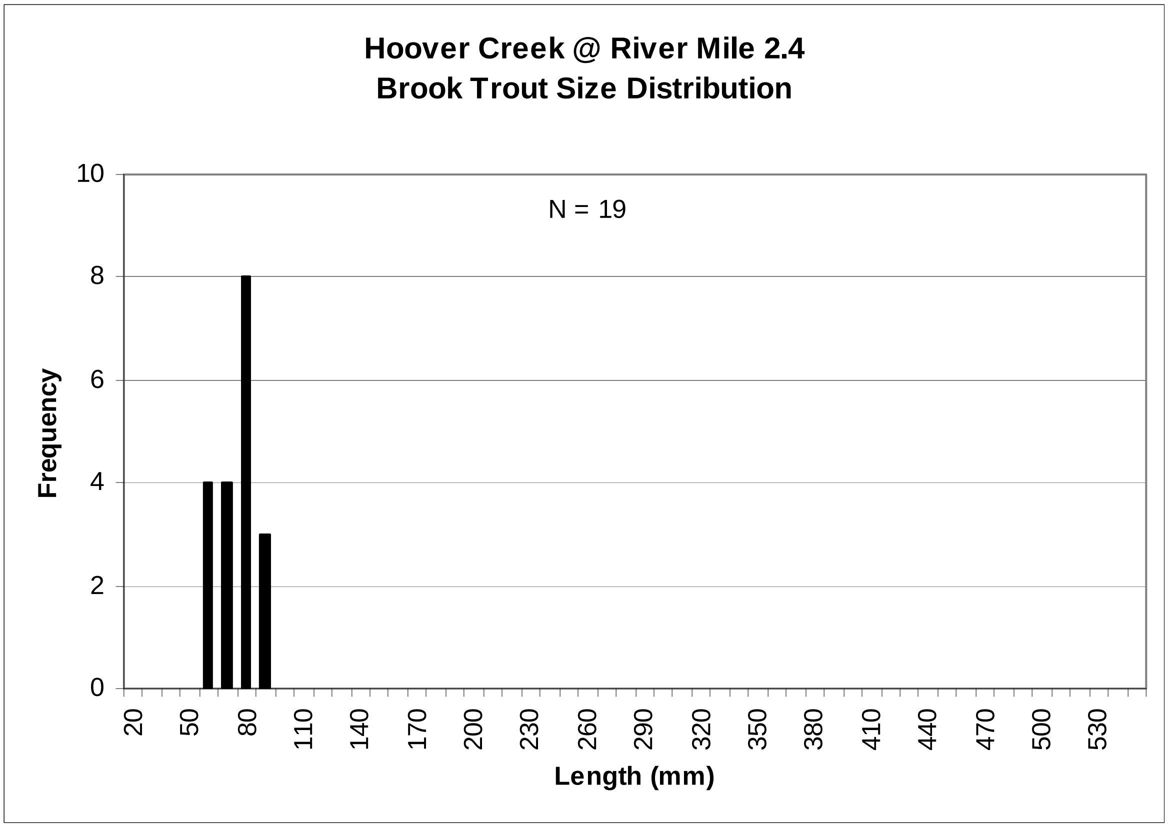

NF Flint Creek- River Mile 3.5
Westslope Cutthroat Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

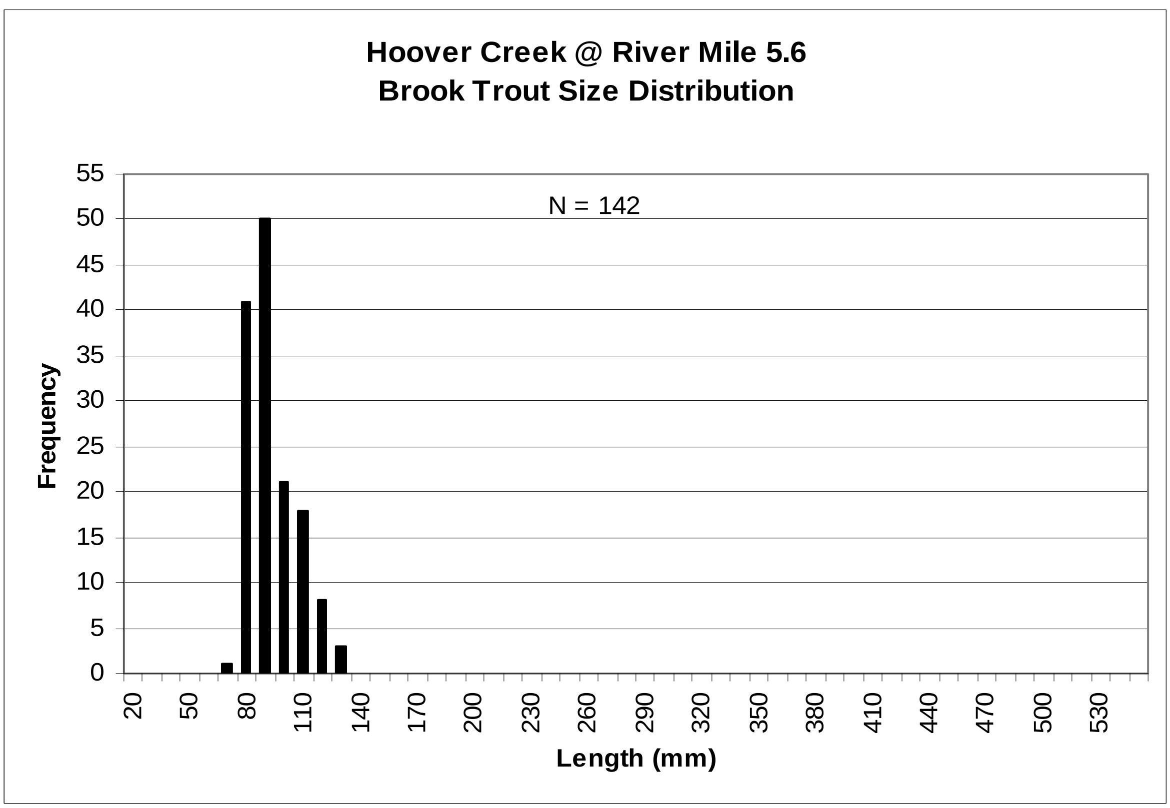

NF Flint Creek- River Mile 3.5
Rainbow Trout Length Distribution
N= 1
Frequency
0
1
2
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

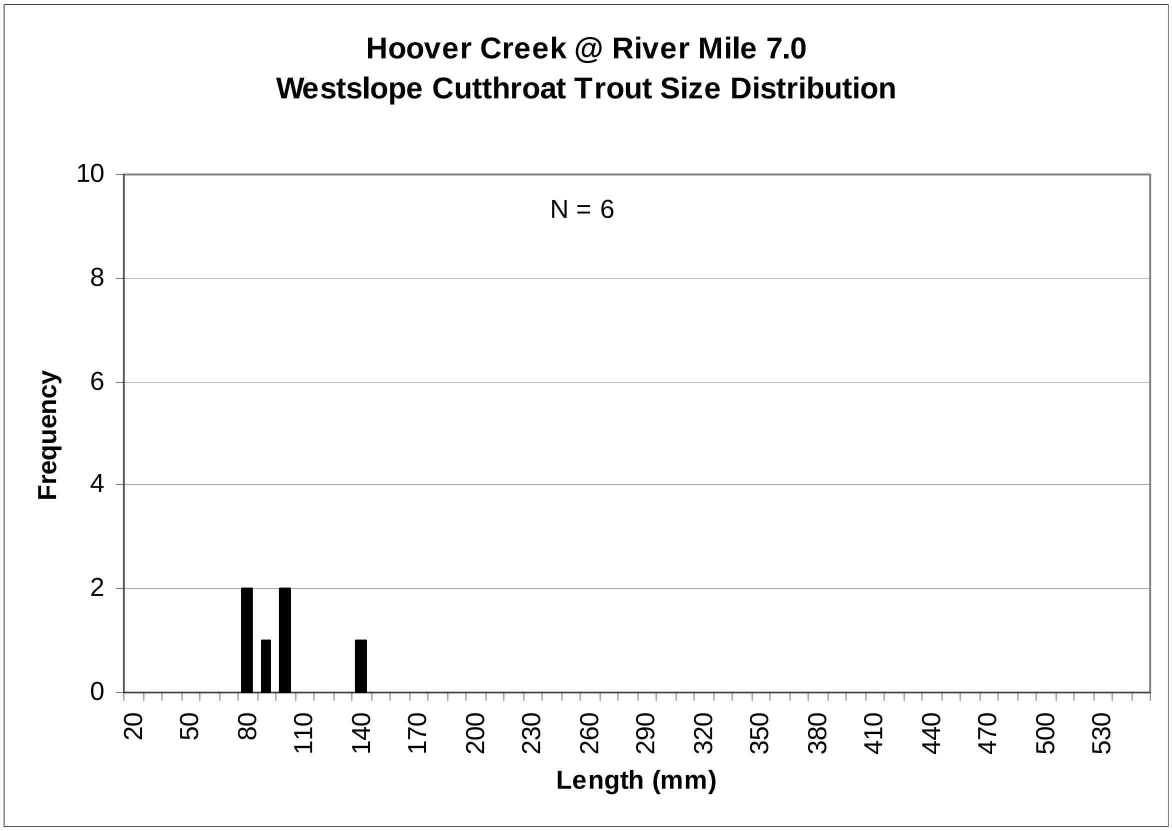

NF Flint Creek- River Mile 3.5
Brook Trout Length Distribution
N= 39
Frequency
0
3
6
9
12
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
Length (mm)

Hoover Creek Drainage

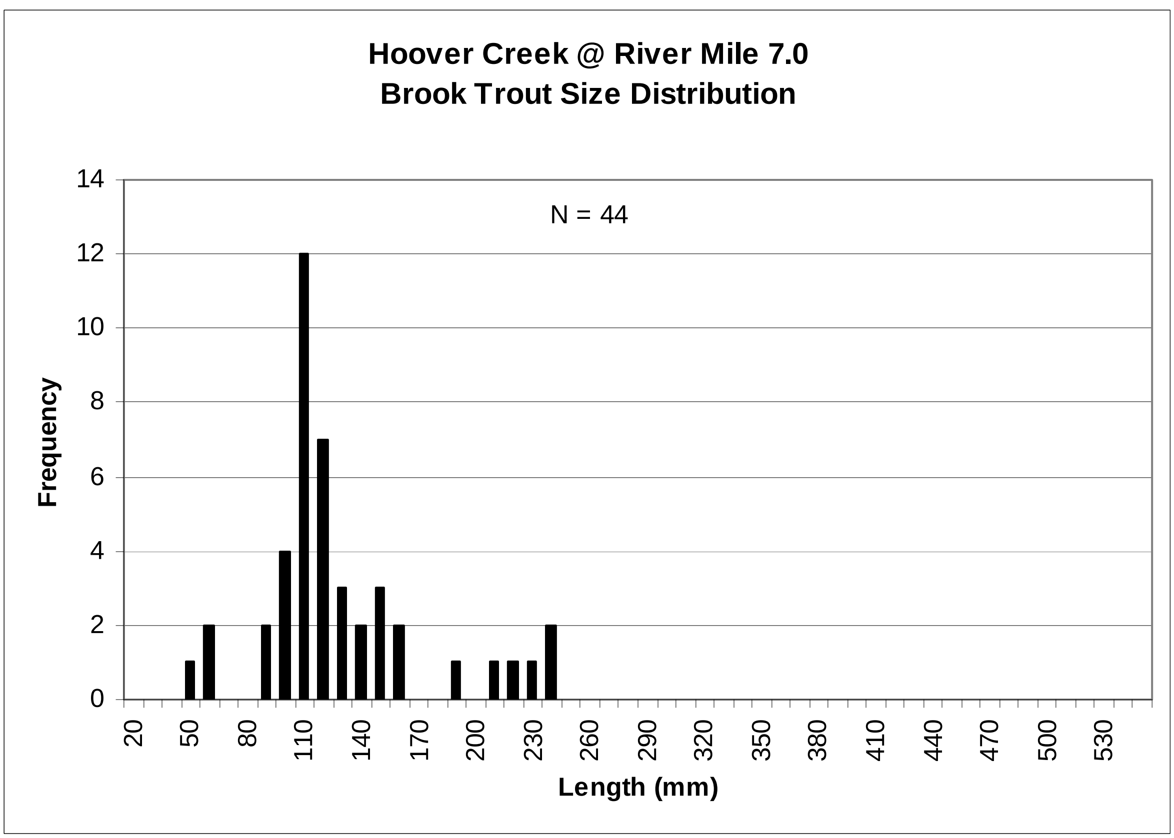
Hoover Creek



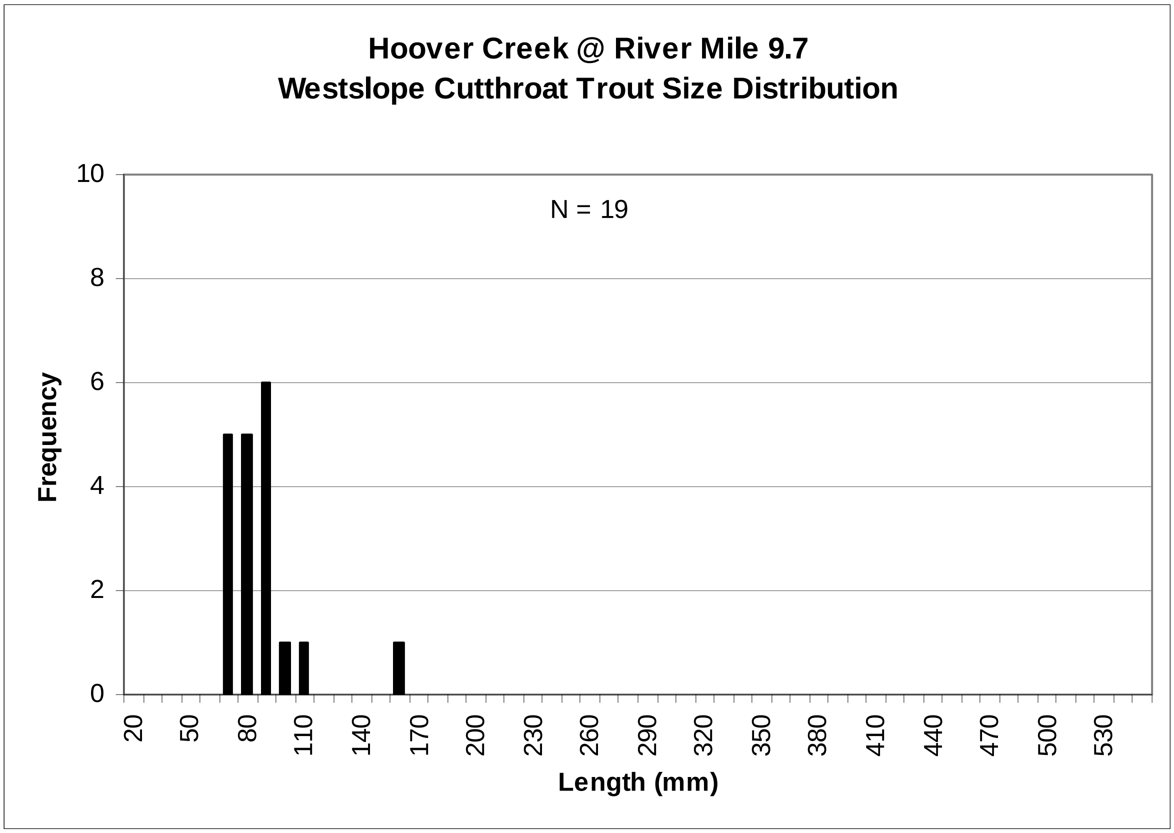


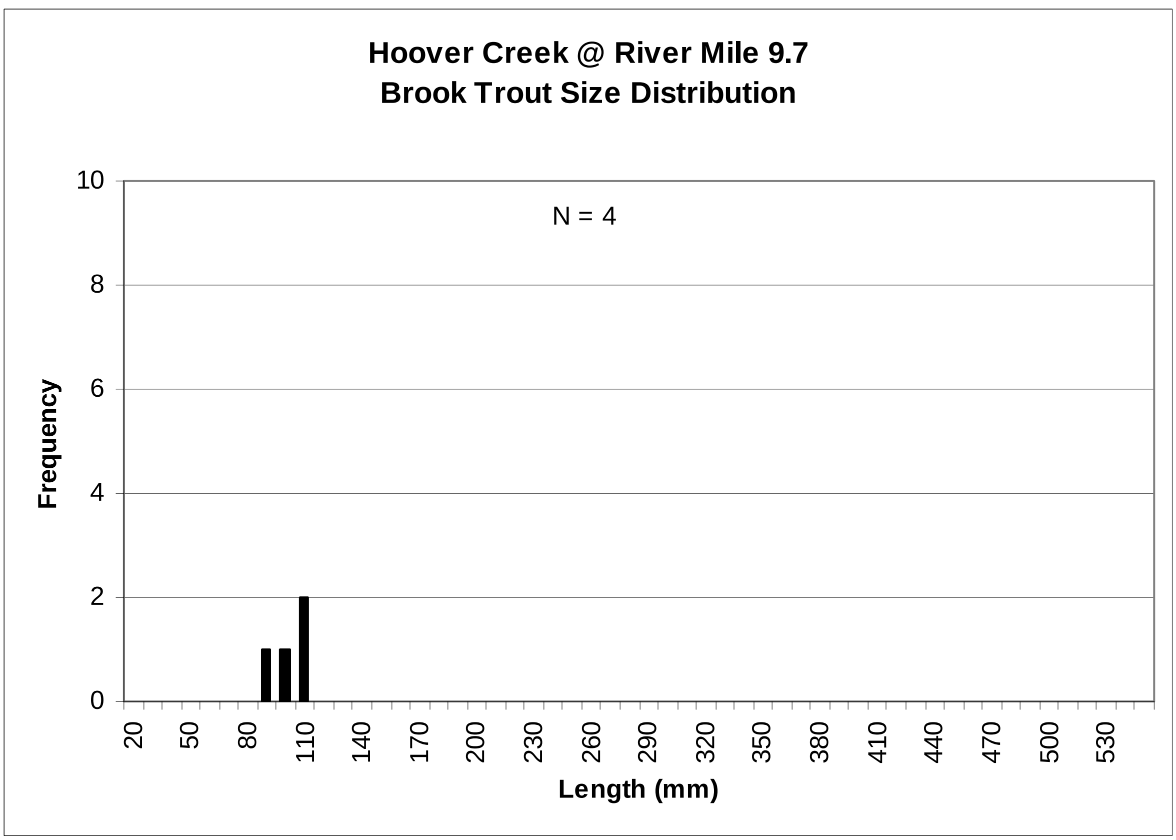


Hoover Creek @ River Mile 7.0
Westslope Cutthroat Trout Size Distribution
N = 6
Frequency
0
2
4
6
8
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)



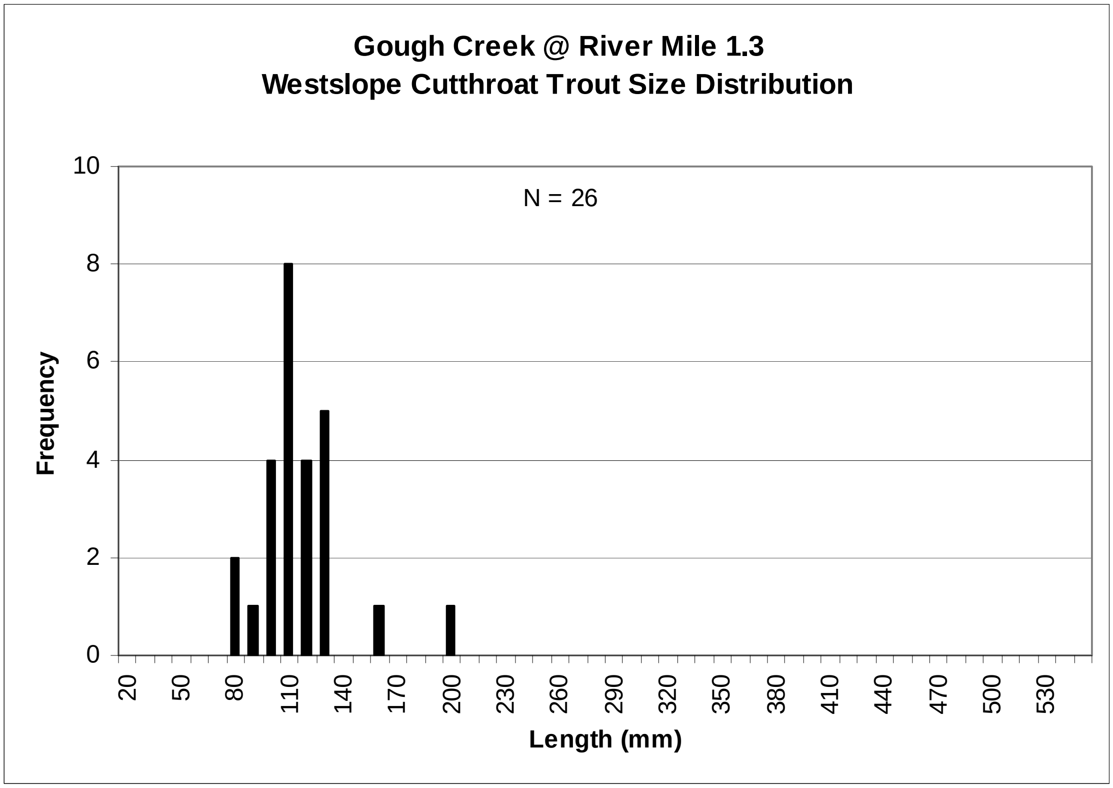
Hoover Creek @ River Mile 7.0
Brook Trout Size Distribution
N = 44
Frequency
0
2
4
6
8
10
12
14
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

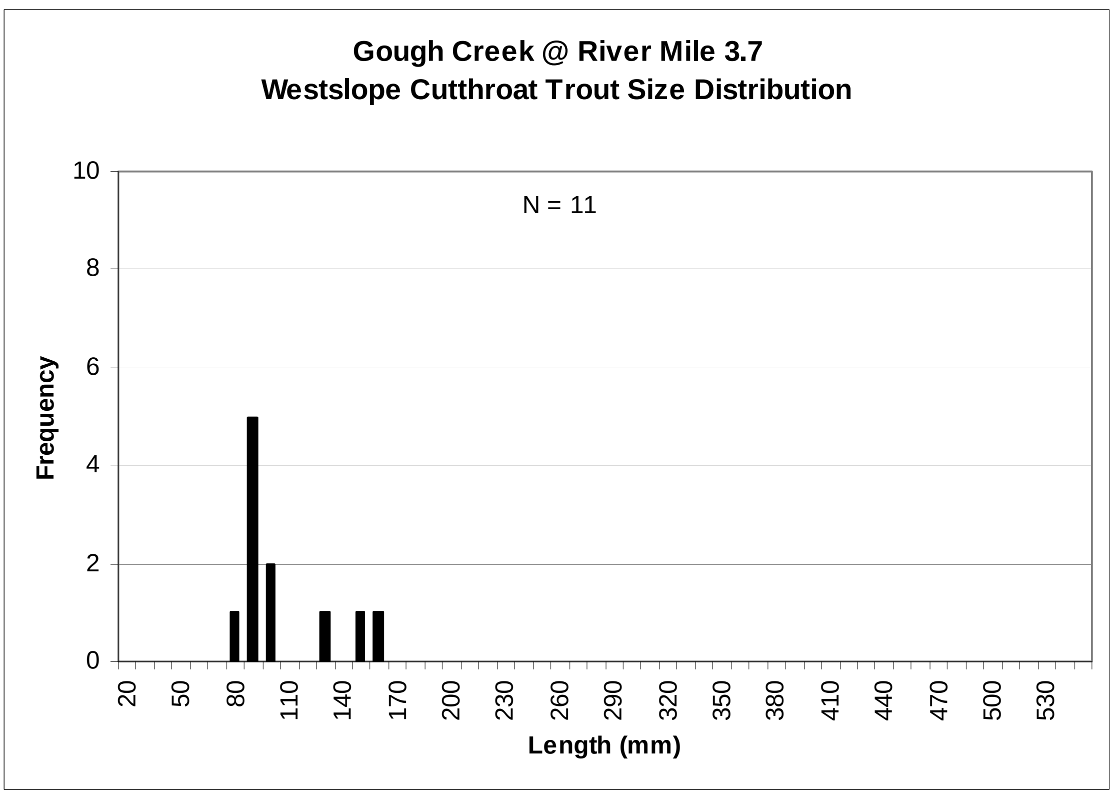

Hoover Creek @ River Mile 9.7
Westslope Cutthroat Trout Size Distribution
N = 19
Frequency
Length (mm)
0
2
4
6
8
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530

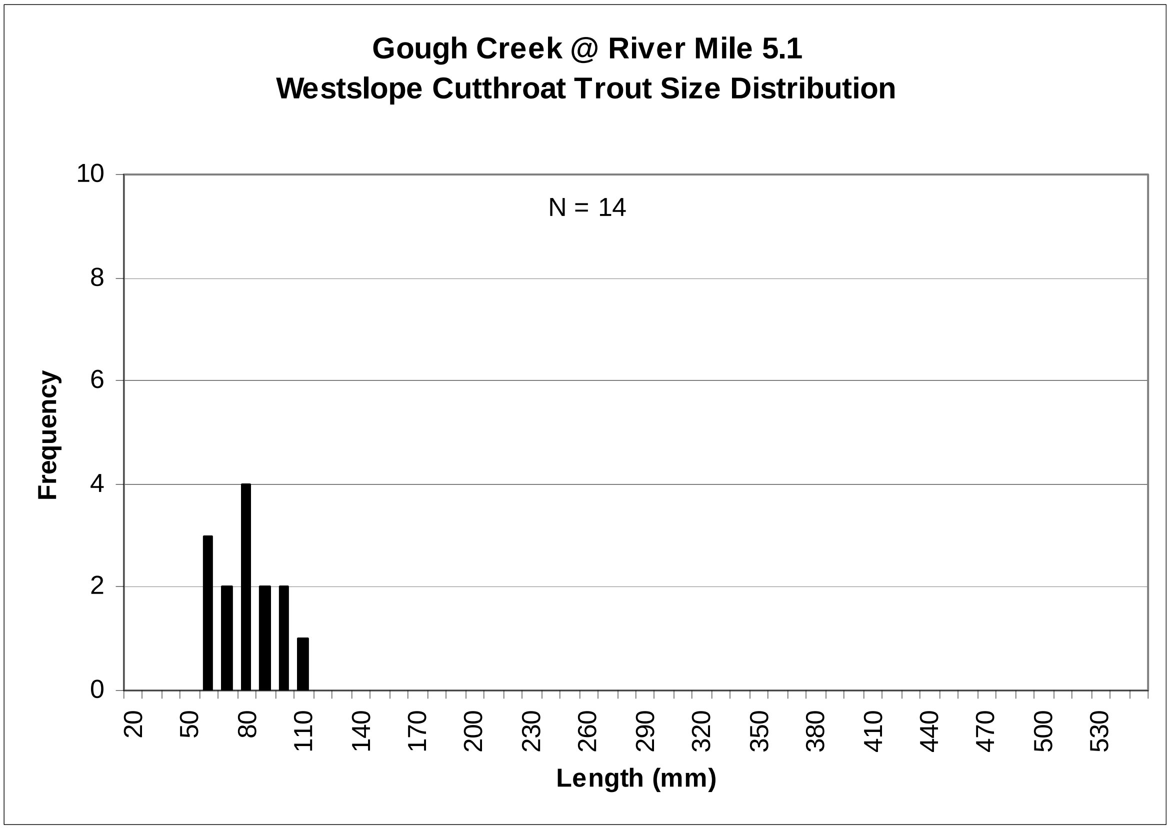

Hoover Creek @ River Mile 9.7
Brook Trout Size Distribution
N = 4
Frequency
Length (mm)
0
2
4
6
8
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530

Gough Creek Drainage

Gough Creek

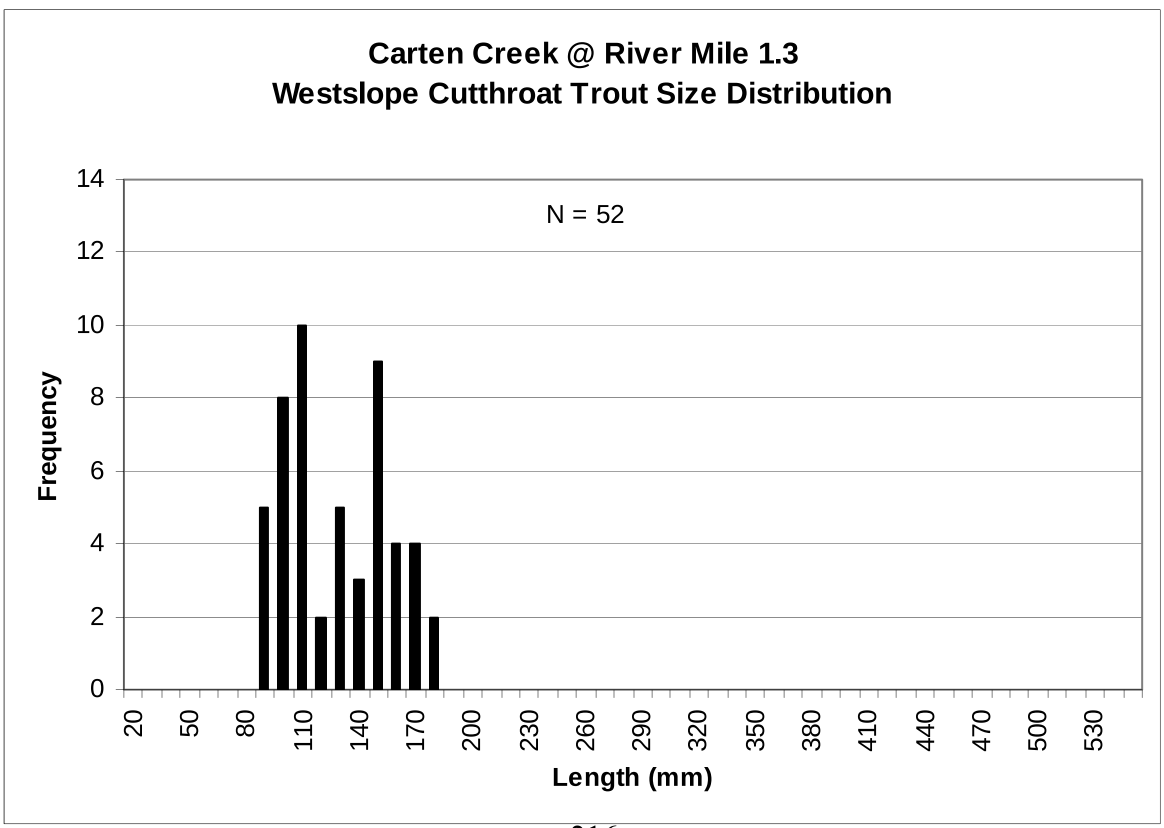


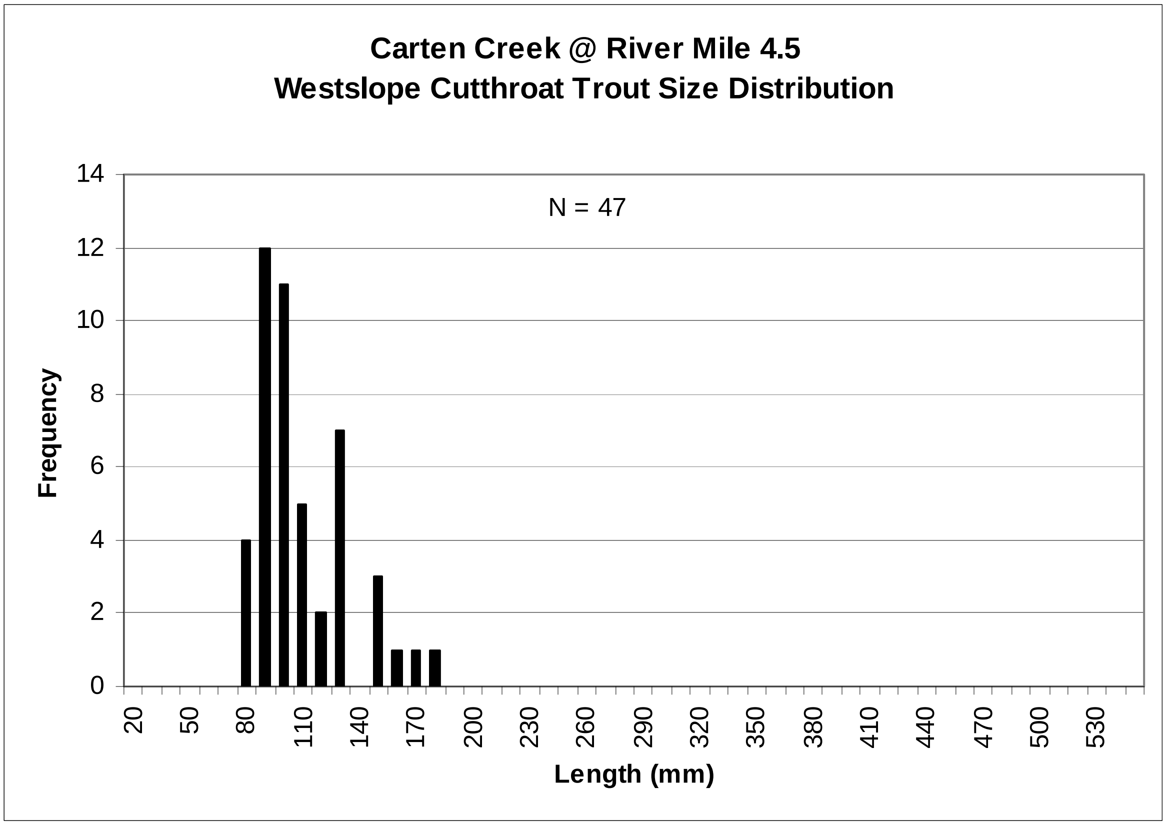




Carten Creek Drainage

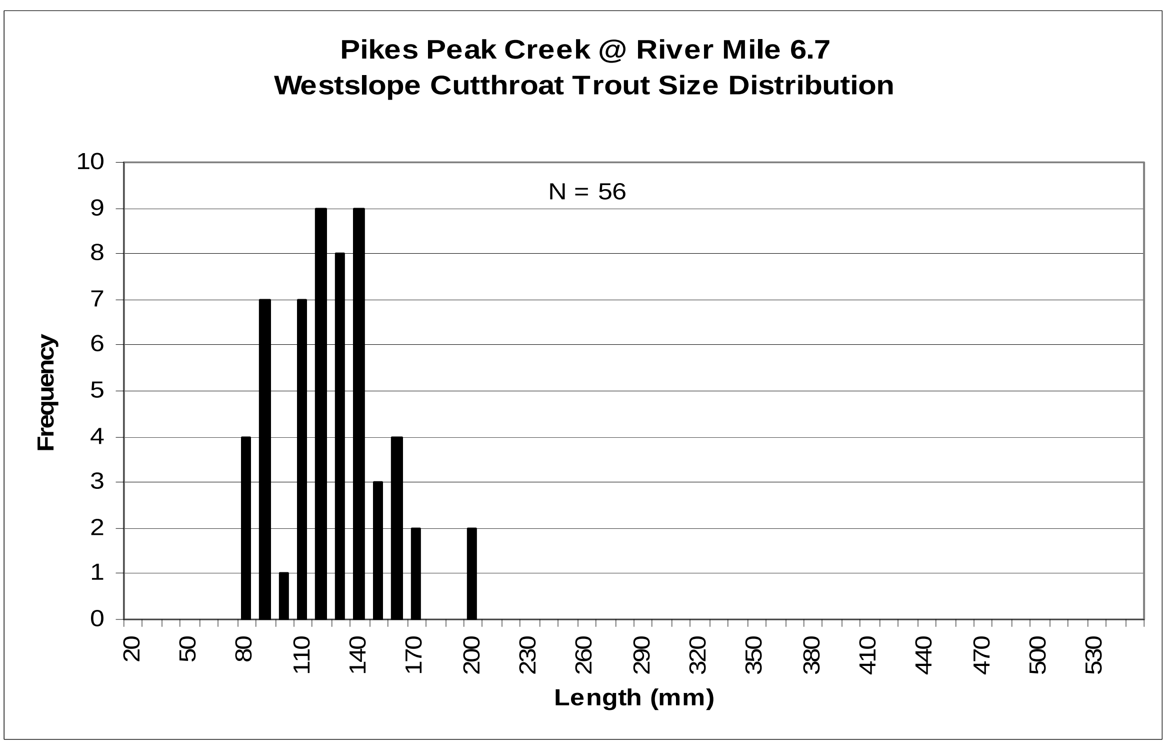
Carten Creek

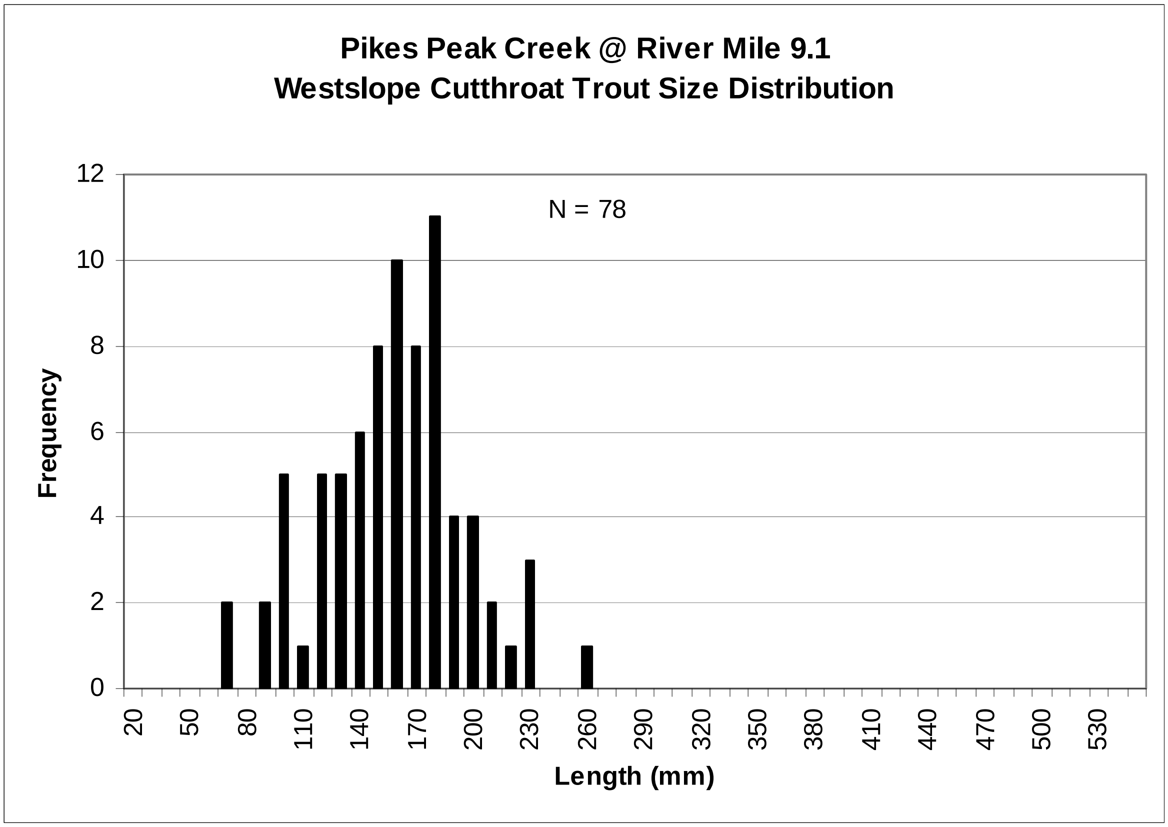




Gold Creek Drainage

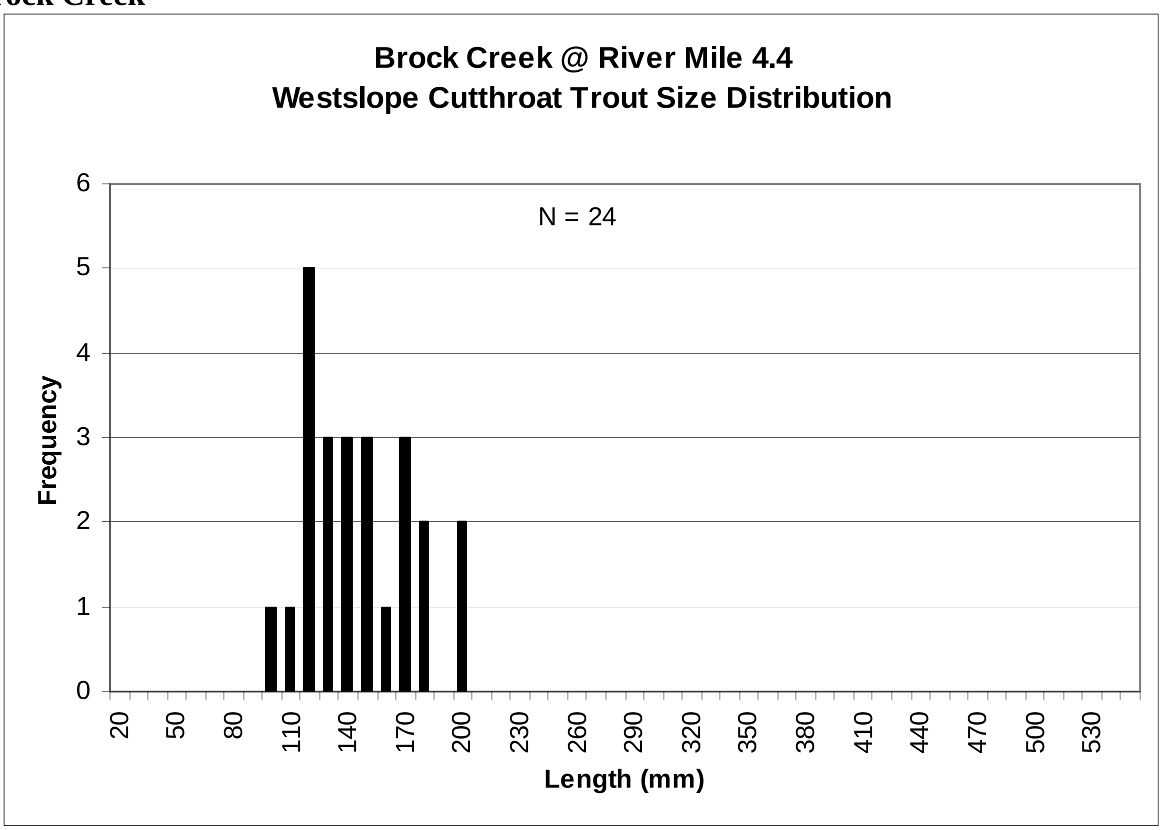
Pikes Peak Creek

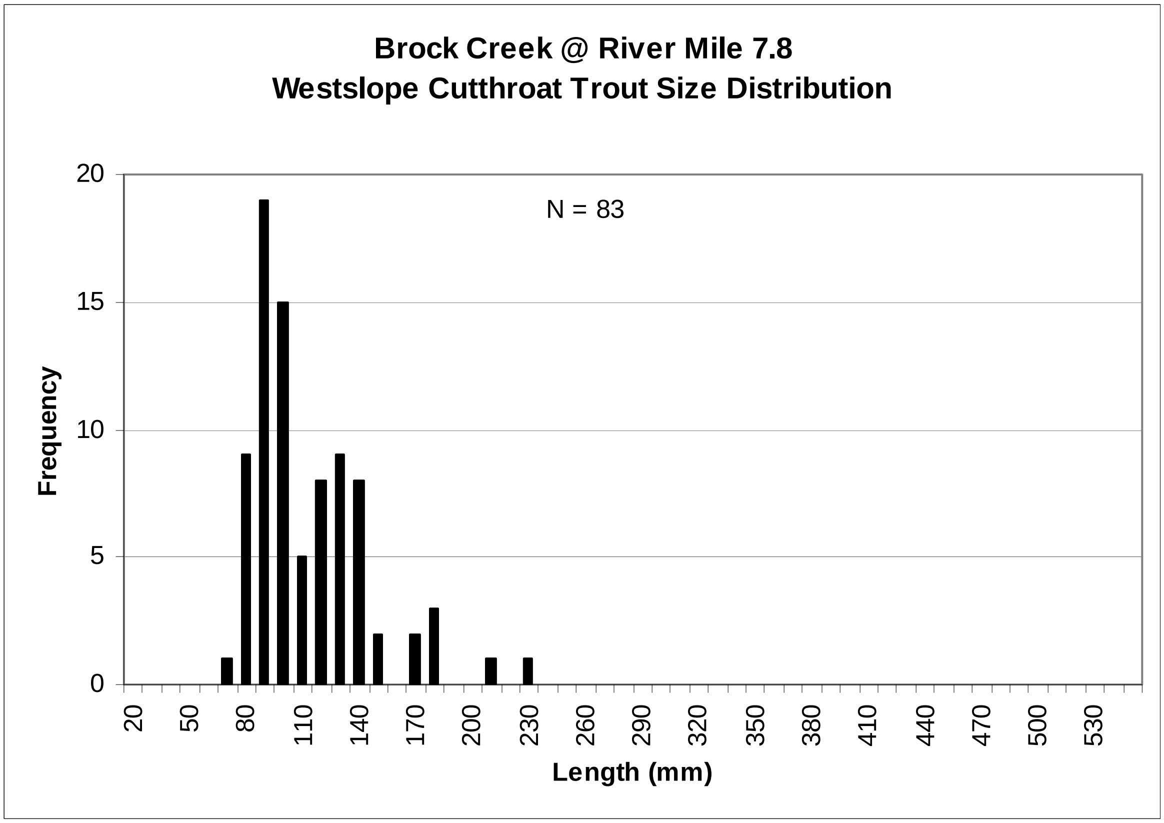




Brock Creek Drainage

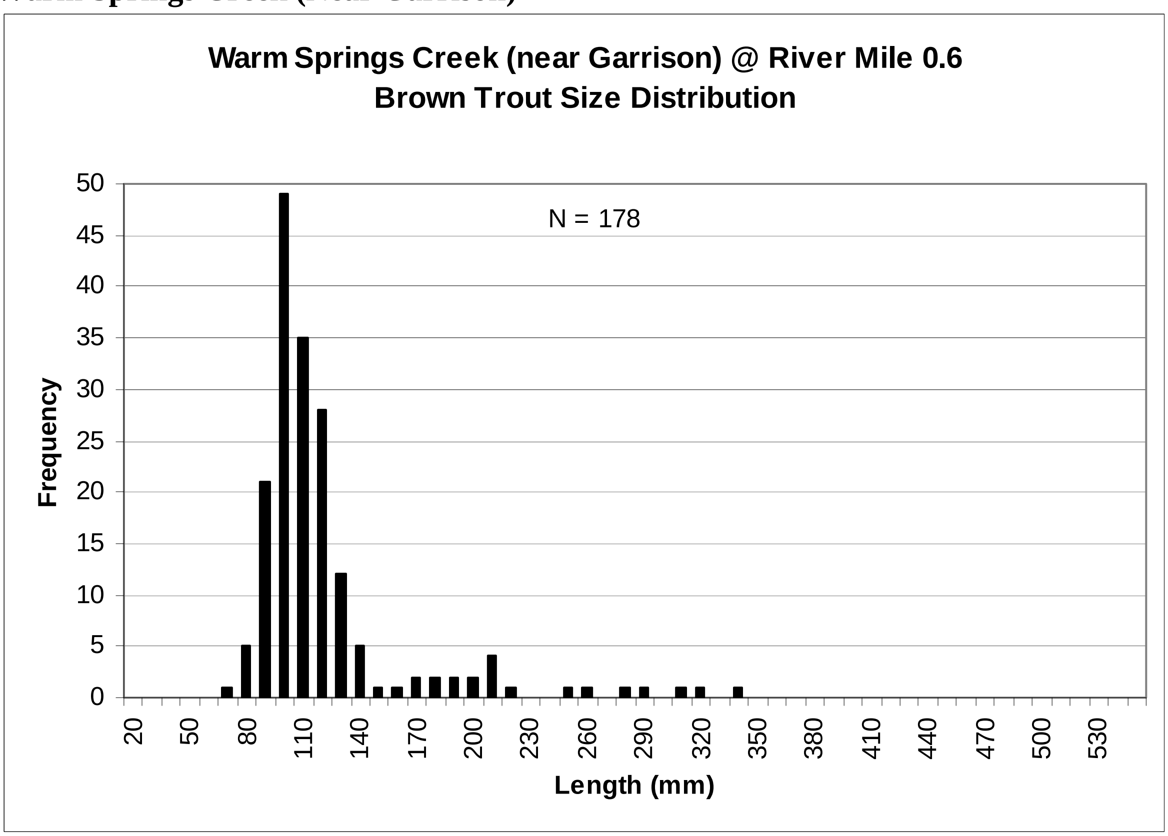
Brock Creek

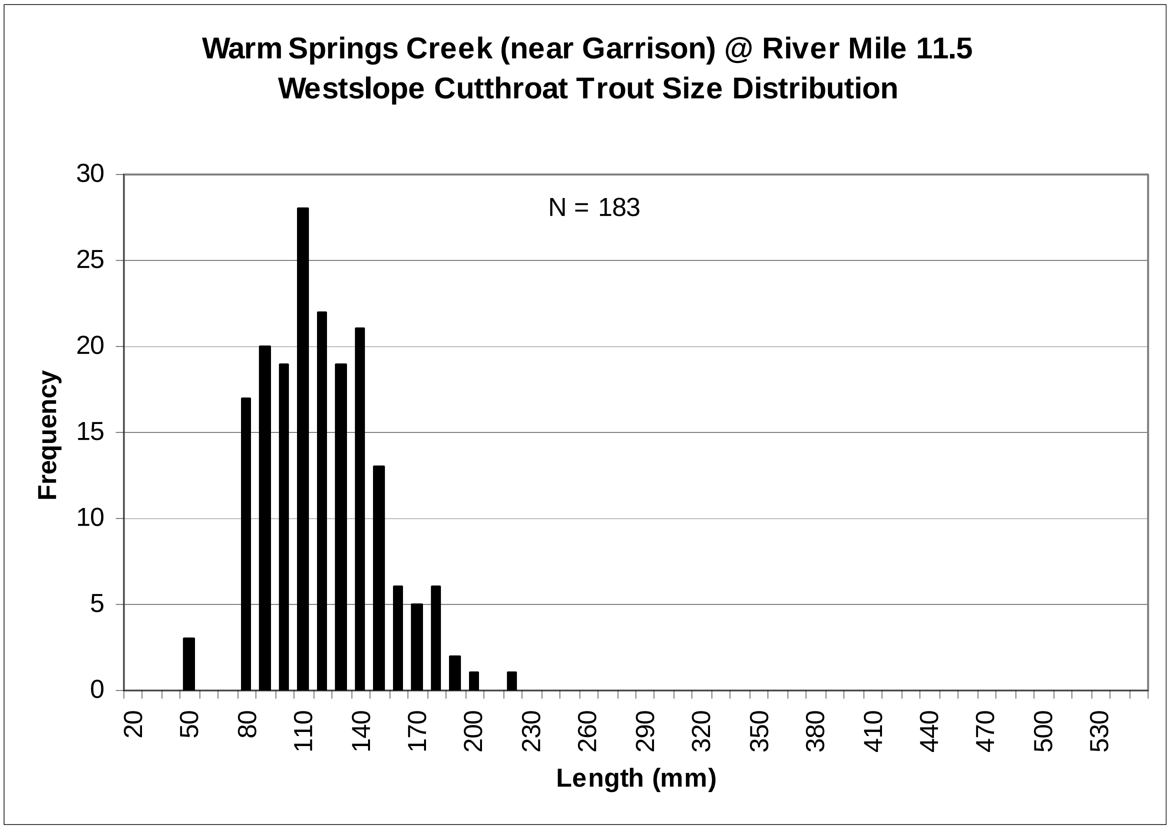




Warm Springs Creek Drainage (Near Garrison)

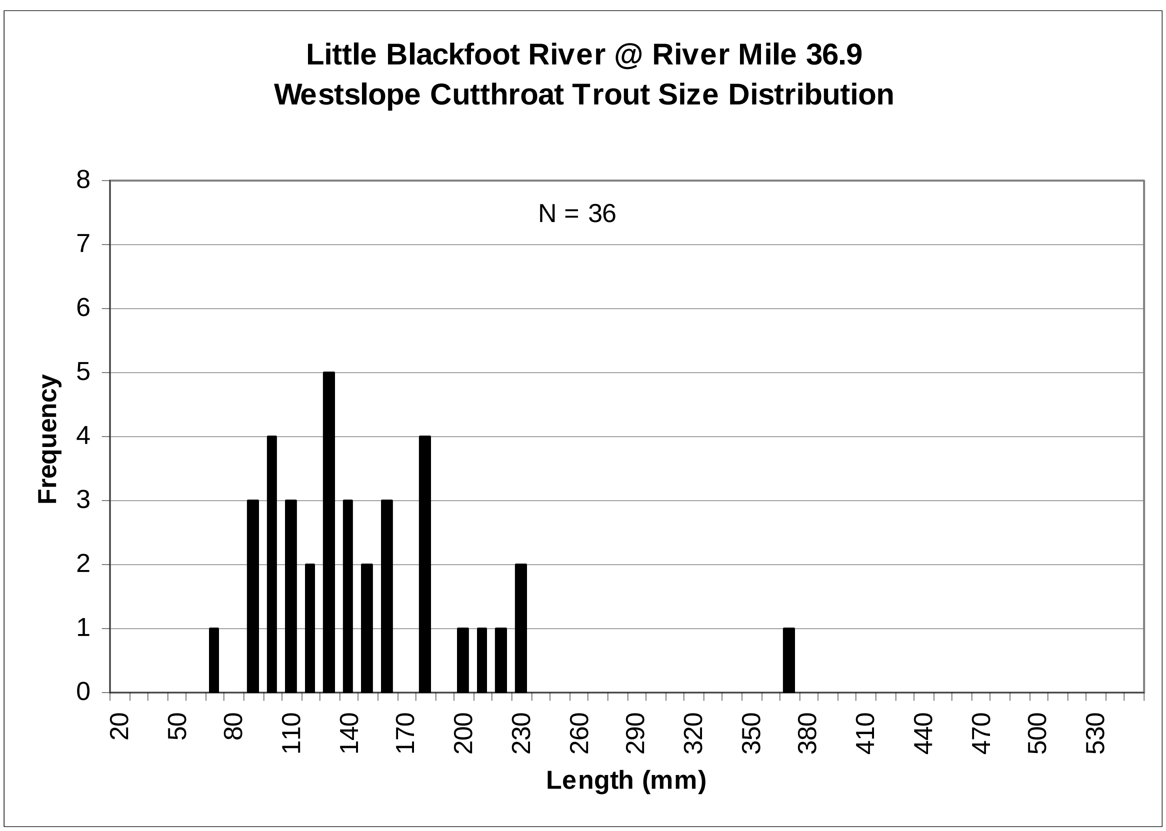
Warm Springs Creek (Near Garrison)

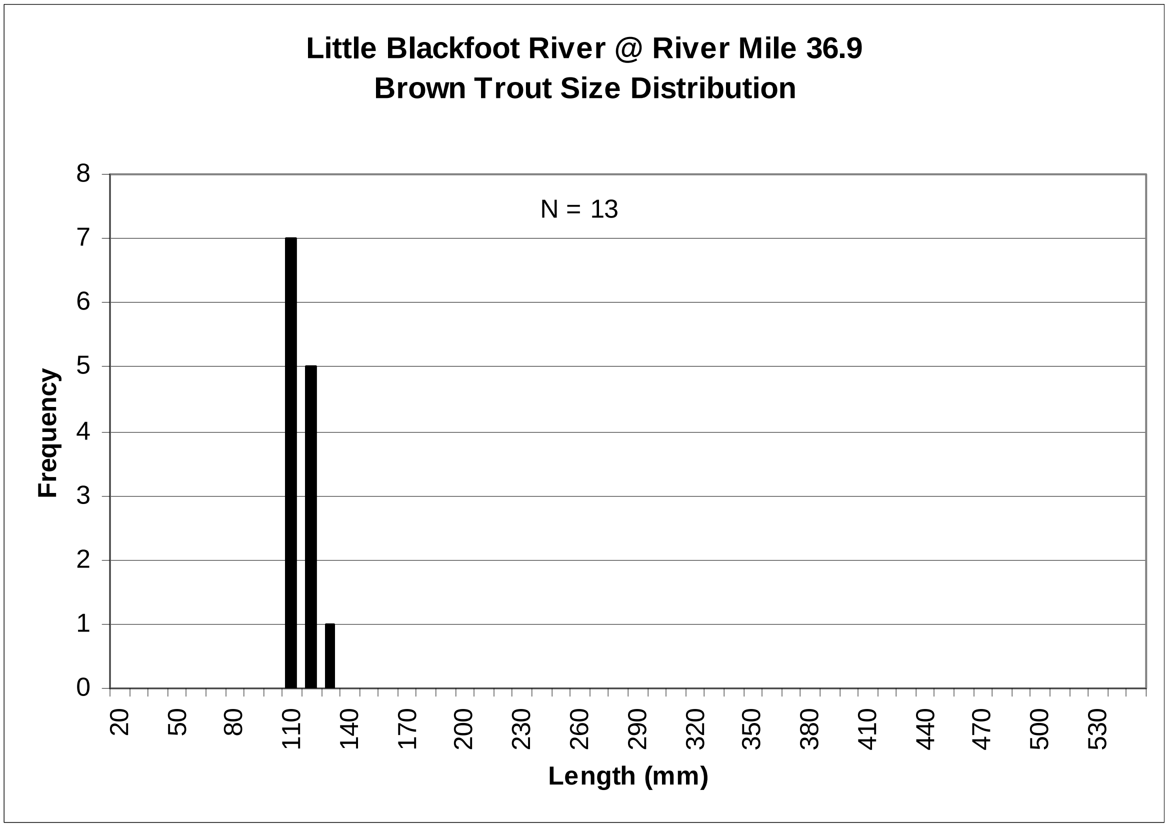


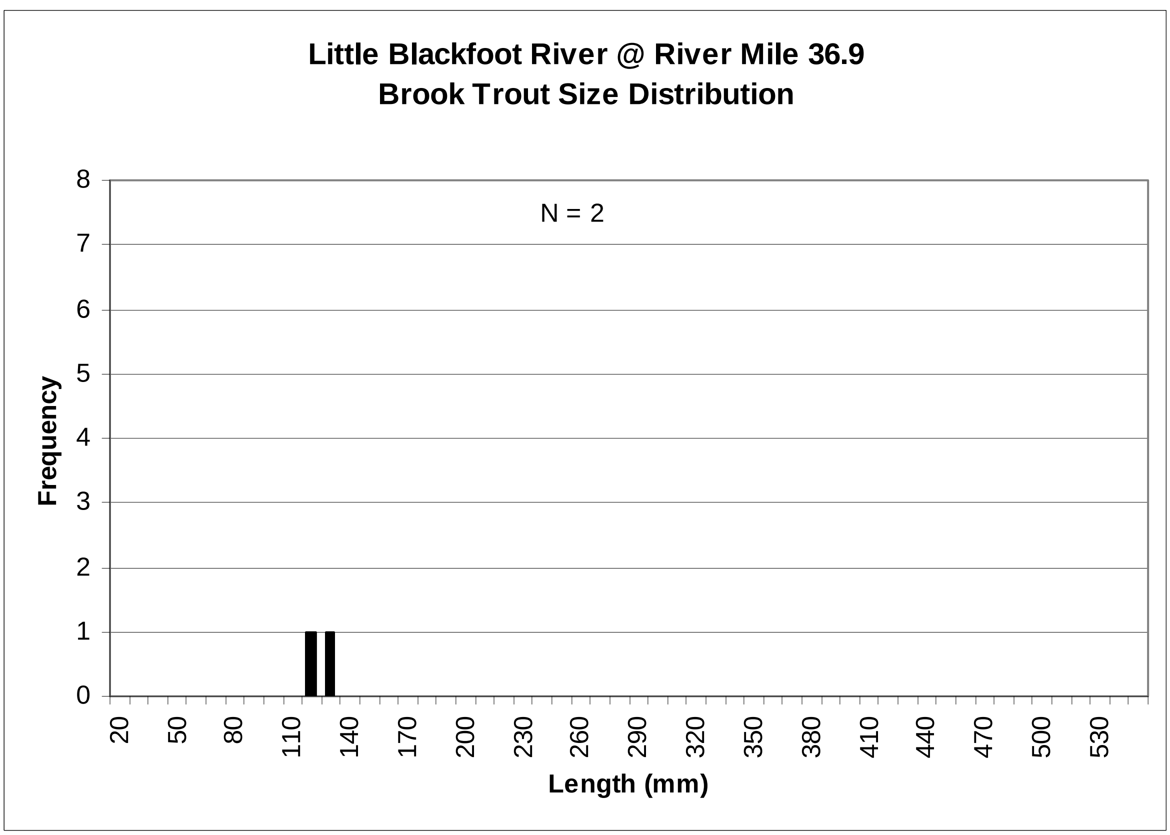


Little Blackfoot River Drainage

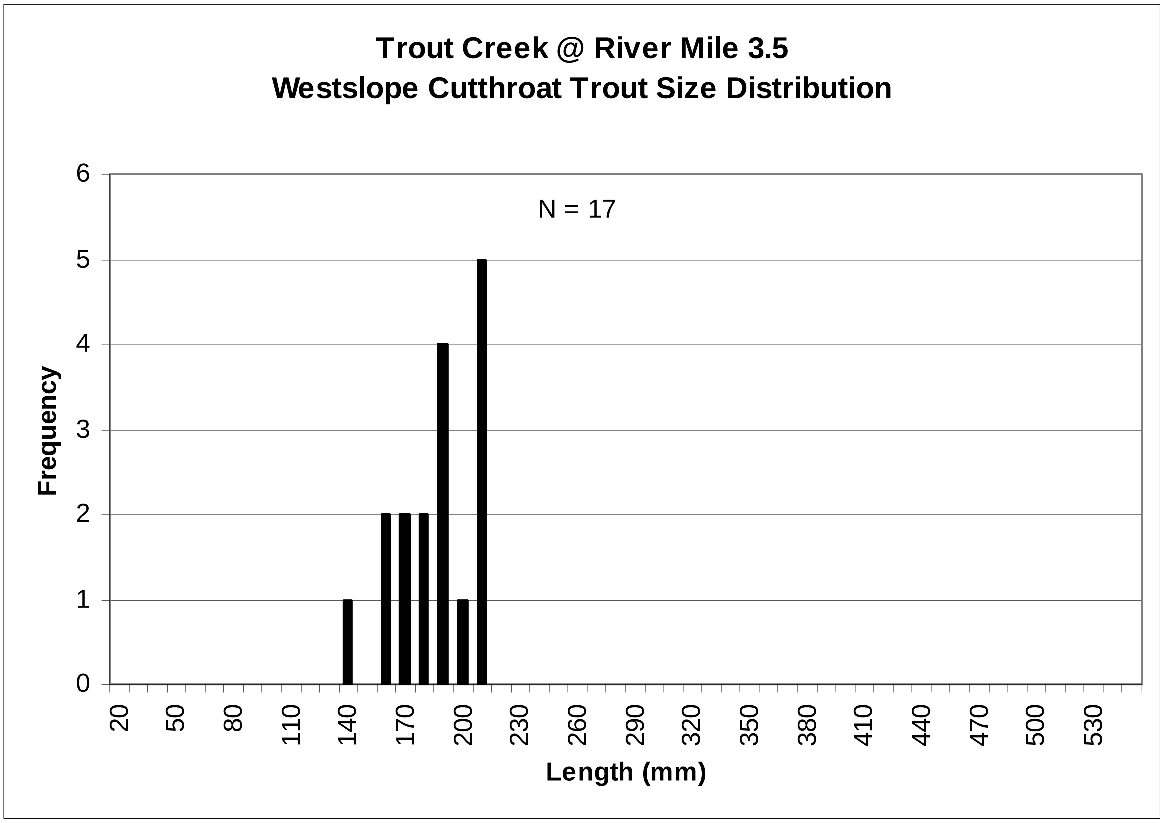
Little Blackfoot River



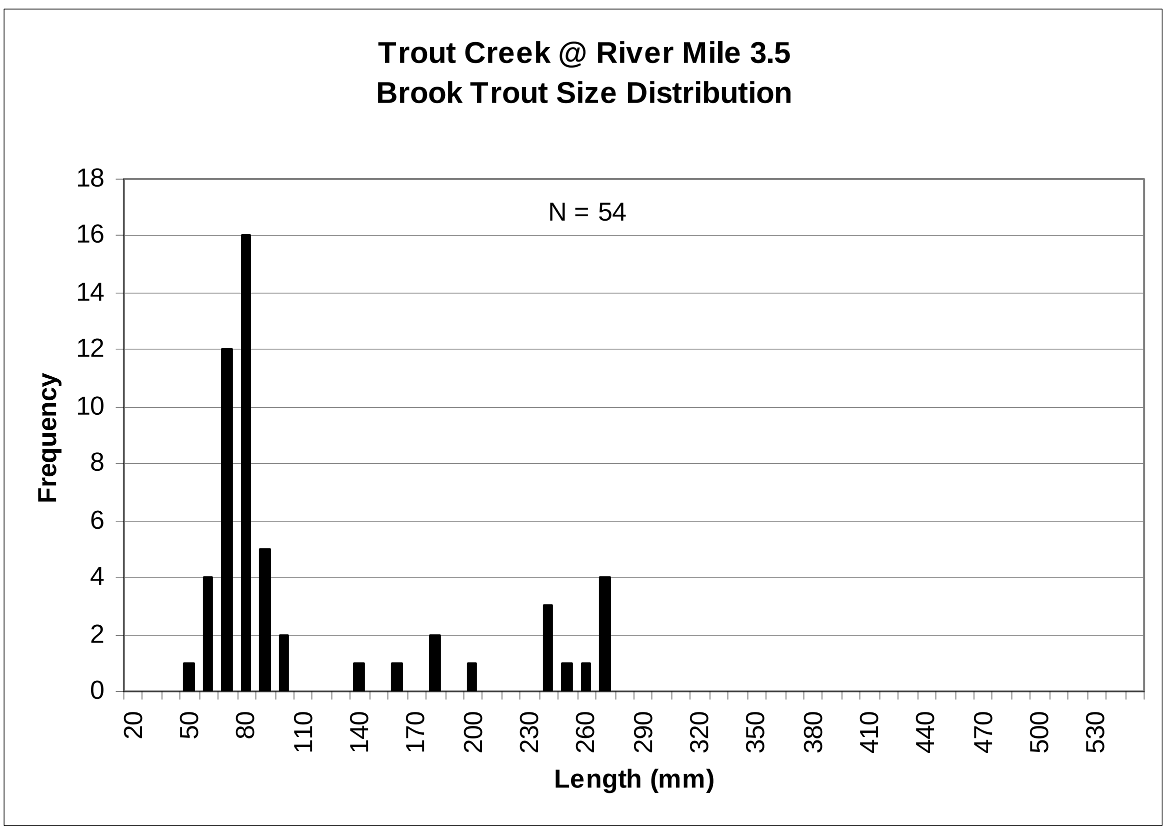

Little Blackfoot River @ River Mile 36.9
Brown Trout Size Distribution
N = 13
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)


Little Blackfoot River @ River Mile 36.9
Brook Trout Size Distribution
N = 2
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

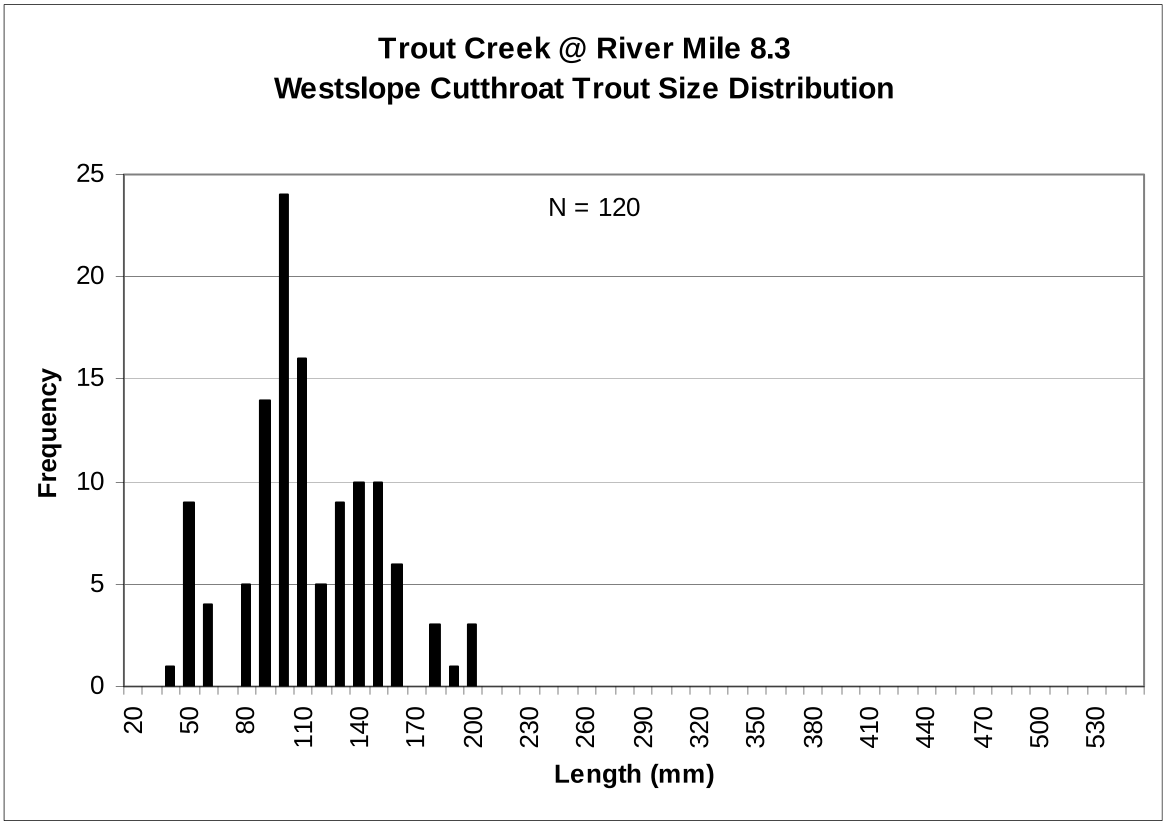
Trout Creek

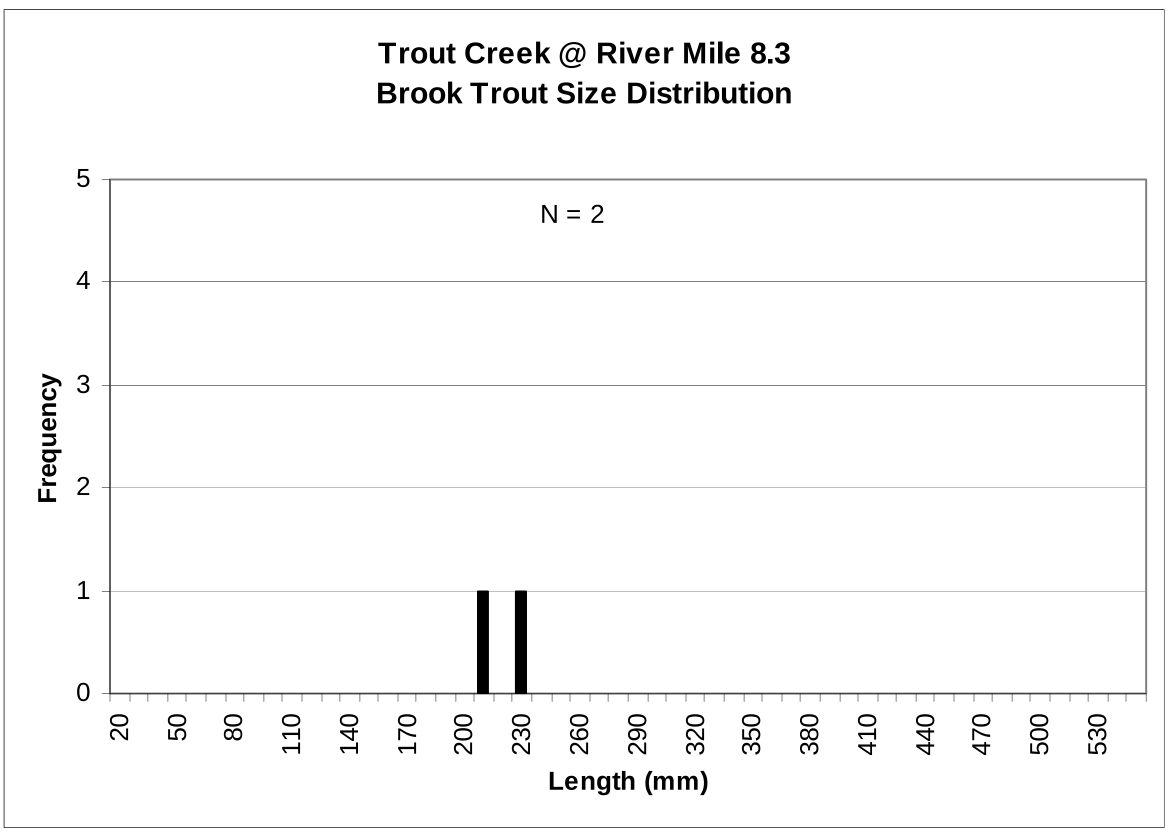


Trout Creek @ River Mile 3.5
Westslope Cutthroat Trout Size Distribution
N = 17
Frequency
0
1
2
3
4
5
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

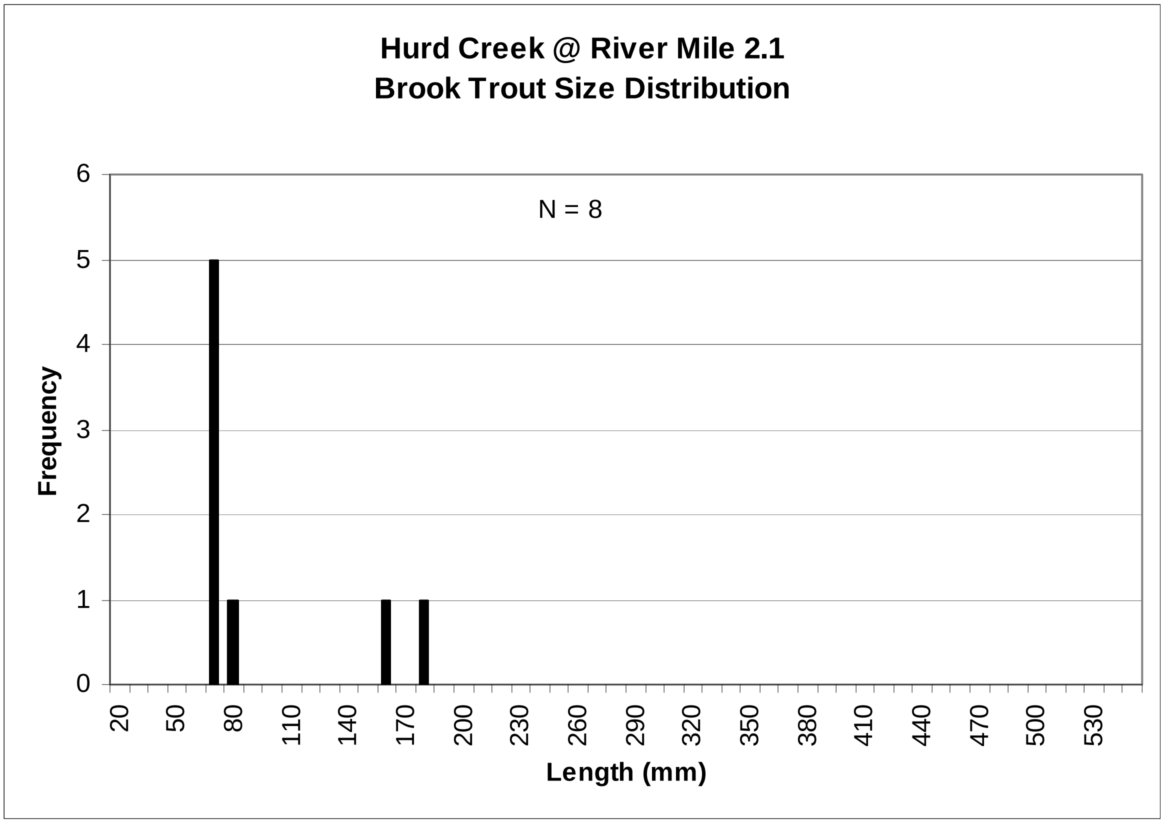


Trout Creek @ River Mile 3.5
Brook Trout Size Distribution
N = 54
Frequency
0
2
4
6
8
10
12
14
16
18
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

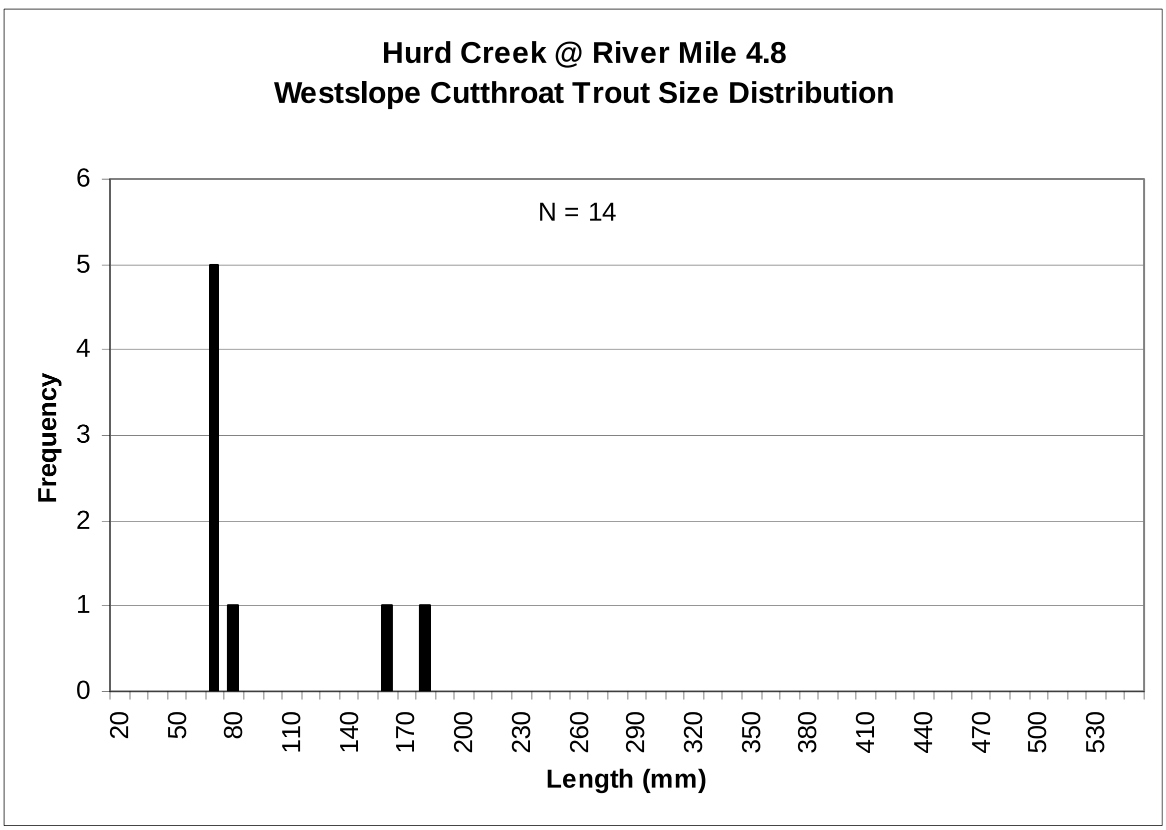

Trout Creek @ River Mile 8.3
Westslope Cutthroat Trout Size Distribution
N = 120
Frequency
25
20
15
10
5
0
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)


Trout Creek @ River Mile 8.3
Brook Trout Size Distribution
N = 2
Frequency
5
4
3
2
1
0
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

Hurd Creek

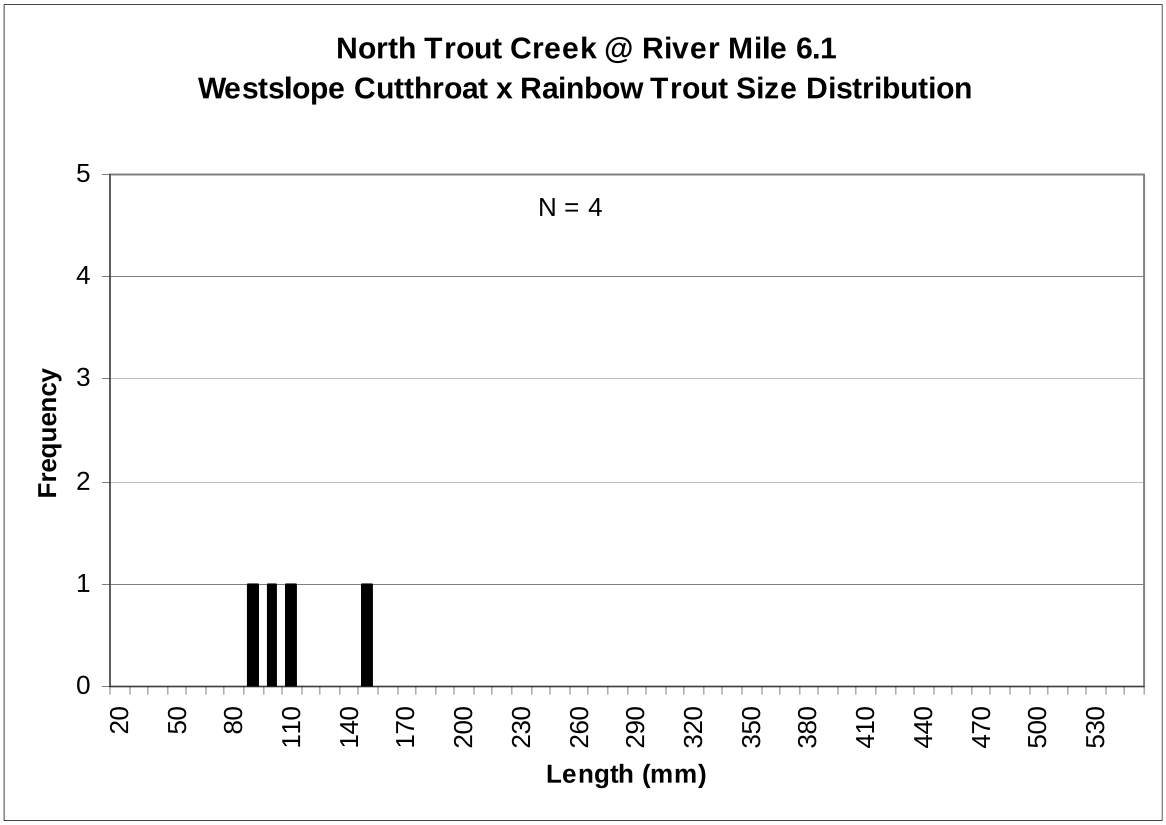


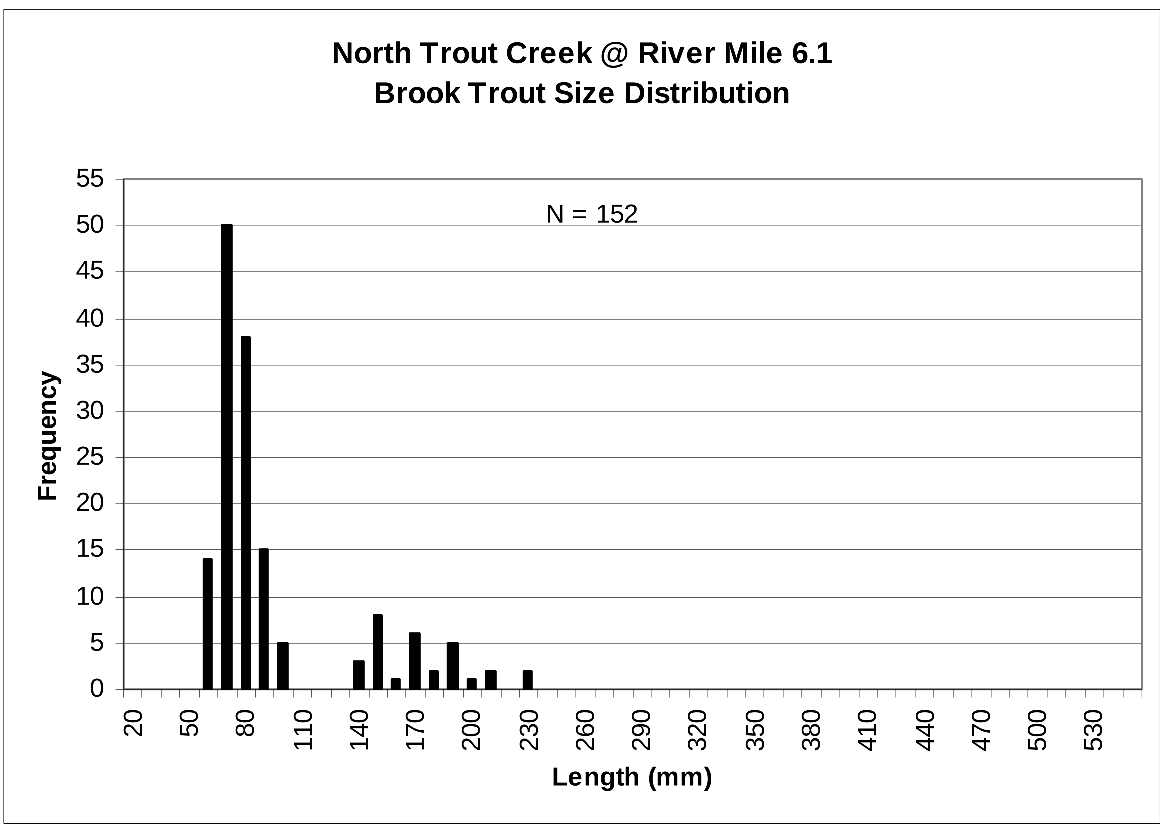
Hurd Creek @ River Mile 2.1
Brook Trout Size Distribution
N = 8
Frequency
0
1
2
3
4
5
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)



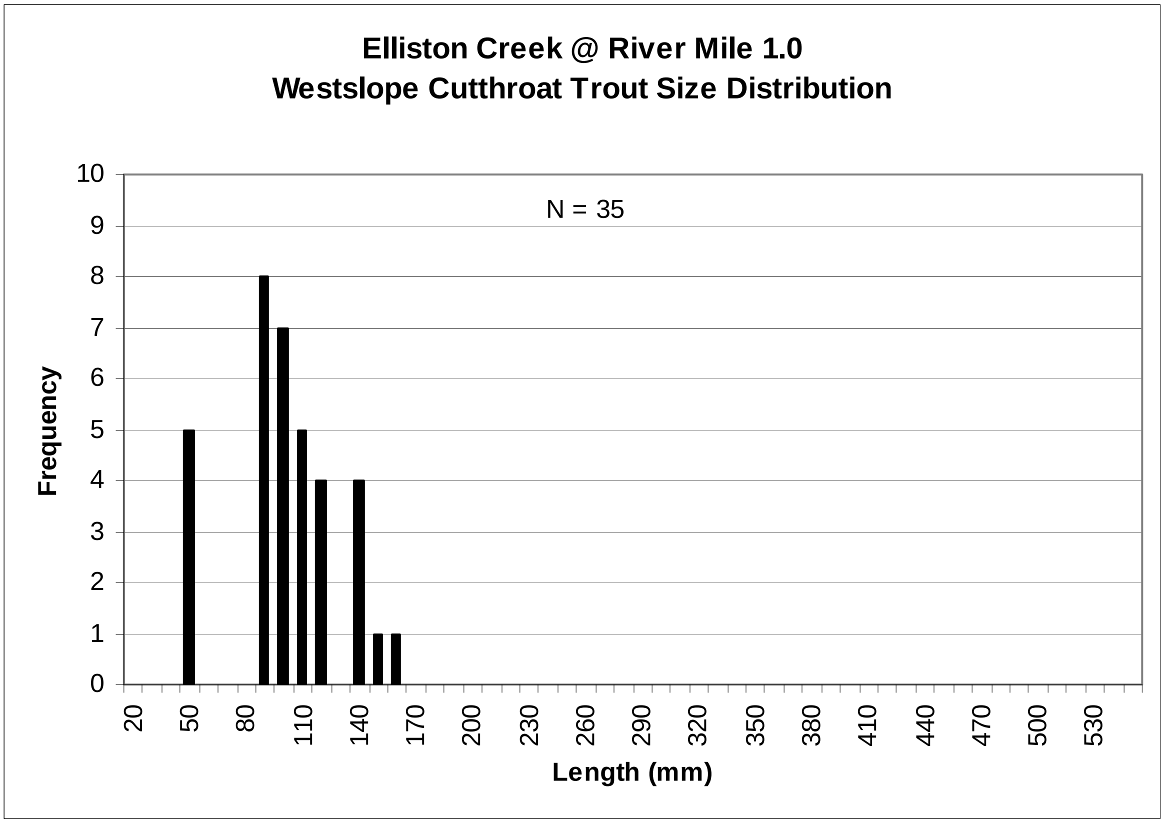
Hurd Creek @ River Mile 4.8
Westslope Cutthroat Trout Size Distribution
N = 14
Frequency
0
1
2
3
4
5
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

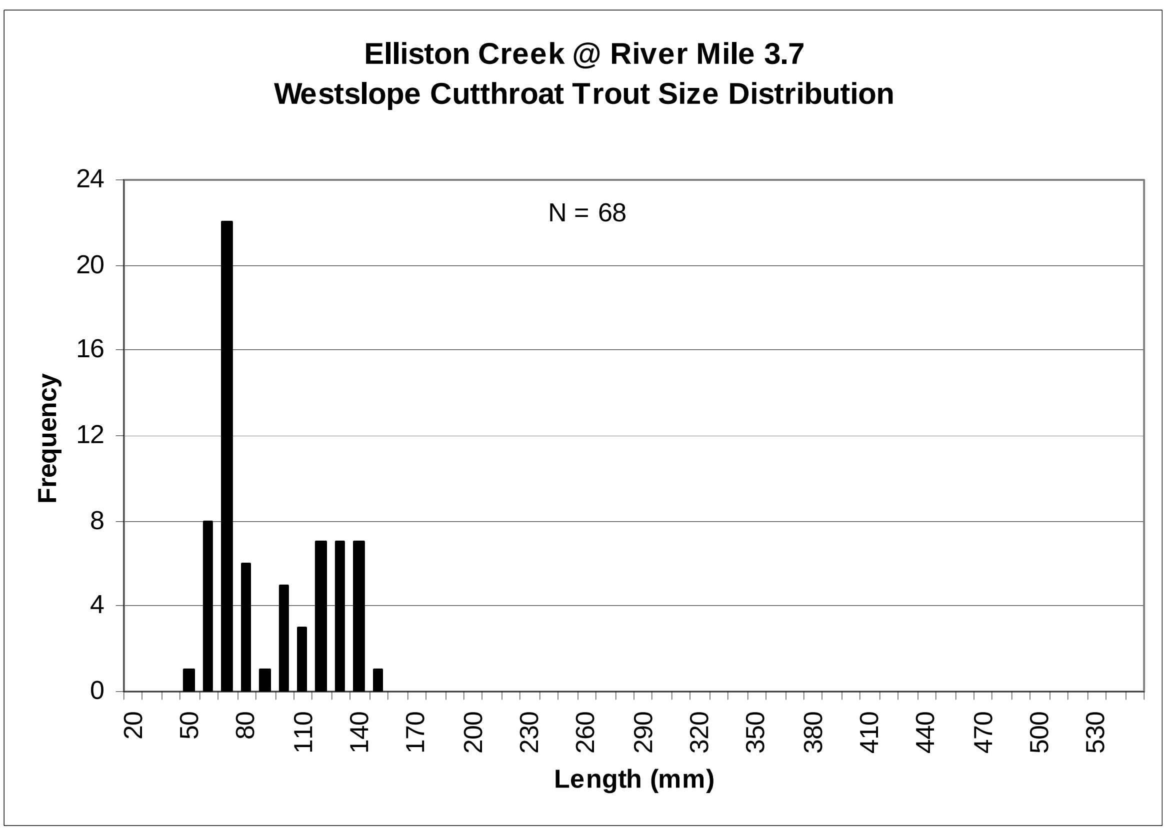
North Trout Creek



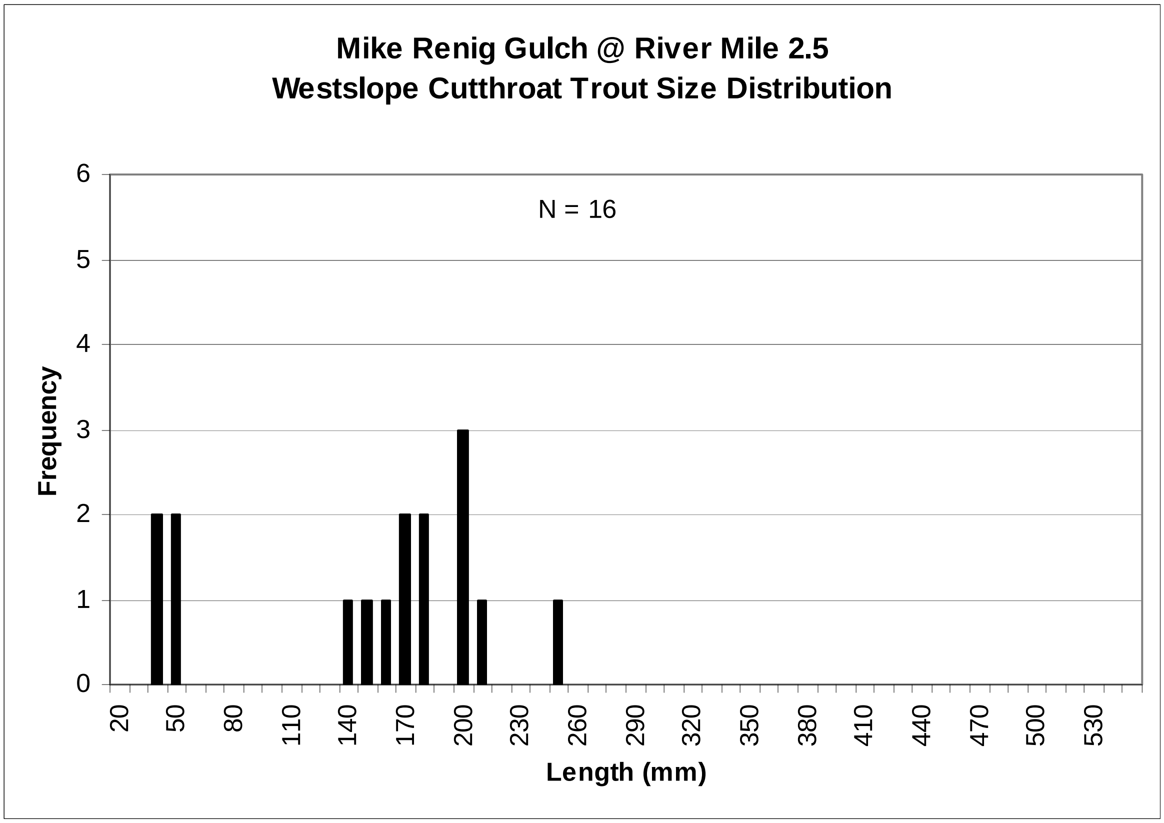


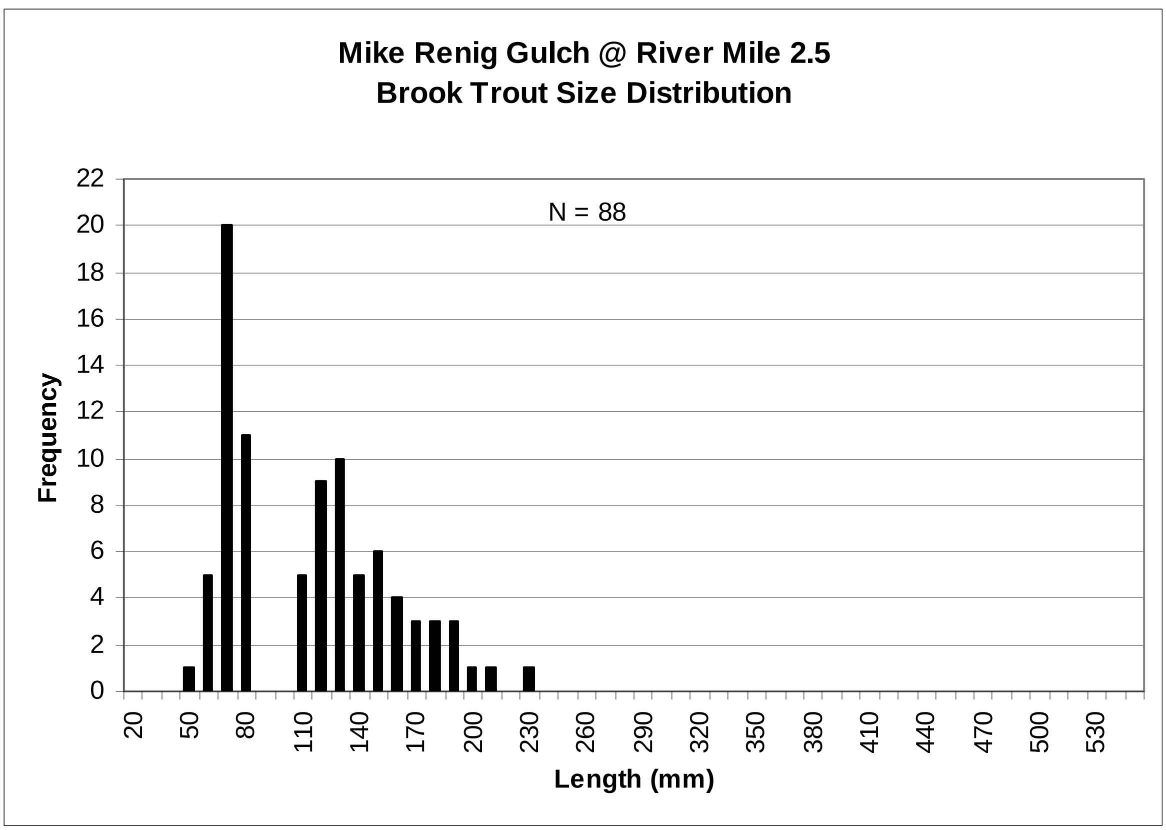
Elliston Creek

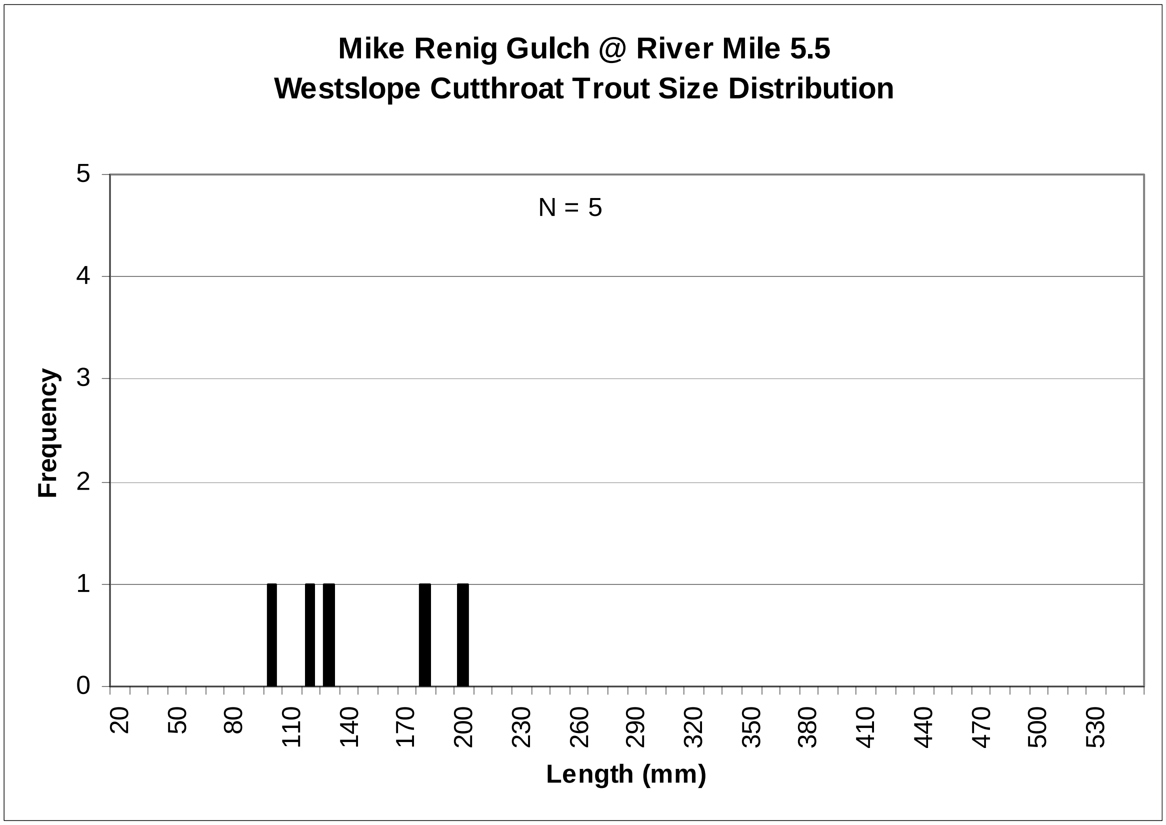




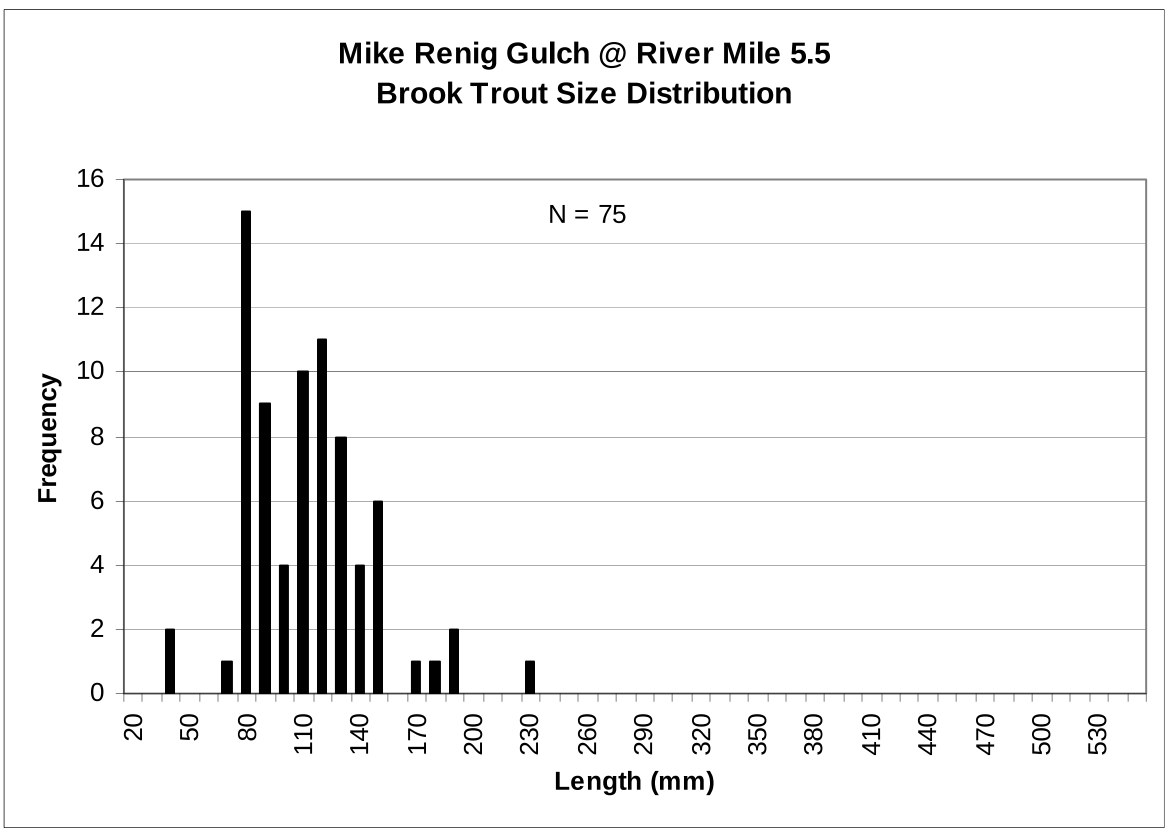
Mike Renig Gulch





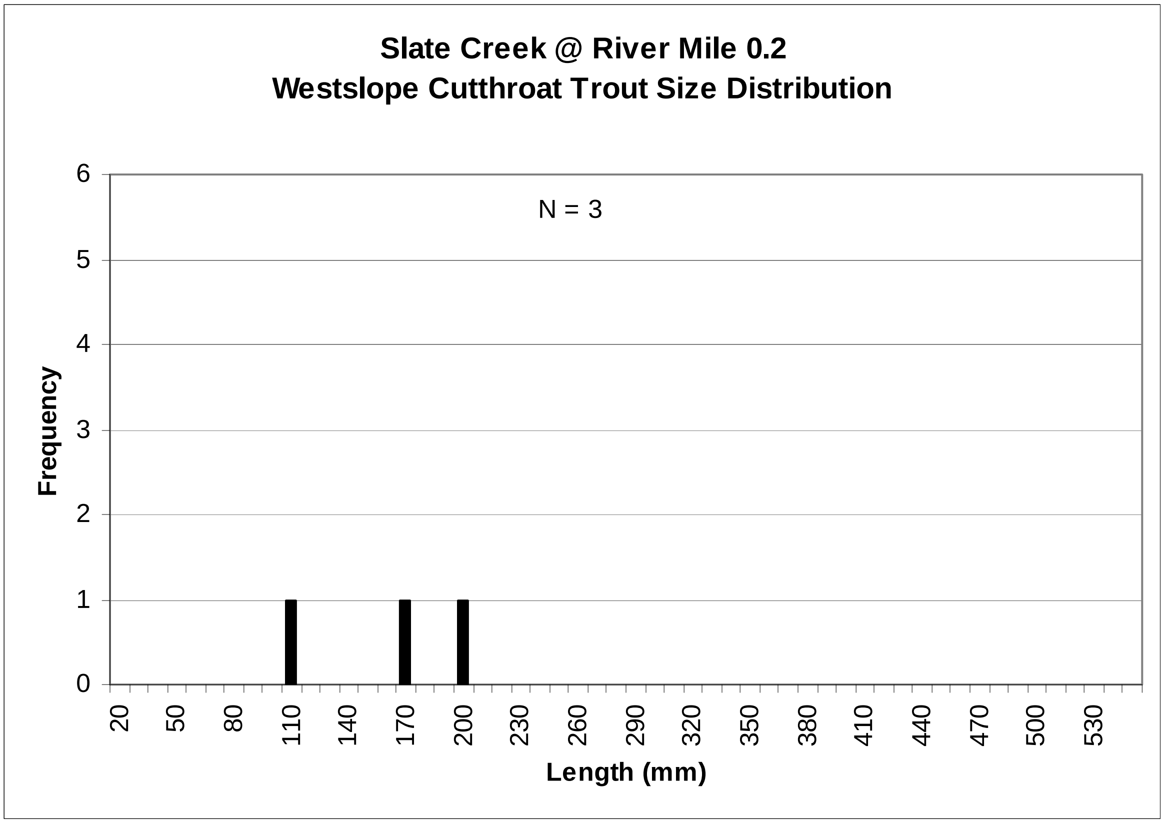


Mike Renig Gulch @ River Mile 5.5
Westslope Cutthroat Trout Size Distribution
N = 5
Frequency
Length (mm)
0
1
2
3
4
5
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530

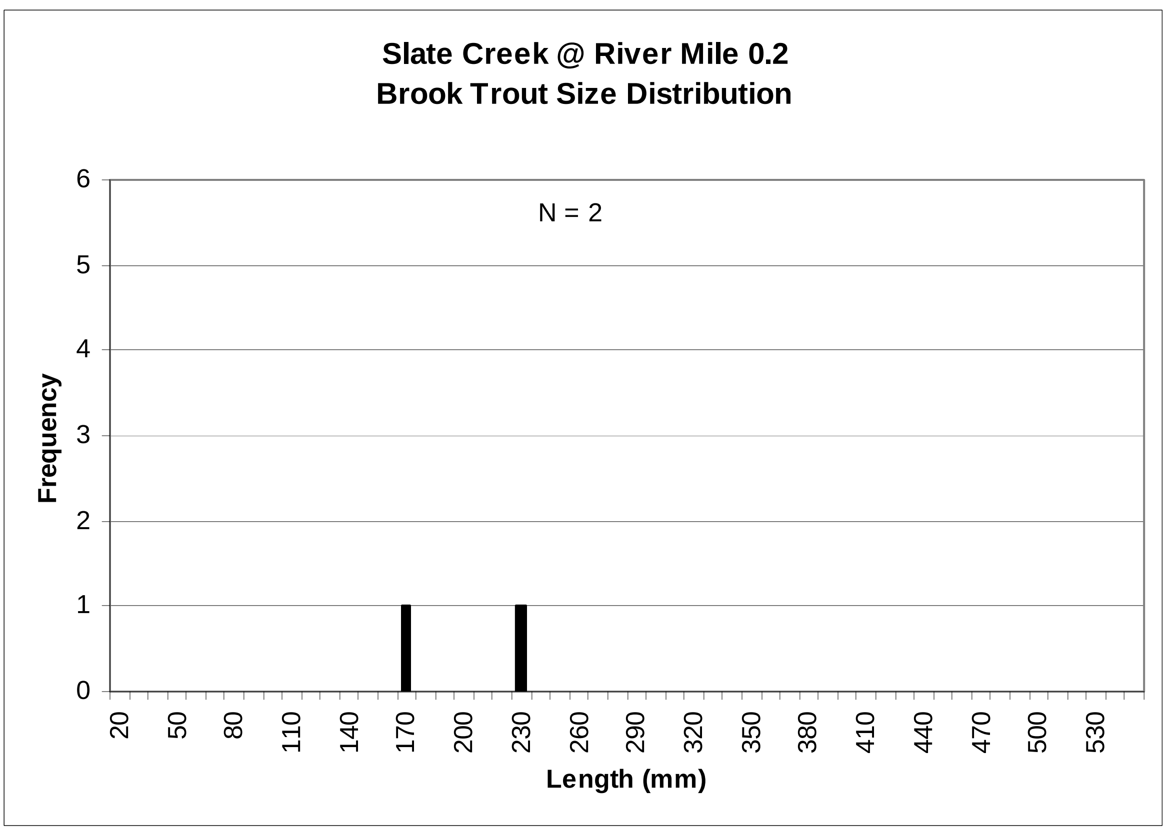


Mike Renig Gulch @ River Mile 5.5
Brook Trout Size Distribution
N = 75
Frequency
Length (mm)
0
2
4
6
8
10
12
14
16
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530

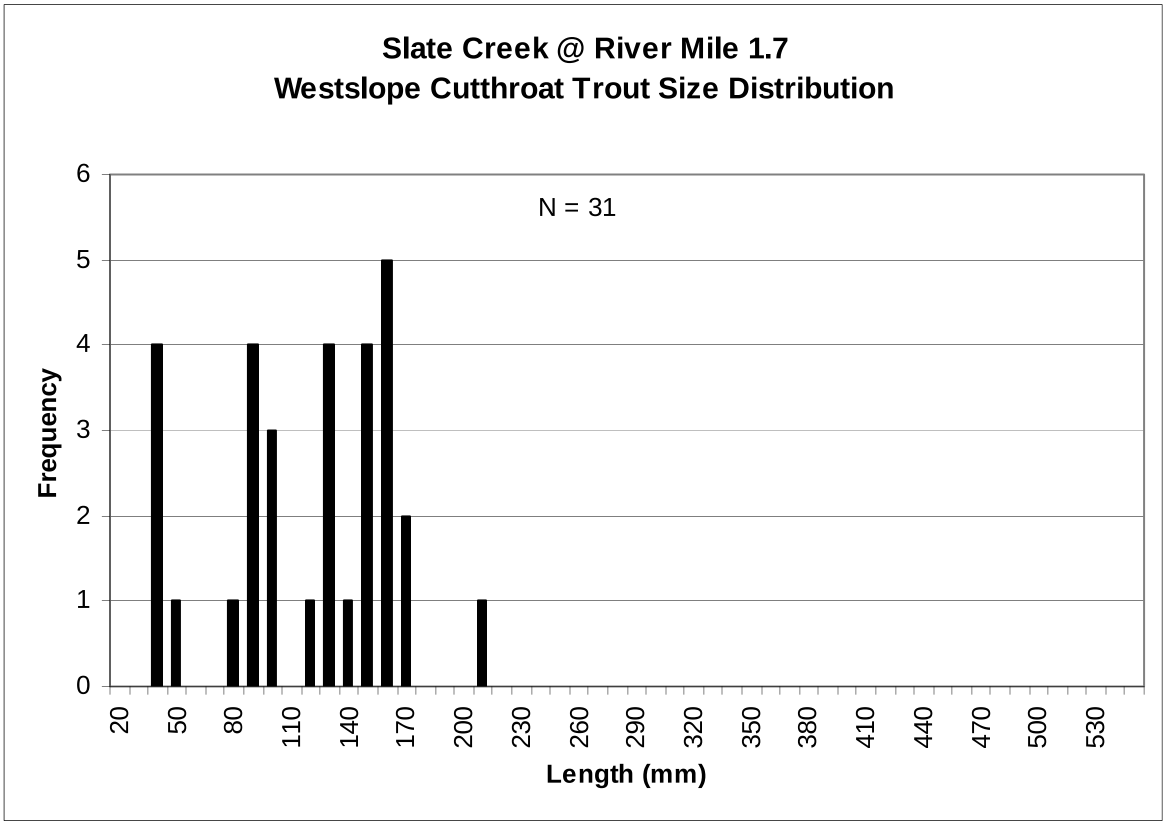
Slate Creek



Slate Creek @ River Mile 0.2
Westslope Cutthroat Trout Size Distribution
N = 3
Frequency
0
1
2
3
4
5
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

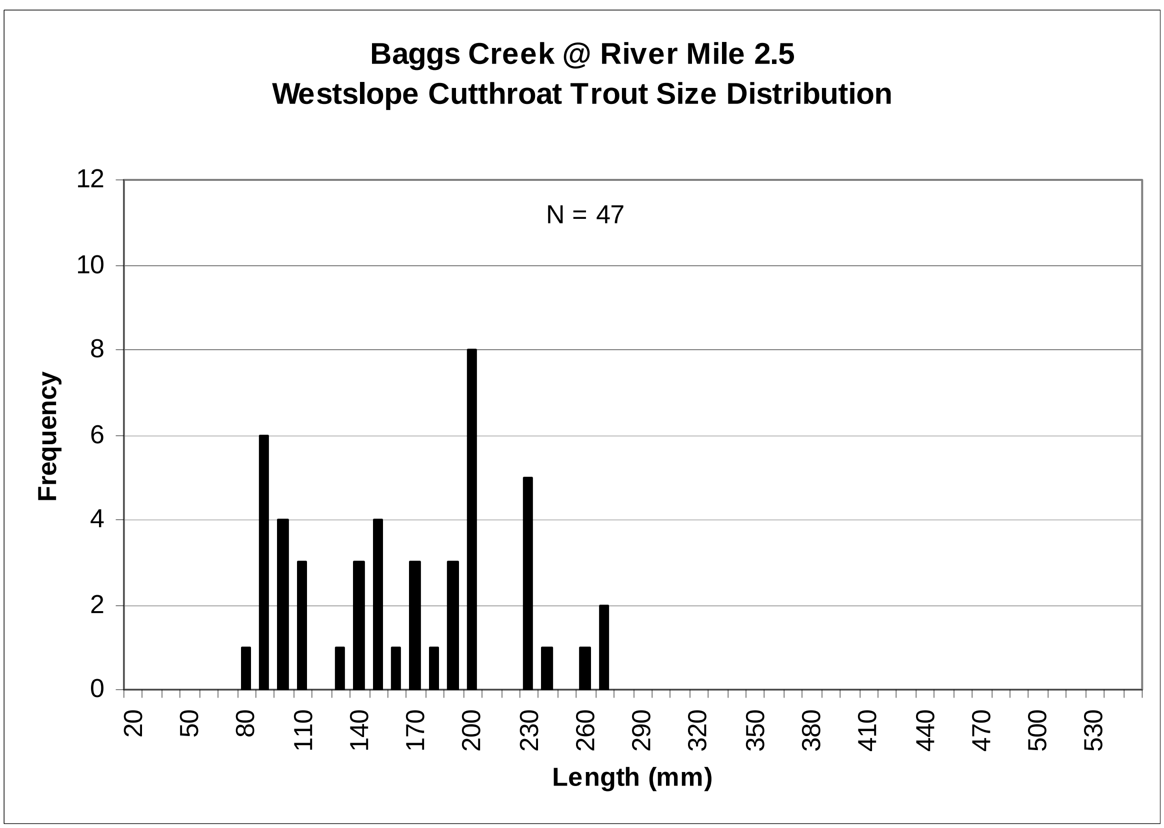


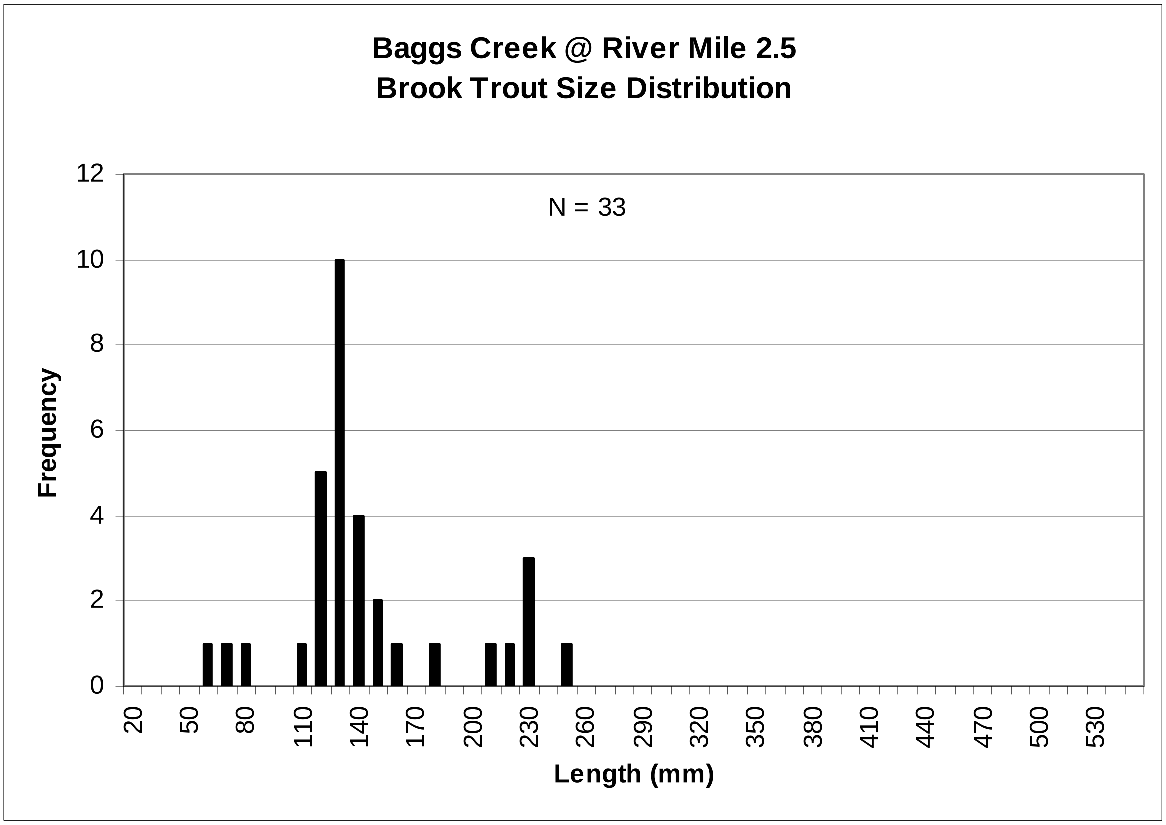
Slate Creek @ River Mile 0.2
Brook Trout Size Distribution
N = 2
Frequency
0
1
2
3
4
5
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)



Cottonwood Creek Drainage

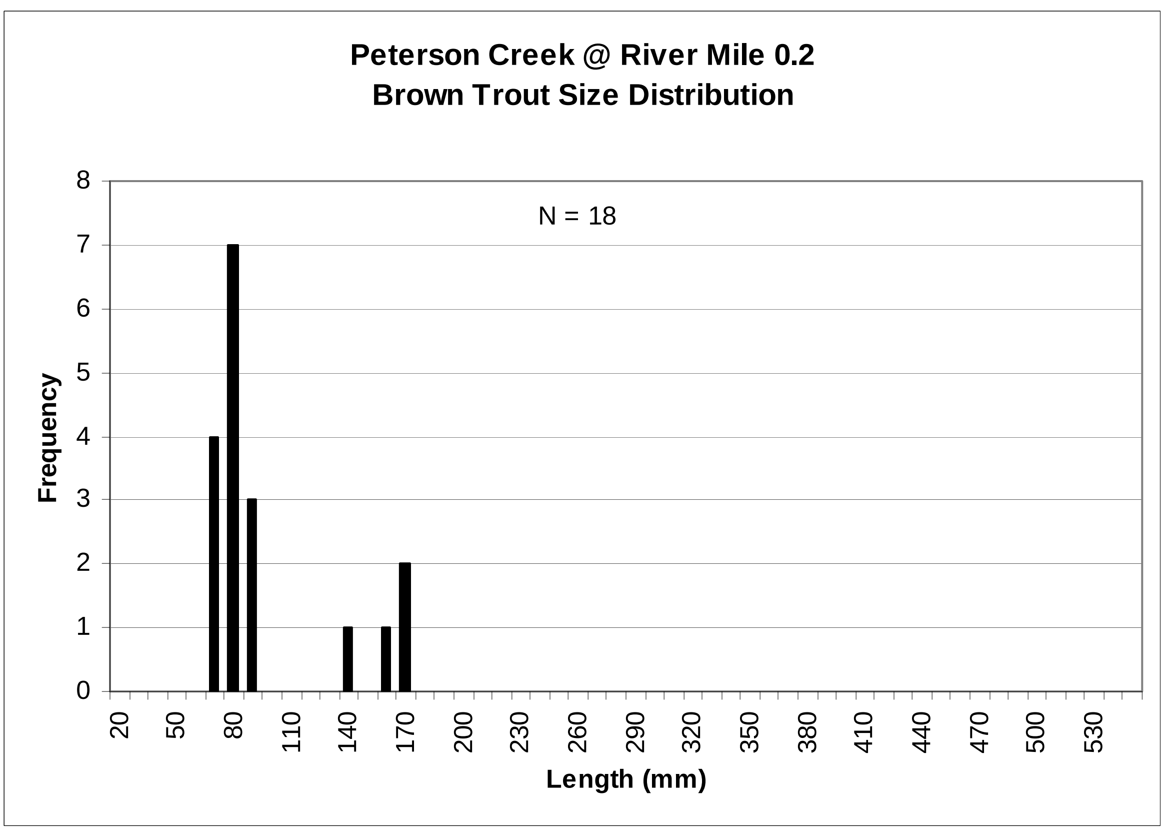
Baggs Creek

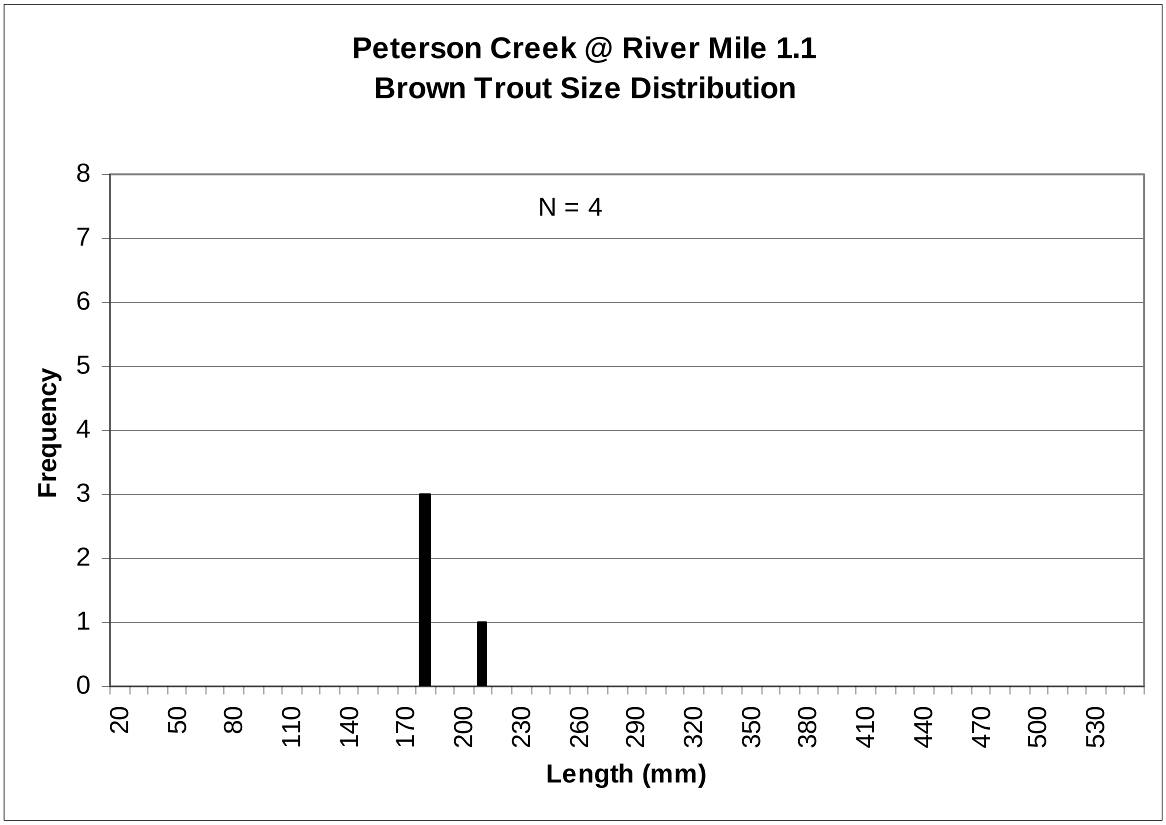




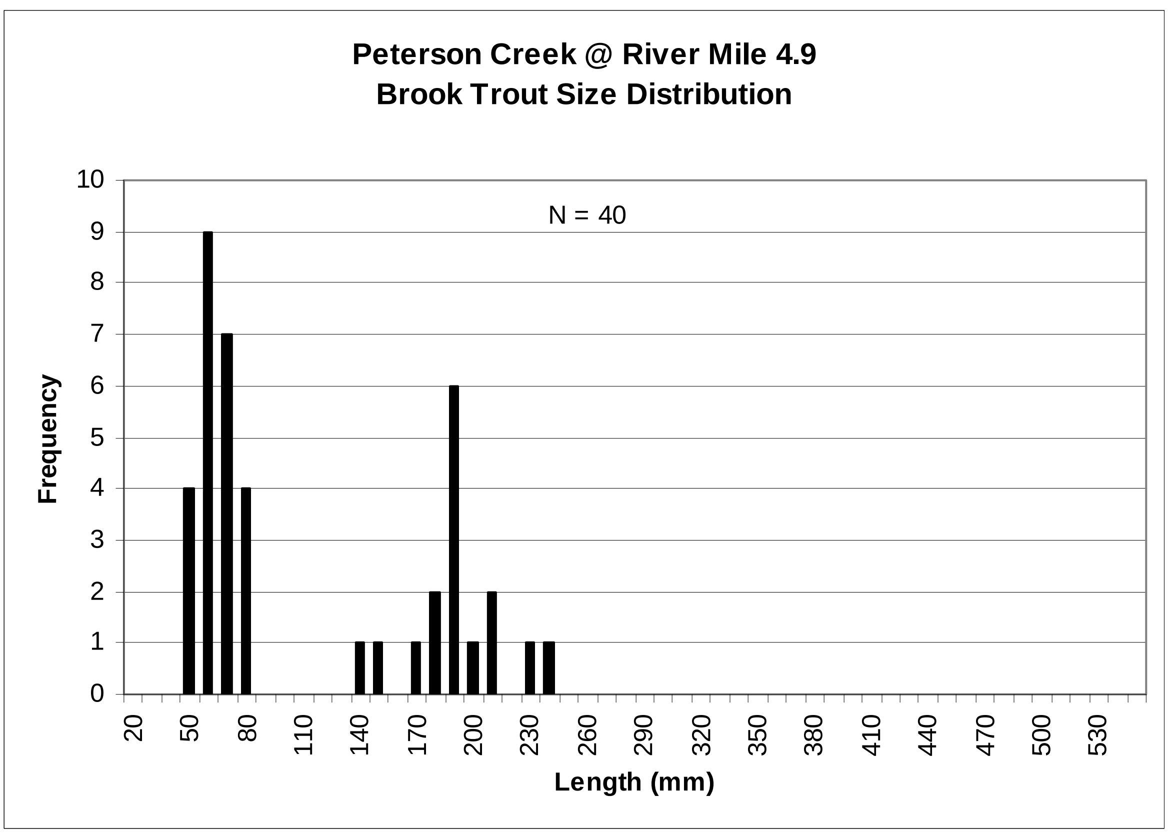
Peterson Creek Drainage

Peterson Creek

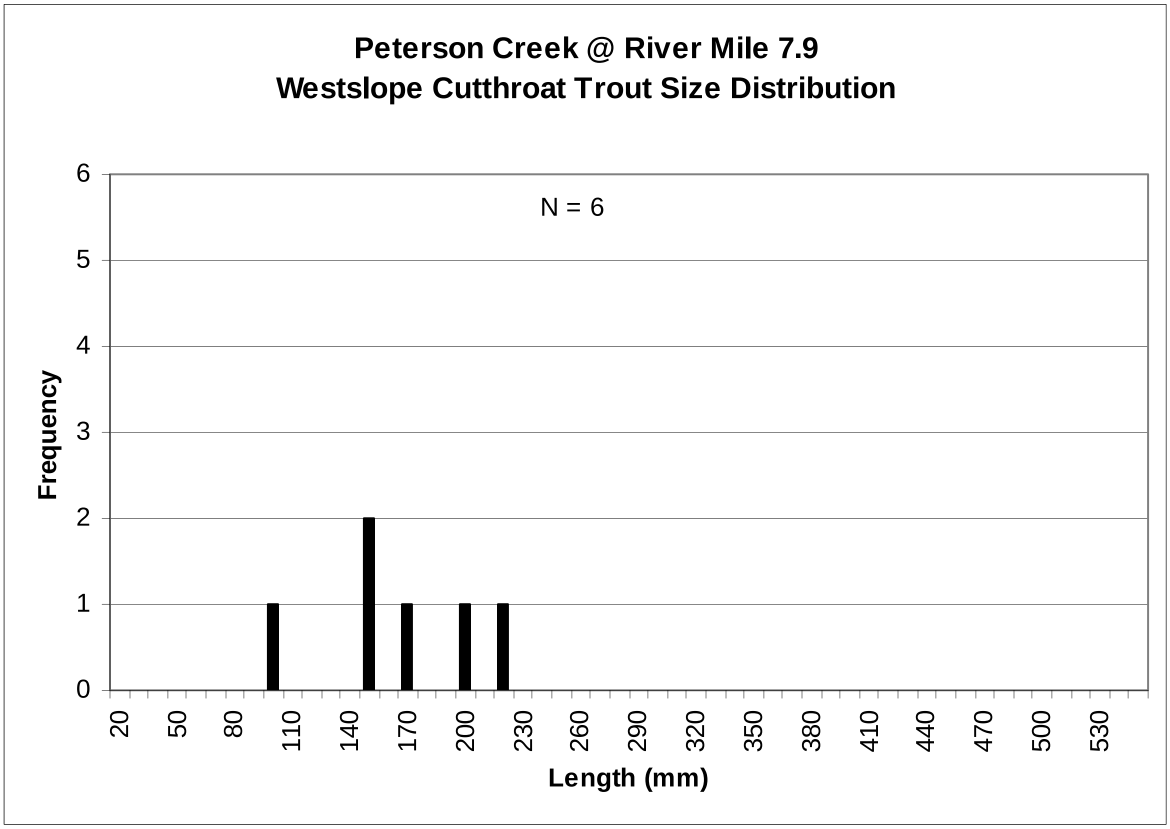




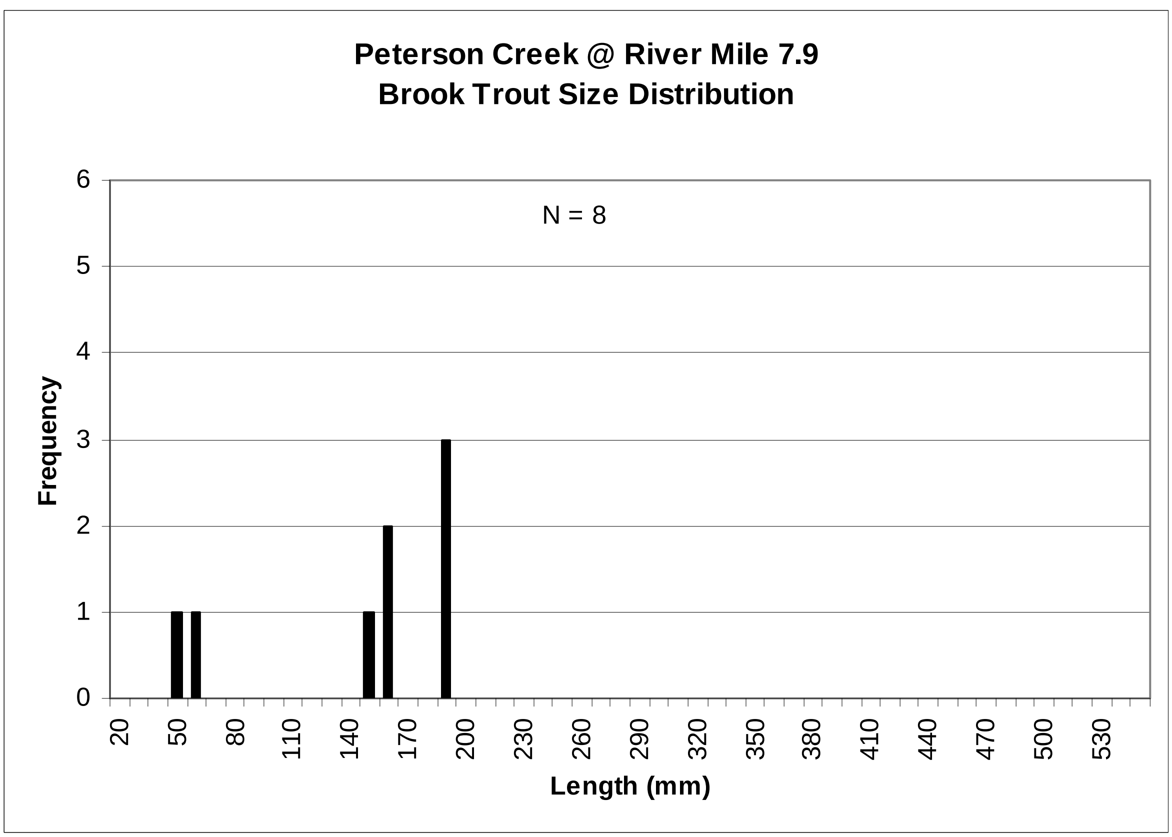
Peterson Creek @ River Mile 1.1
Brown Trout Size Distribution
N = 4
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)



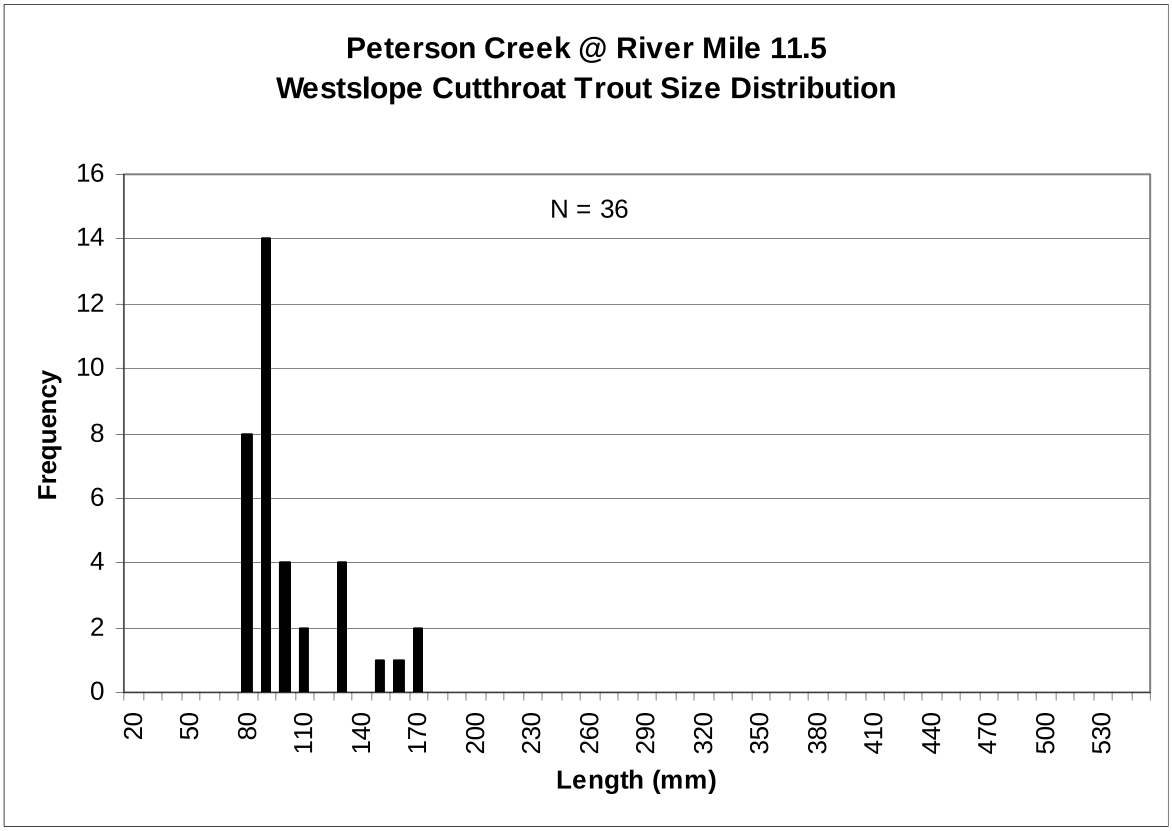
Peterson Creek @ River Mile 4.9
Brook Trout Size Distribution
N = 40
Frequency
0
1
2
3
4
5
6
7
8
9
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)



Peterson Creek @ River Mile 7.9
Westslope Cutthroat Trout Size Distribution
N = 6
Frequency
0
1
2
3
4
5
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

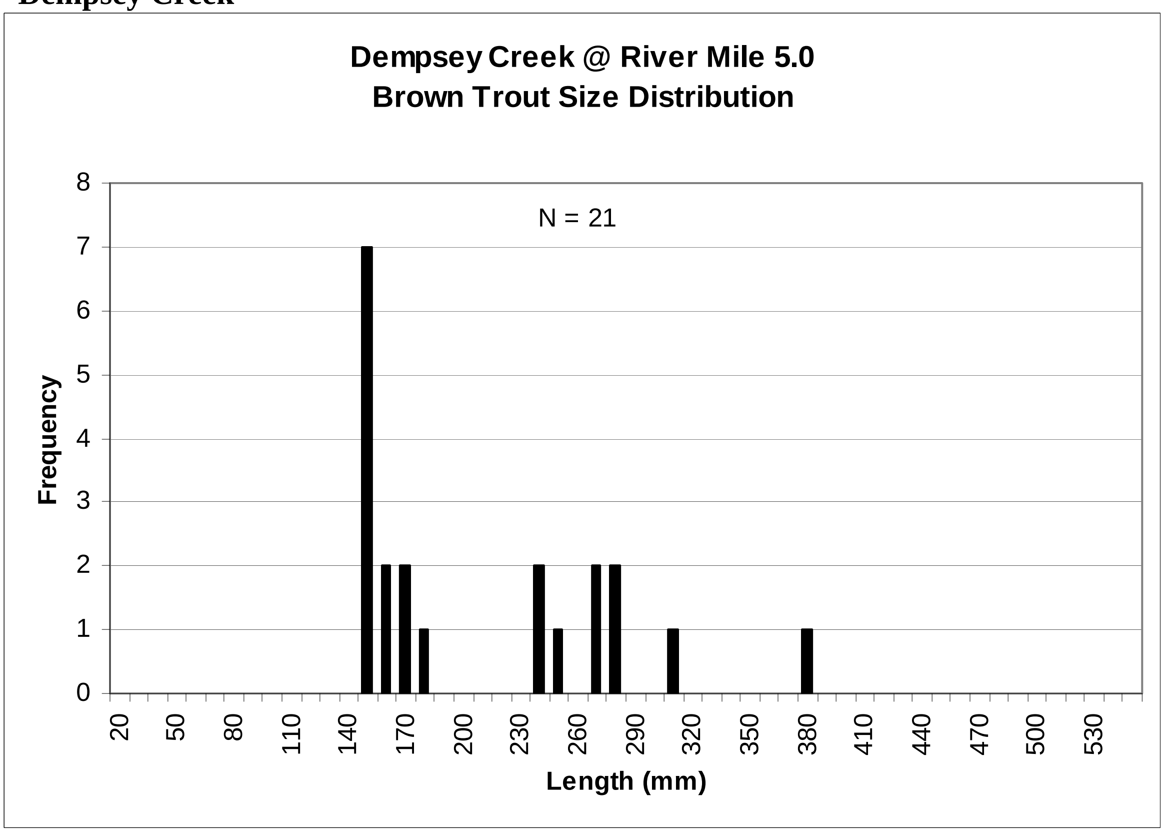


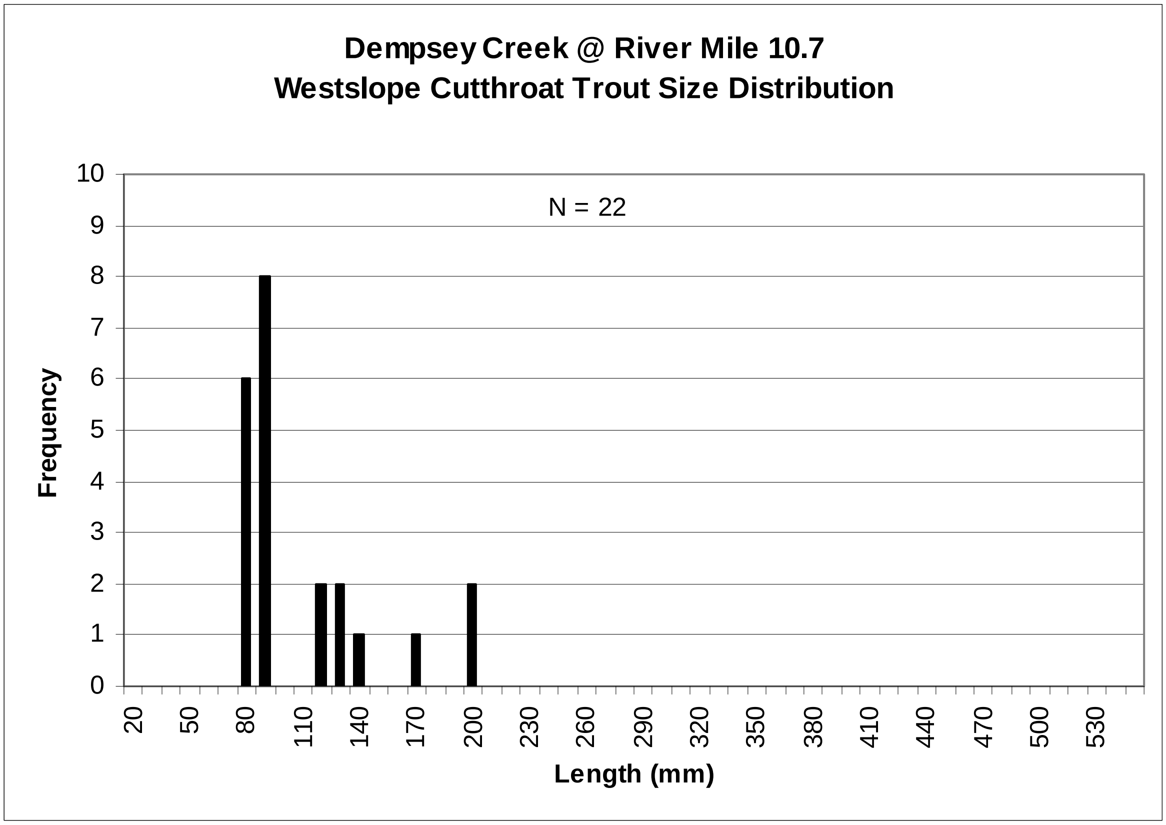
Peterson Creek @ River Mile 7.9
Brook Trout Size Distribution
N = 8
Frequency
0
1
2
3
4
5
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

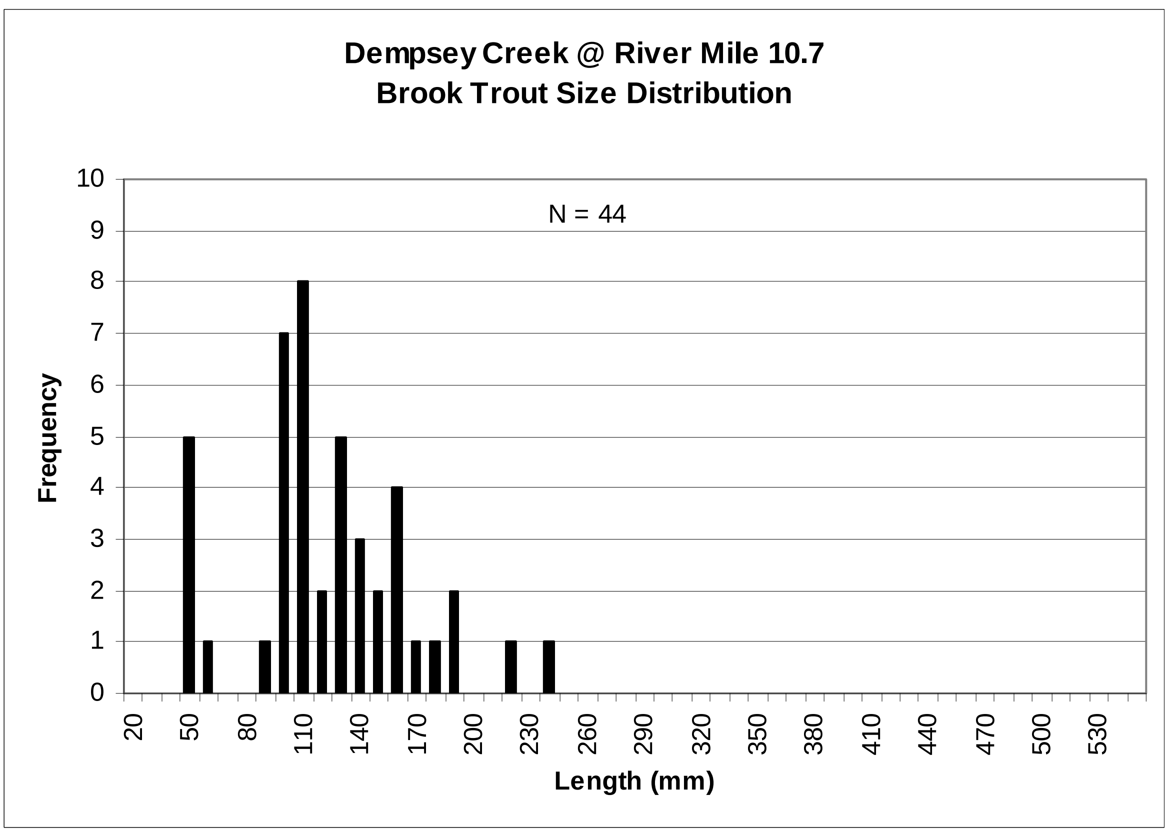


Dempsey Creek Drainage

Dempsey Creek

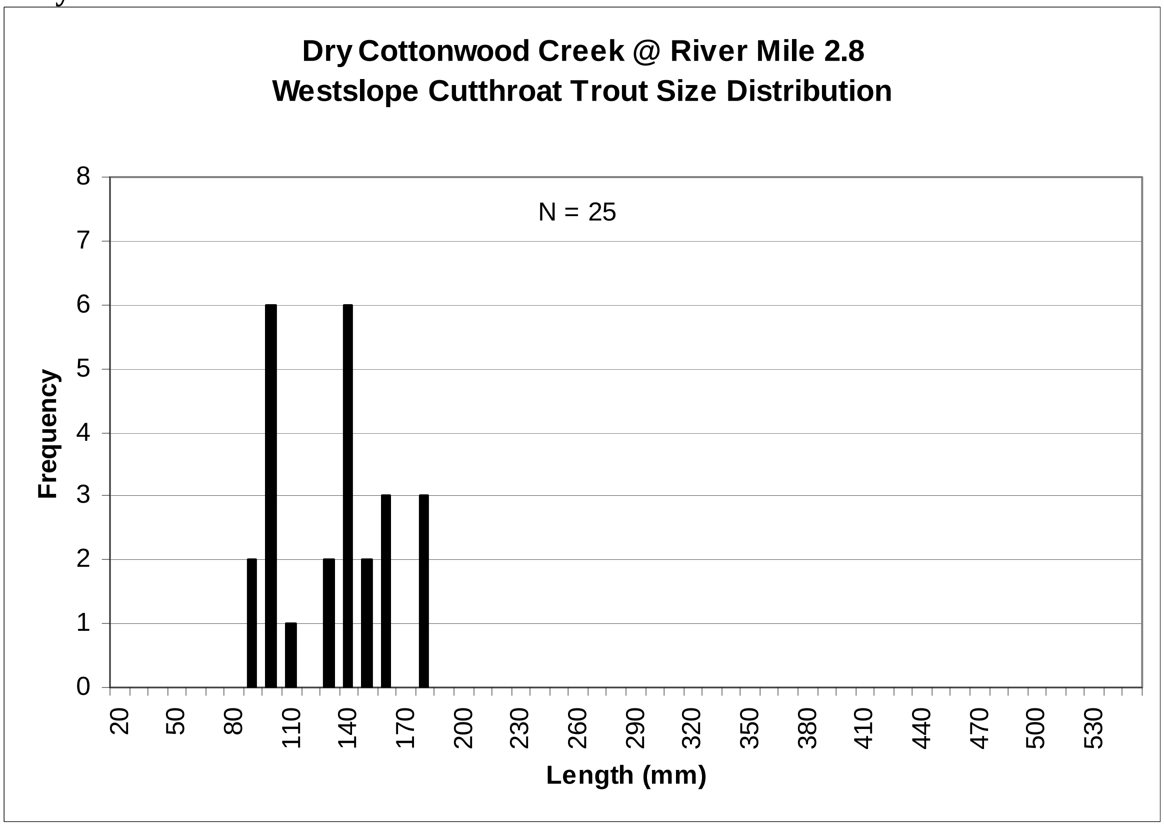


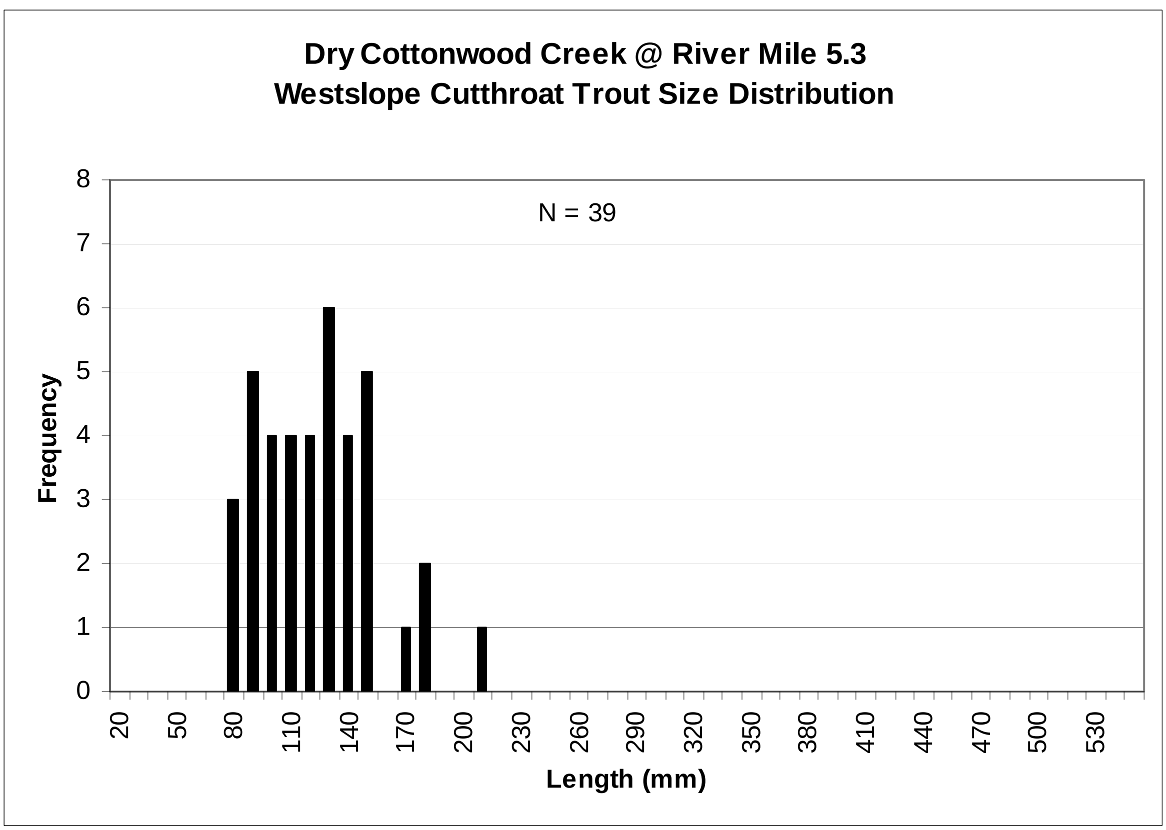

Dempsey Creek @ River Mile 10.7
Westslope Cutthroat Trout Size Distribution
N = 22
Frequency
Length (mm)
0
1
2
3
4
5
6
7
8
9
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530


Dempsey Creek @ River Mile 10.7
Brook Trout Size Distribution
N = 44
Frequency
Length (mm)
0
1
2
3
4
5
6
7
8
9
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530

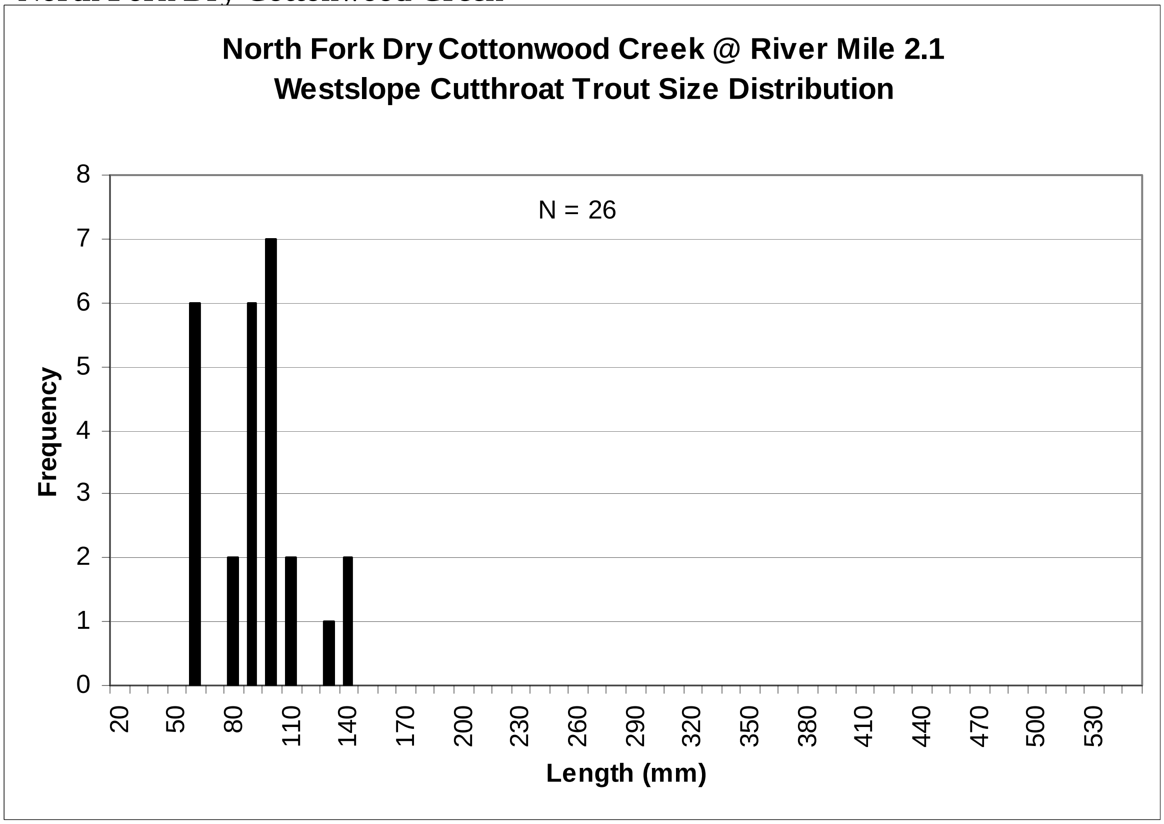
Dry Cottonwood Creek Drainage

Dry Cottonwood Creek



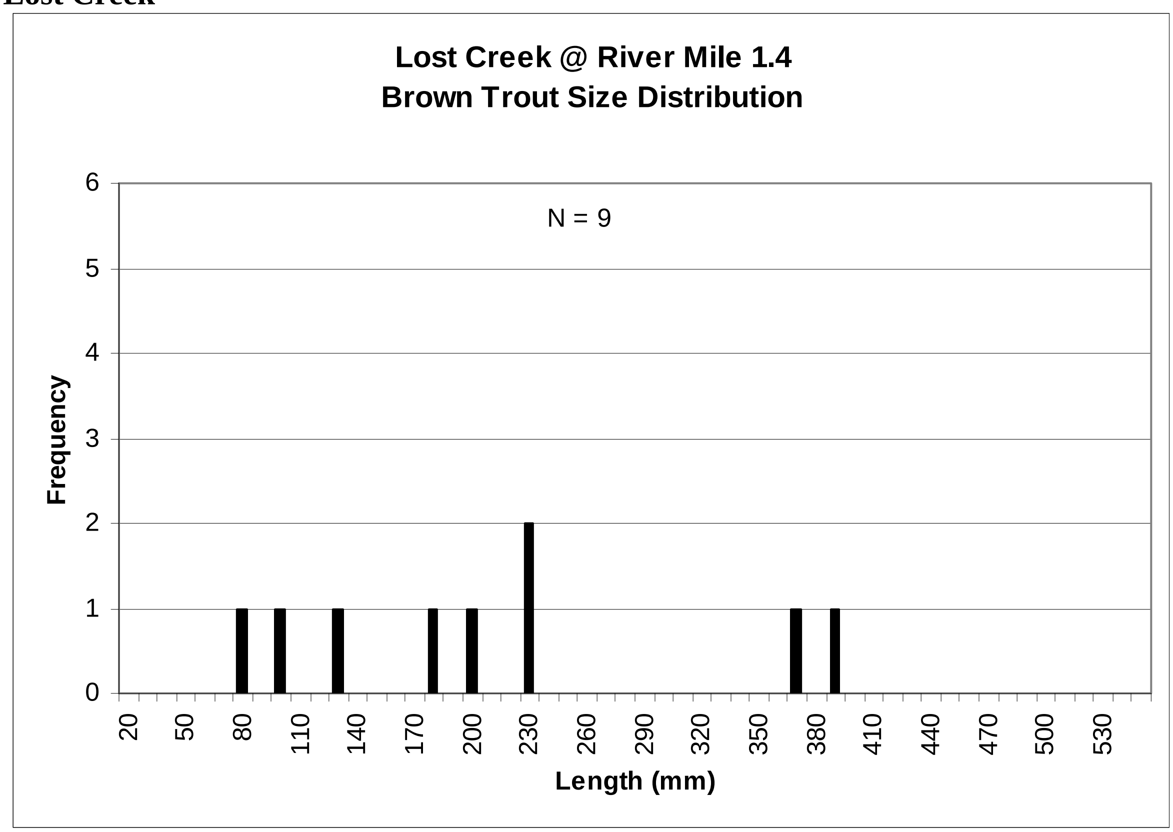


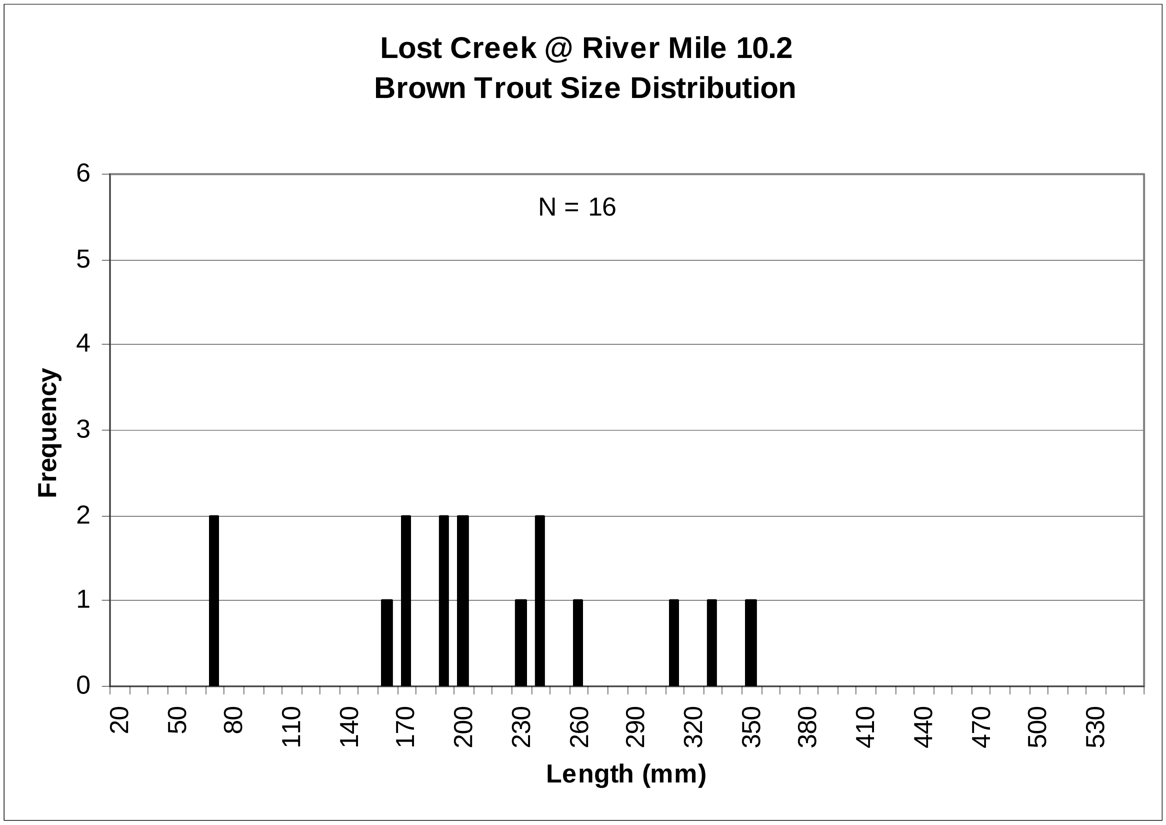
North Fork Dry Cottonwood Creek

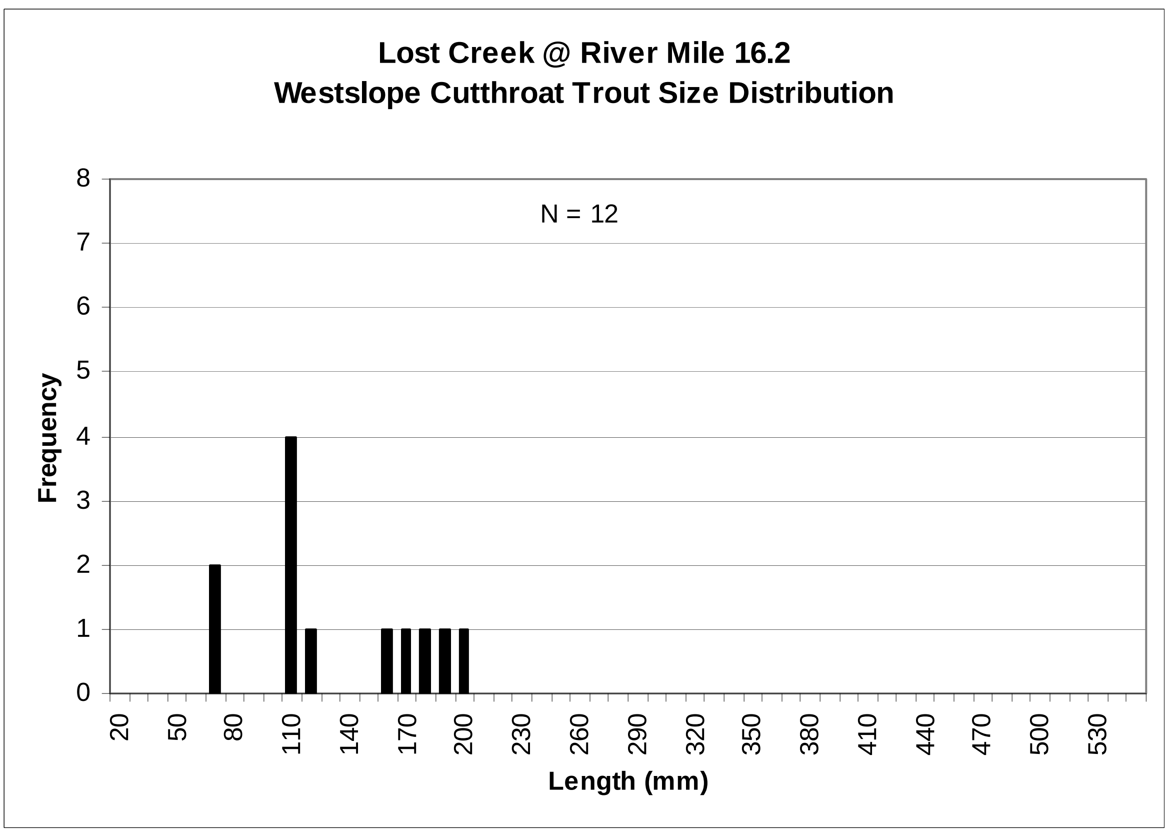


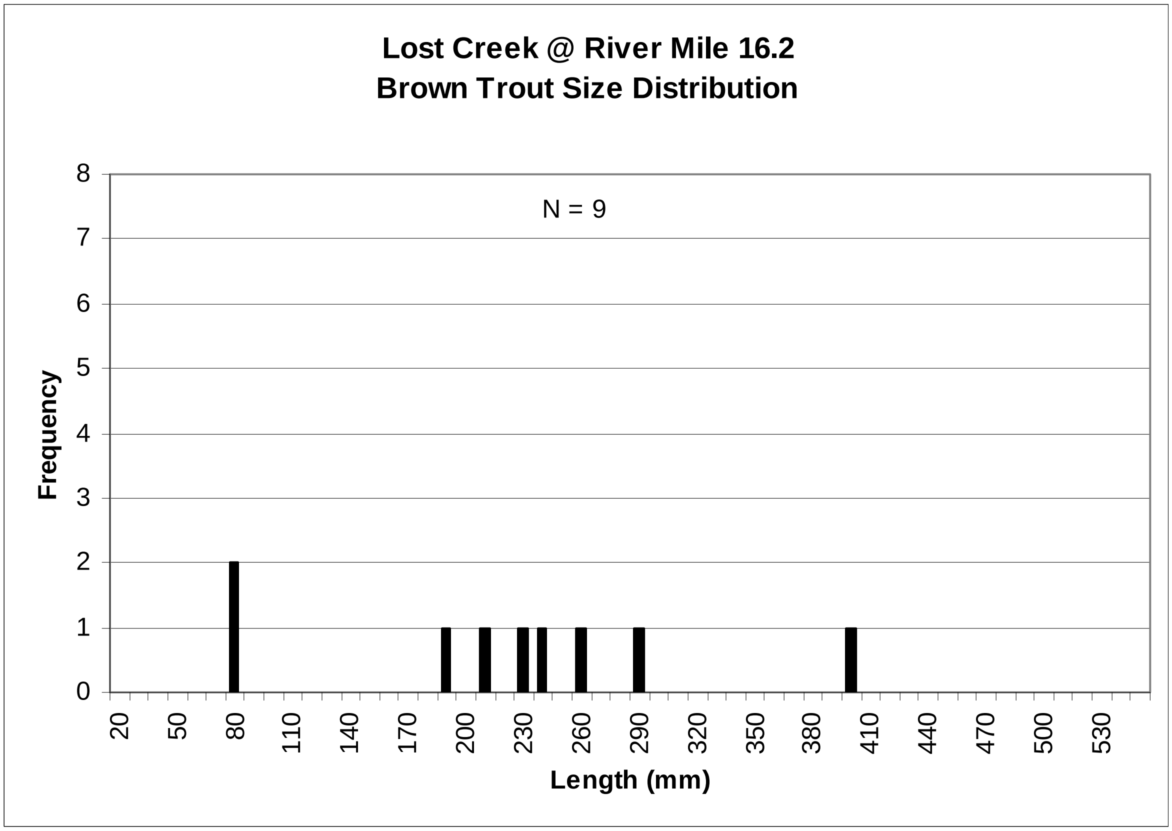
Lost Creek Drainage

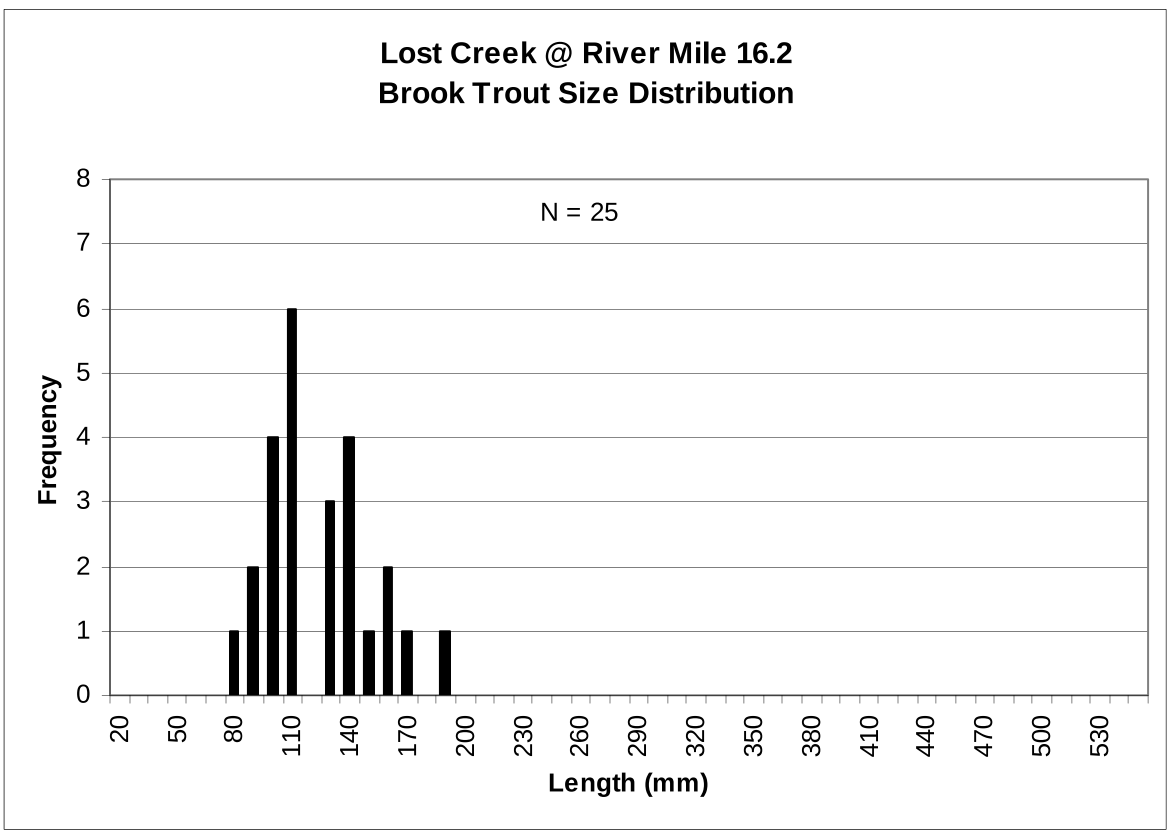
Lost Creek

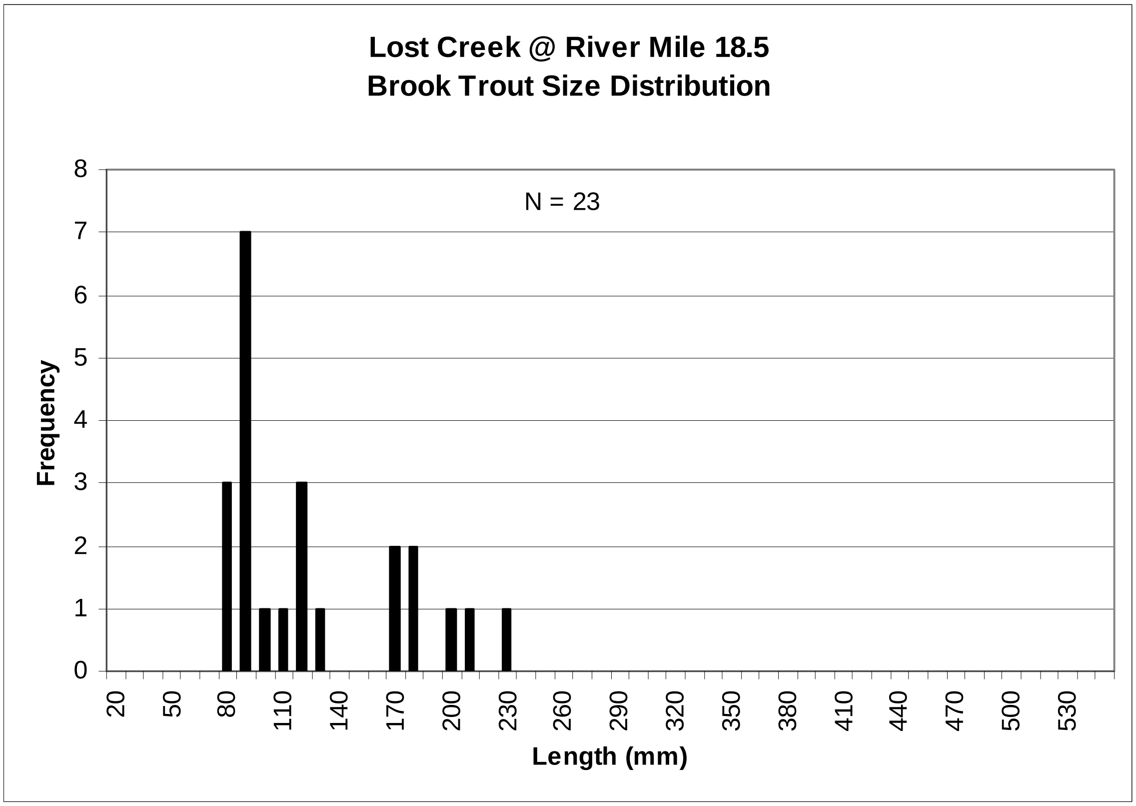



Lost Creek @ River Mile 10.2
Brown Trout Size Distribution
N = 16
Frequency
0
1
2
3
4
5
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)


Lost Creek @ River Mile 16.2
Westslope Cutthroat Trout Size Distribution
N = 12
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

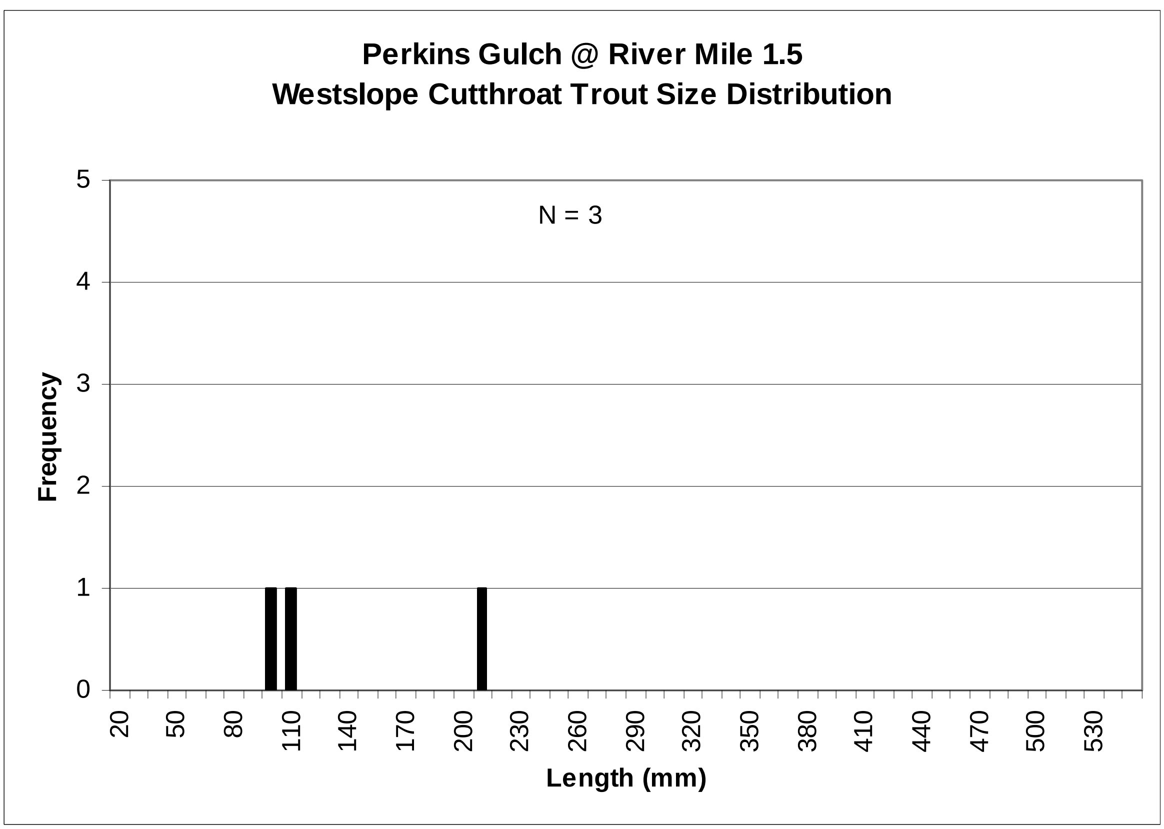

Lost Creek @ River Mile 16.2
Brown Trout Size Distribution
N = 9
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

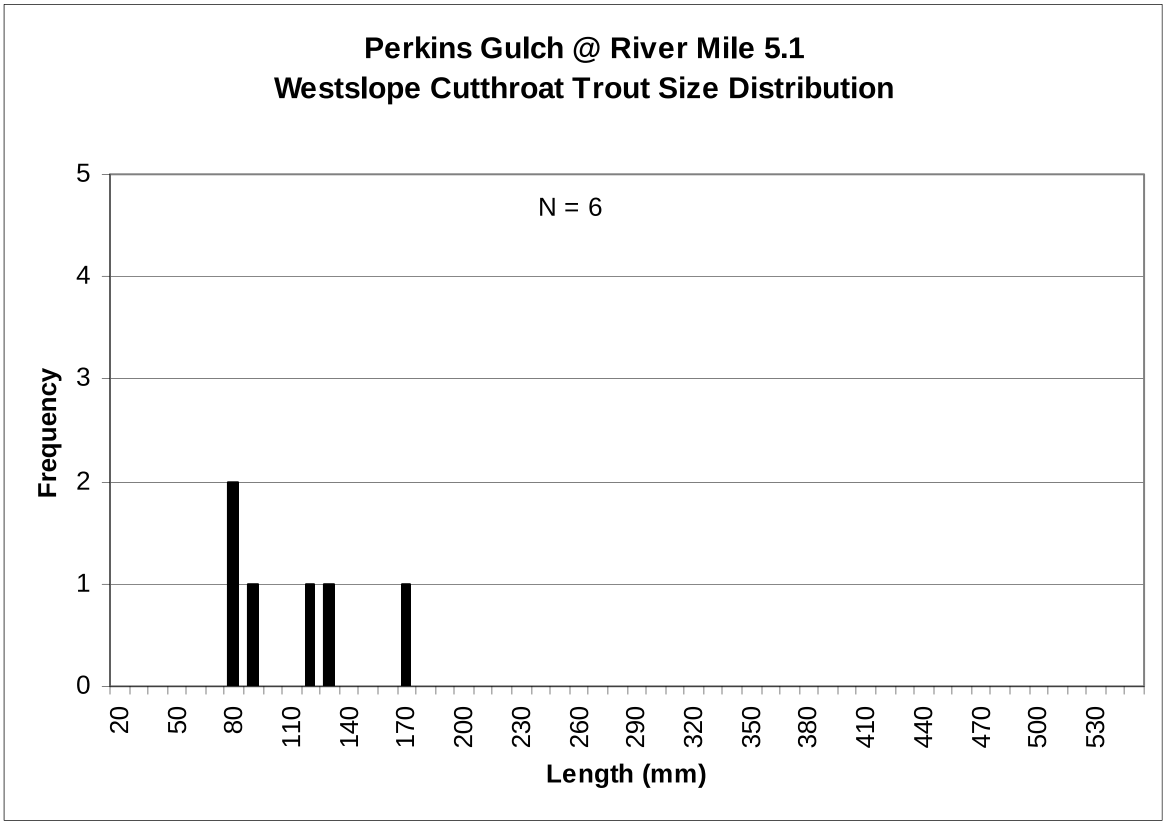

Lost Creek @ River Mile 16.2
Brook Trout Size Distribution
N = 25
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)



Perkins Gulch Drainage

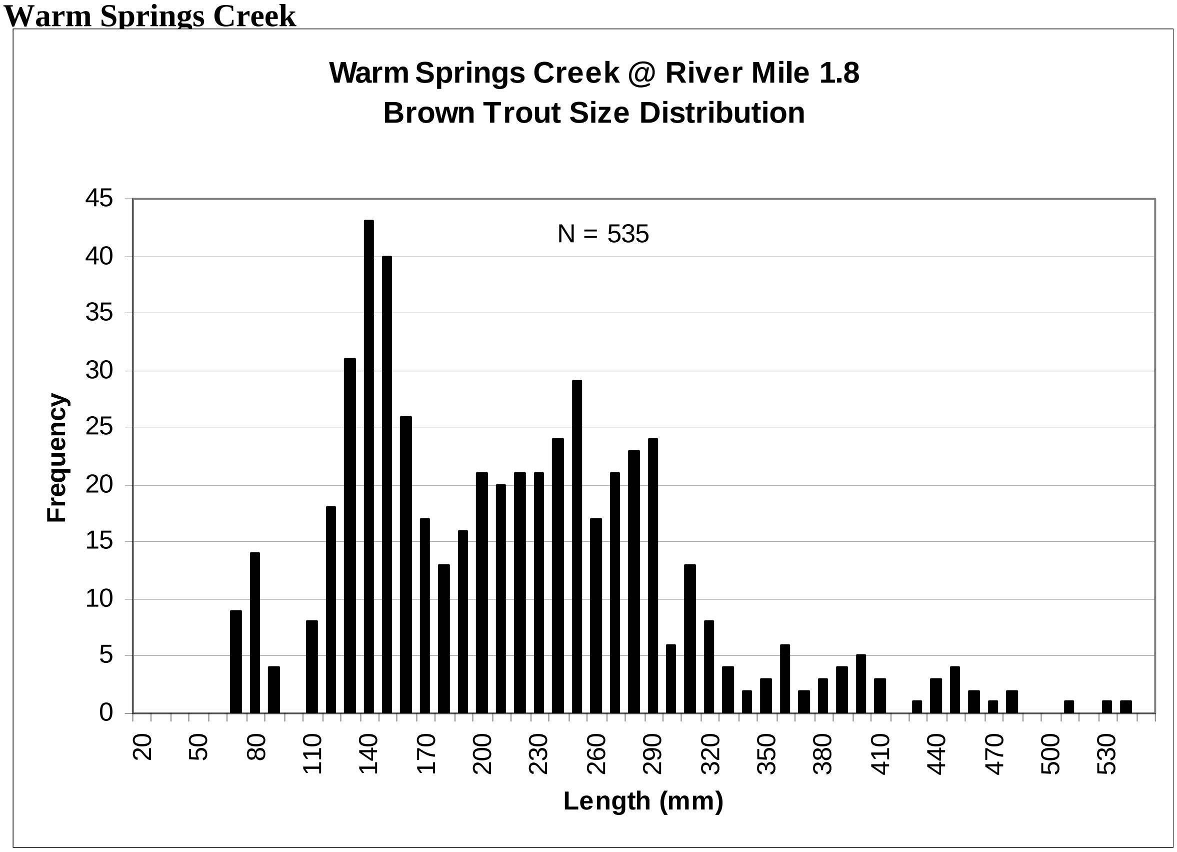
Perkins Gulch





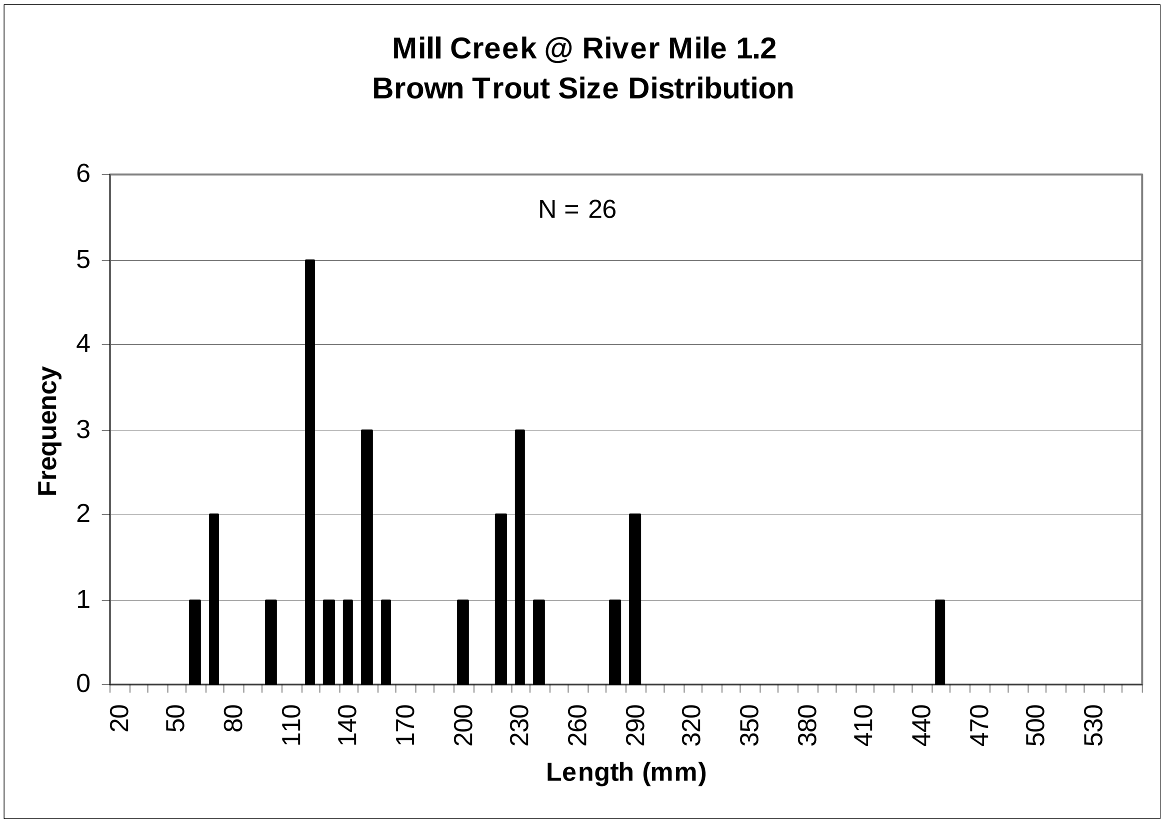
Warm Springs Creek Drainage

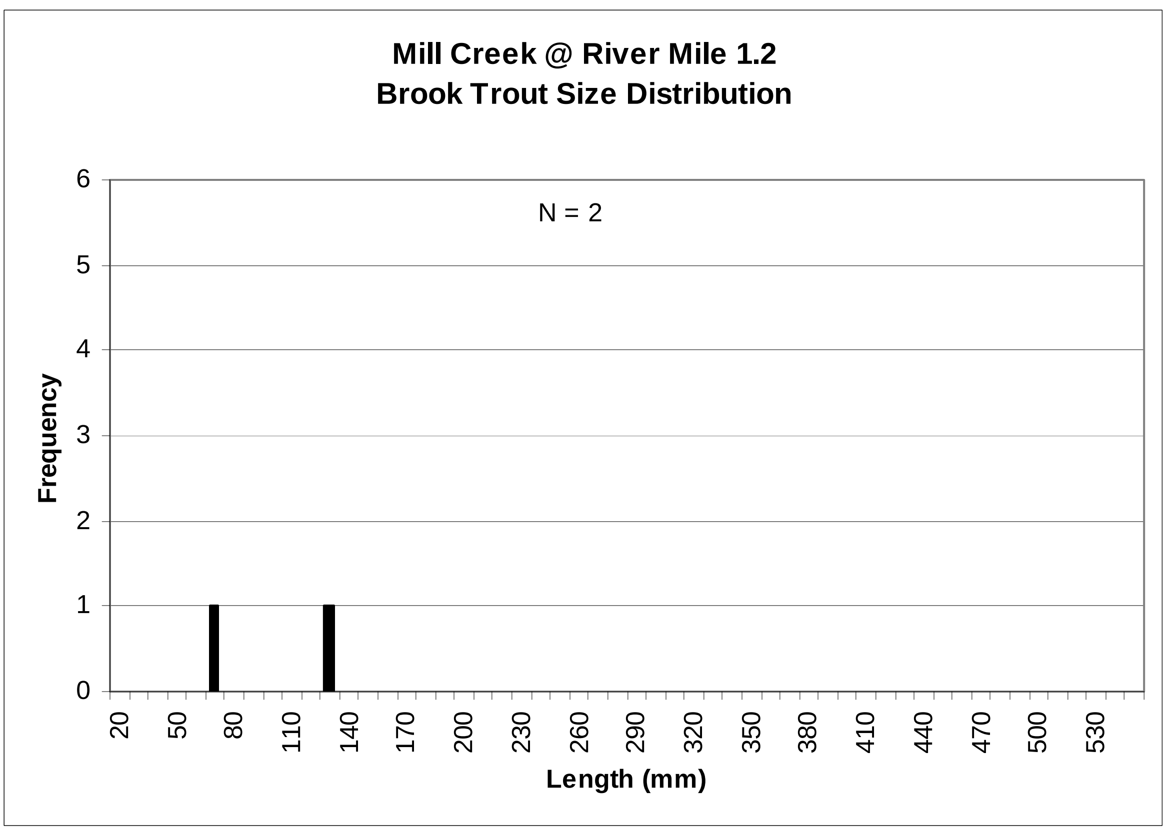
Warm Springs Creek

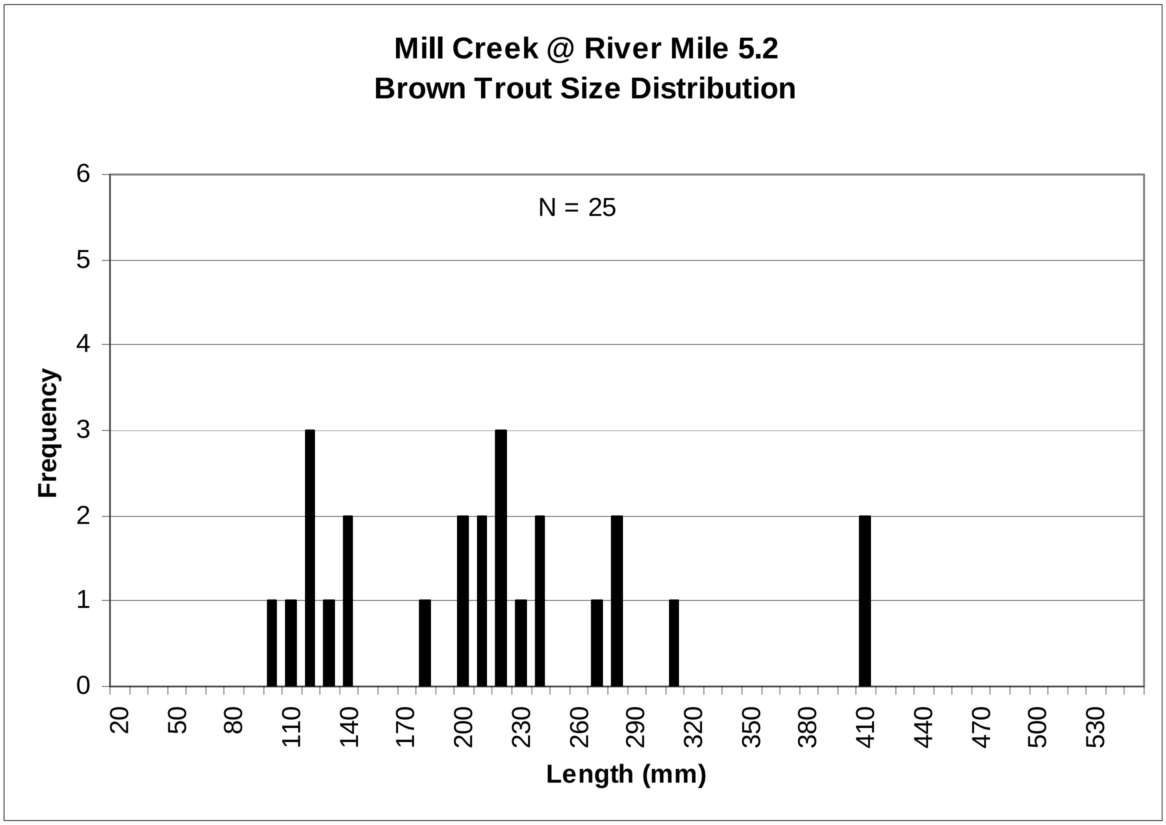


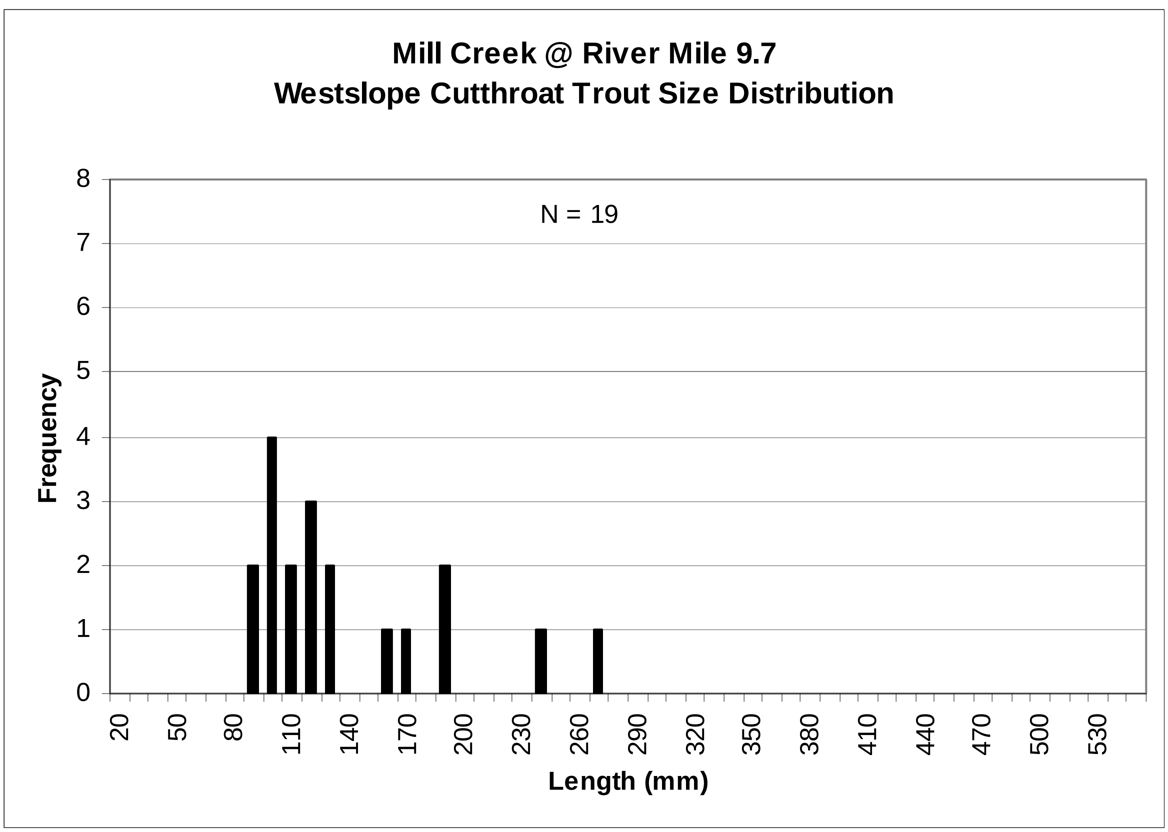
Mill Creek Drainage

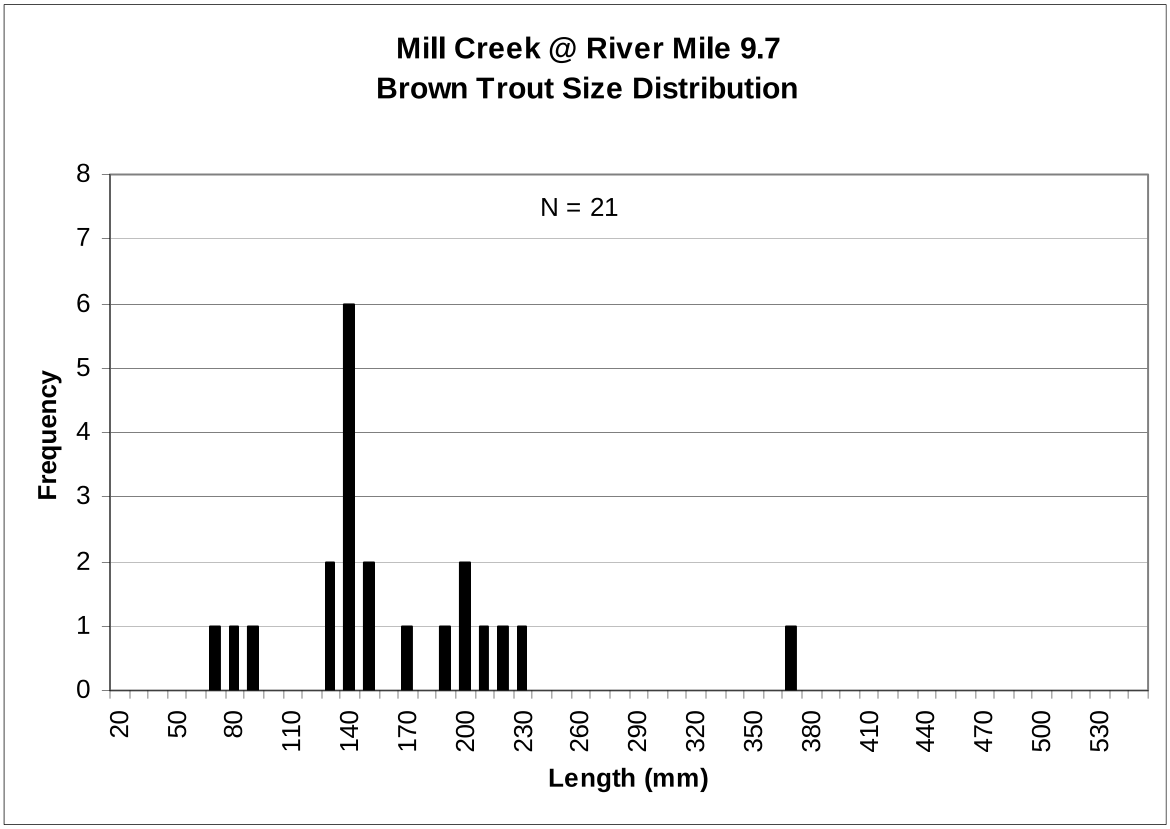
Mill Creek

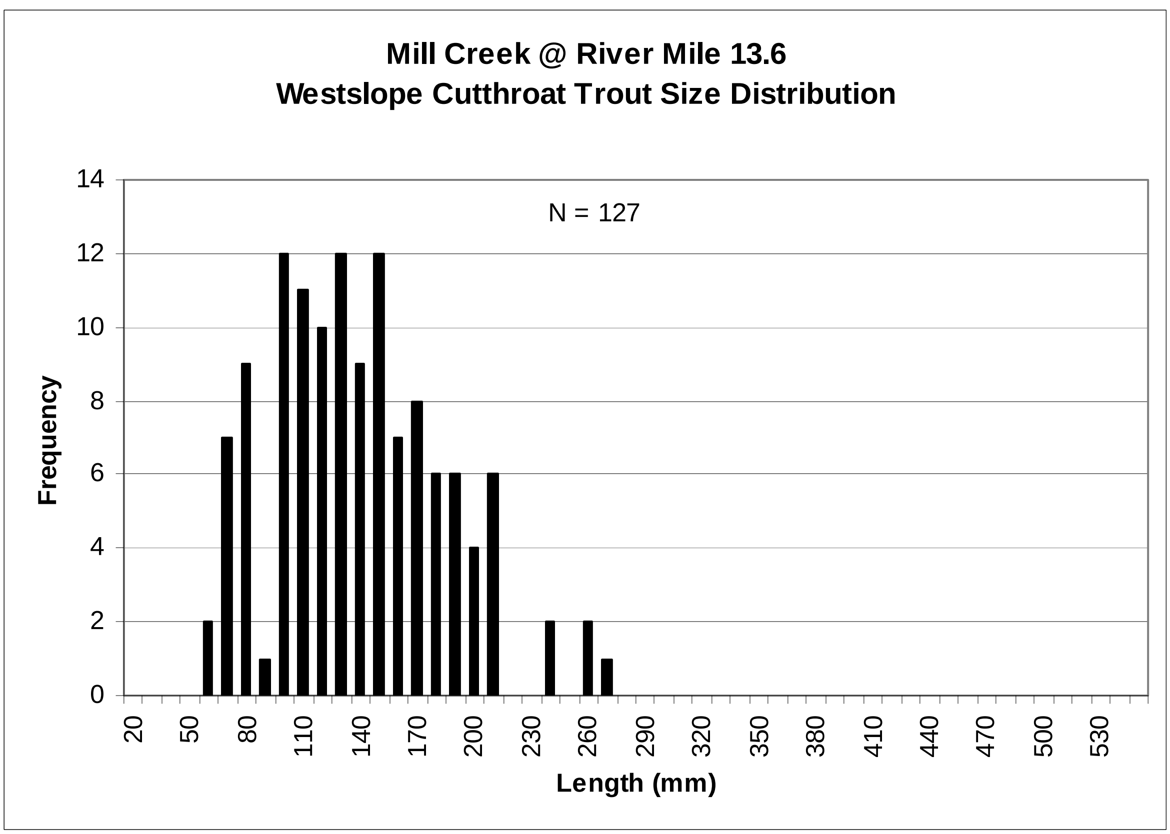





Mill Creek @ River Mile 5.2
Brown Trout Size Distribution
N = 25
Frequency
0
1
2
3
4
5
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

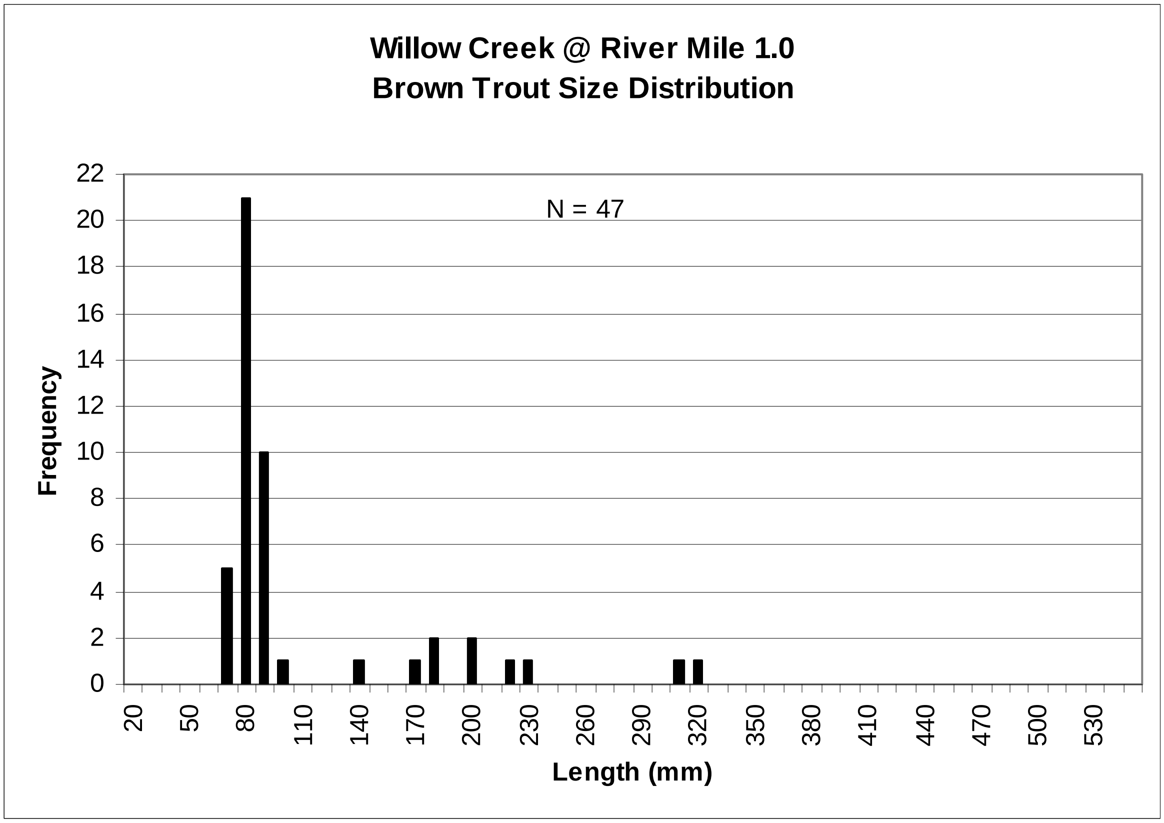

Mill Creek @ River Mile 9.7
Westslope Cutthroat Trout Size Distribution
N = 19
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

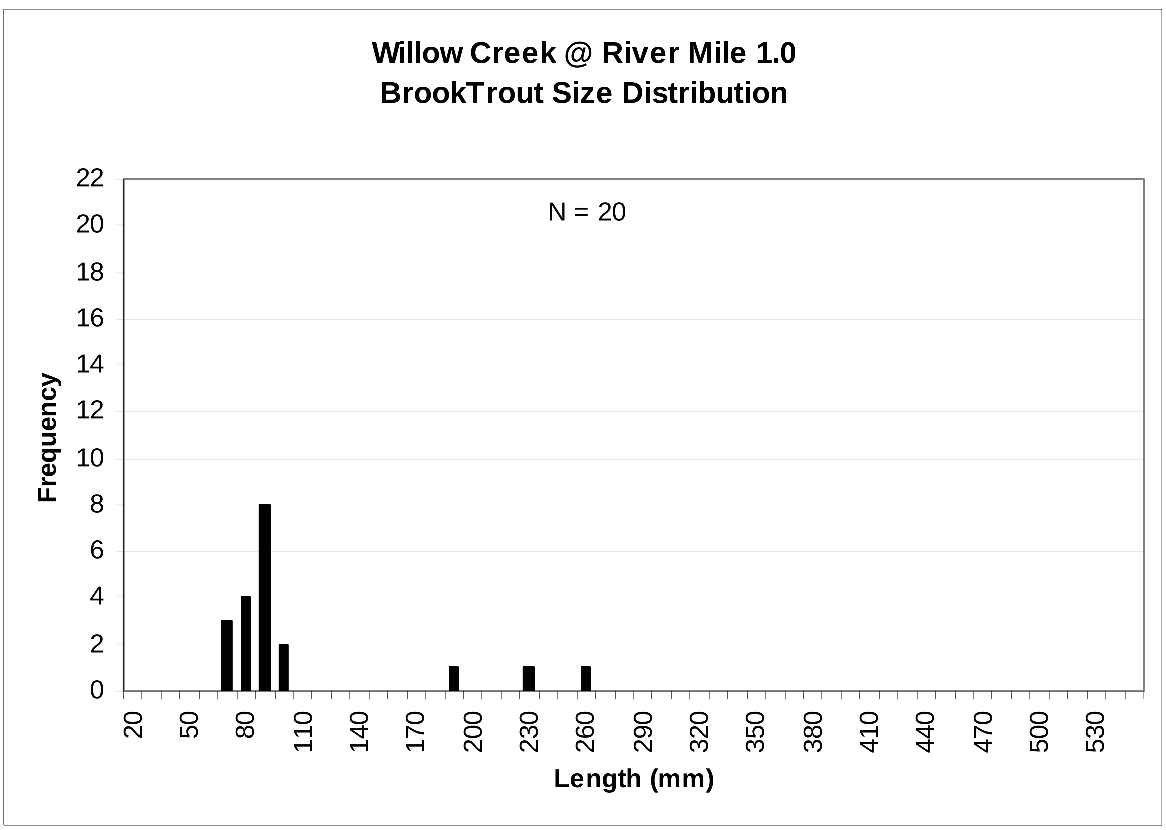

Mill Creek @ River Mile 9.7
Brown Trout Size Distribution
N = 21
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

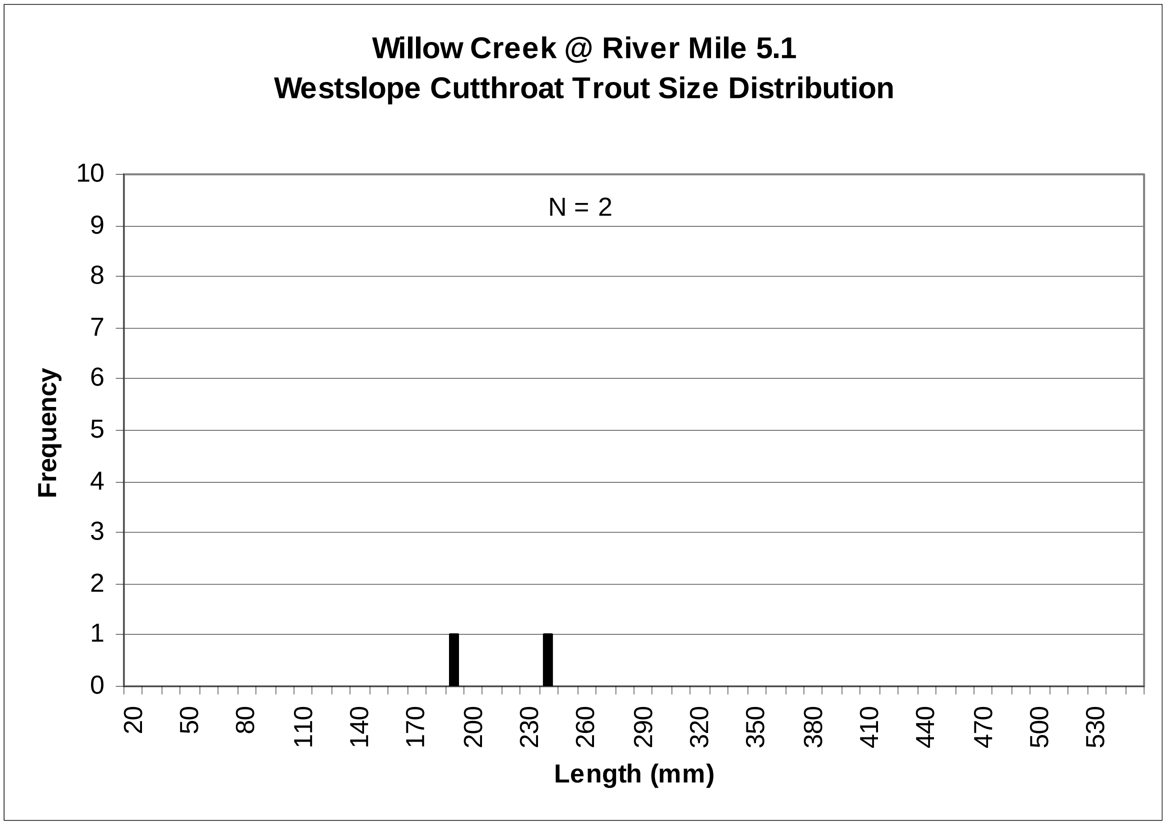

Mill Creek @ River Mile 13.6
Westslope Cutthroat Trout Size Distribution
N = 127
Frequency
0
2
4
6
8
10
12
14
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

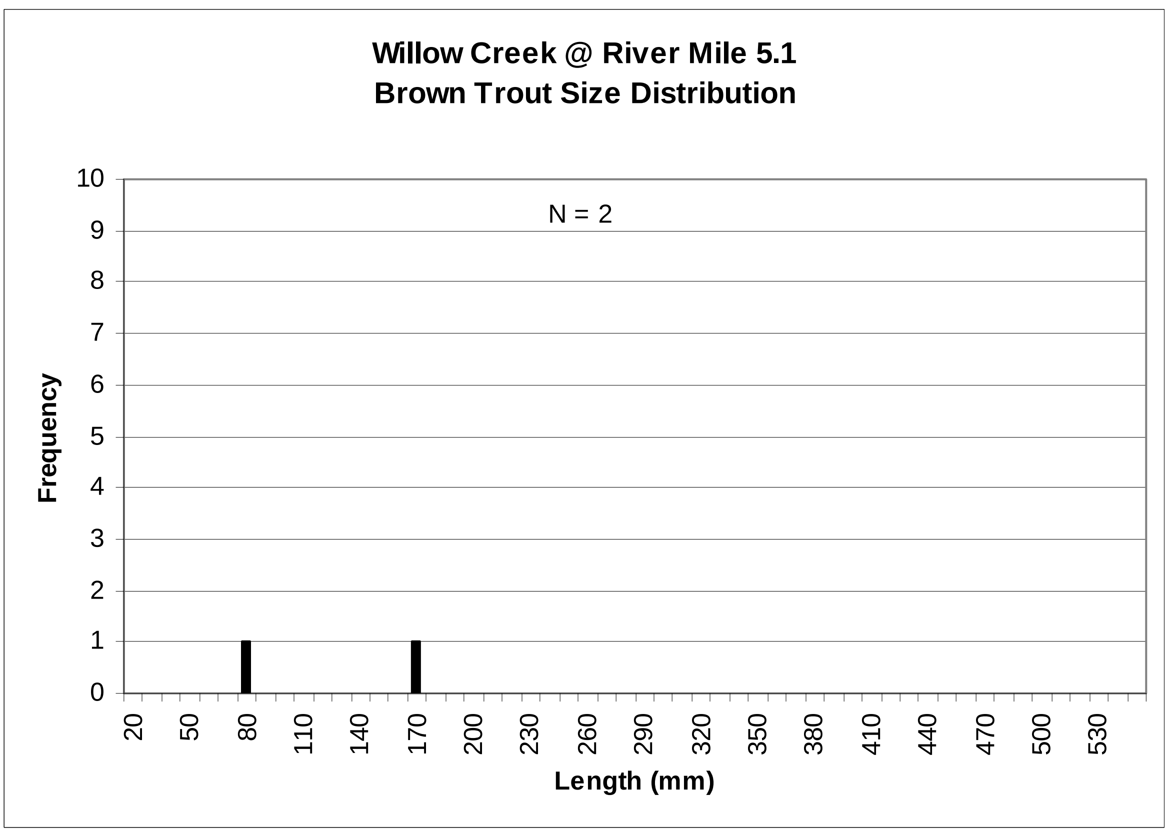
Willow Creek Drainage

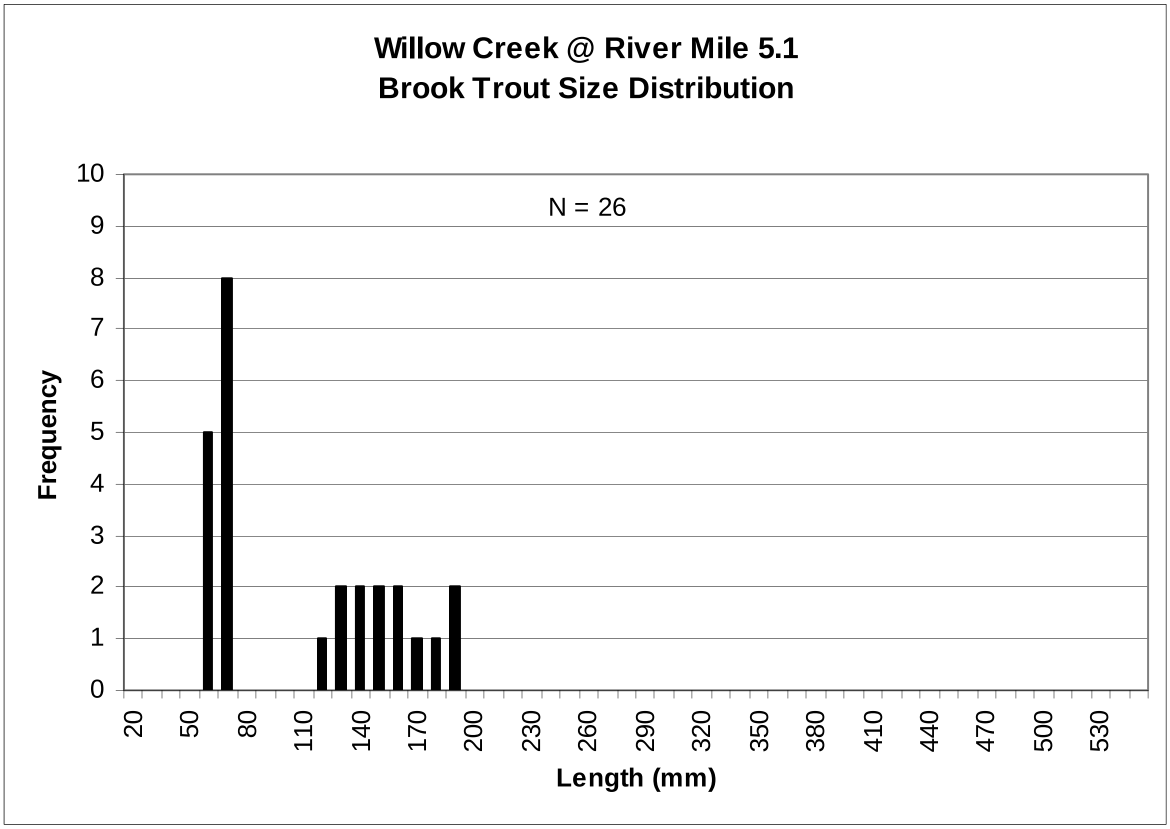
Willow Creek

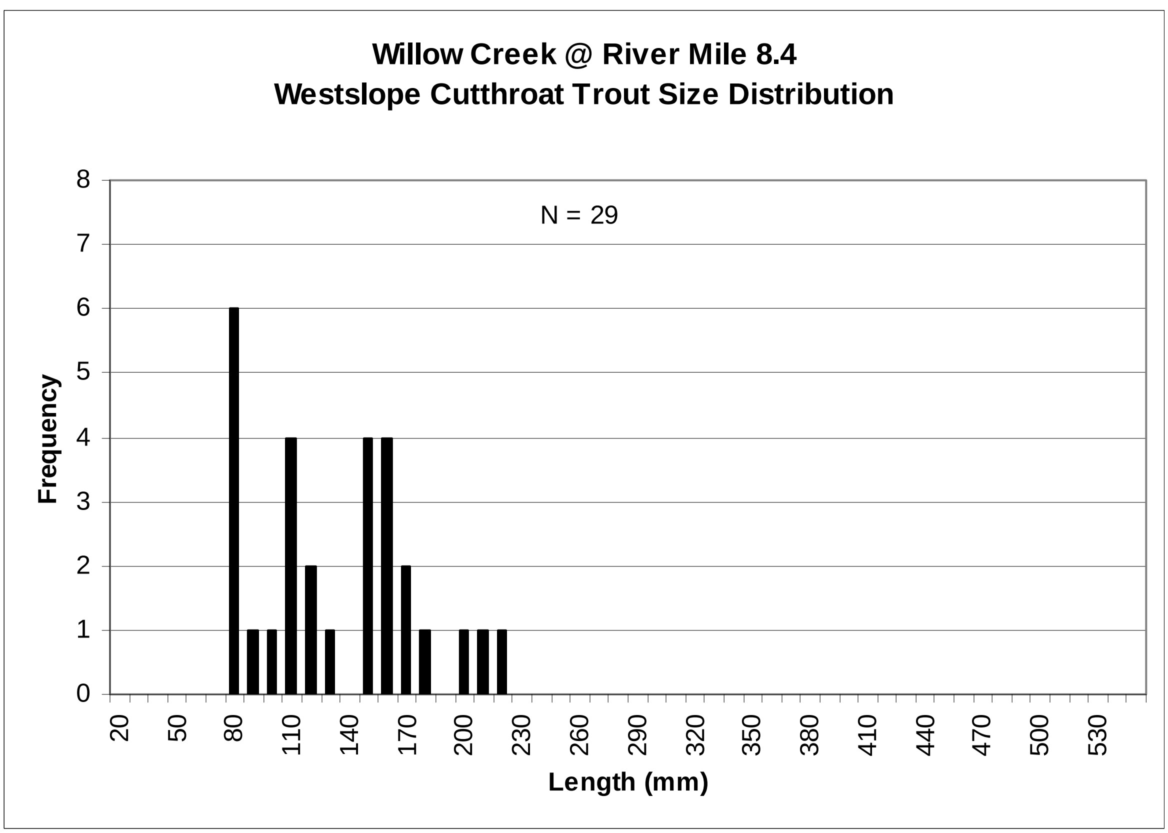


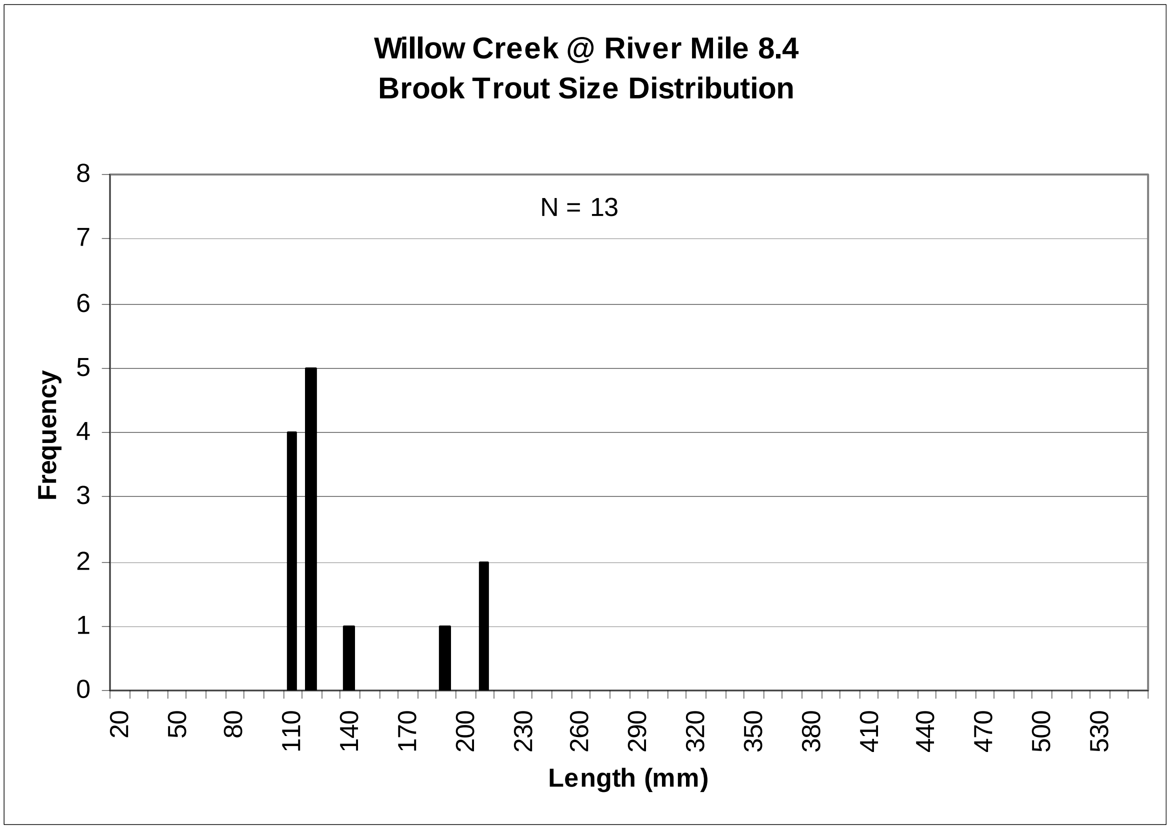



Willow Creek @ River Mile 5.1
Westslope Cutthroat Trout Size Distribution
N = 2
Frequency
0
1
2
3
4
5
6
7
8
9
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)


Willow Creek @ River Mile 5.1
Brown Trout Size Distribution
N = 2
Frequency
0
1
2
3
4
5
6
7
8
9
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

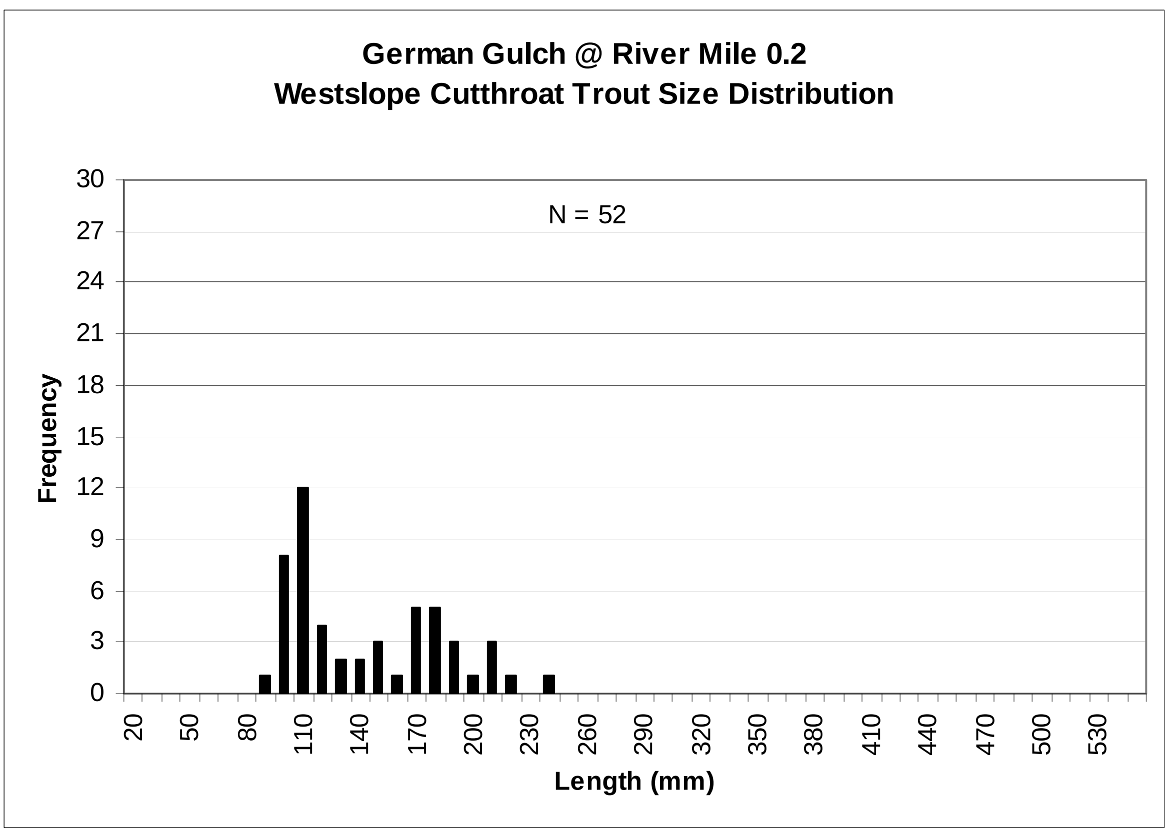

Willow Creek @ River Mile 5.1
Brook Trout Size Distribution
N = 26
Frequency
Length (mm)
0
1
2
3
4
5
6
7
8
9
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530

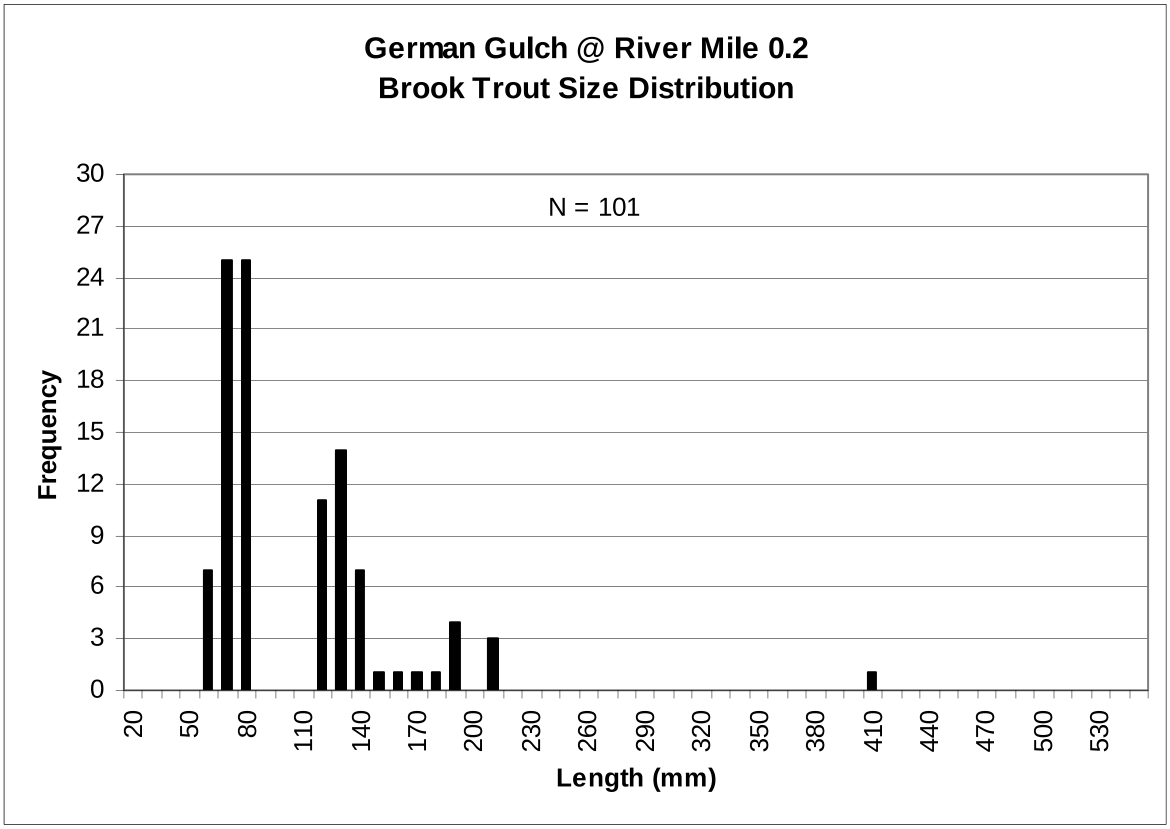

Willow Creek @ River Mile 8.4
Westslope Cutthroat Trout Size Distribution
N = 29
Frequency
Length (mm)
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530

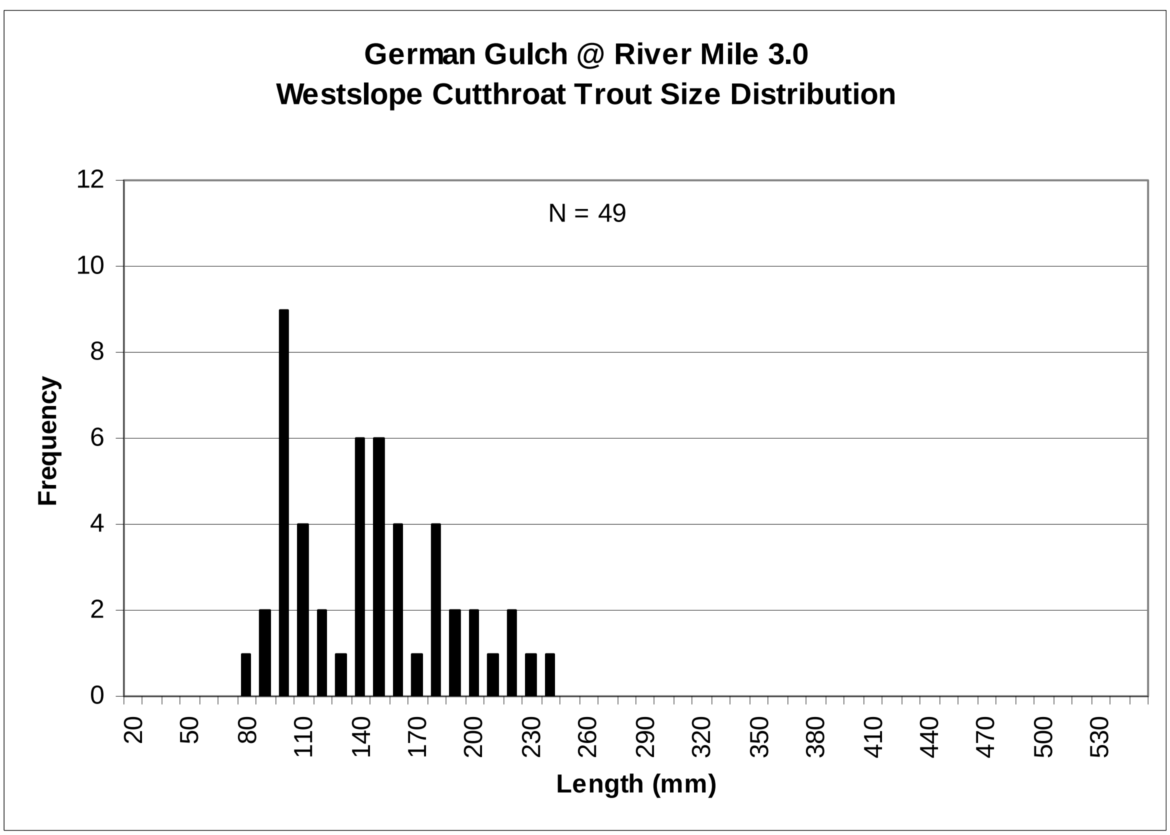


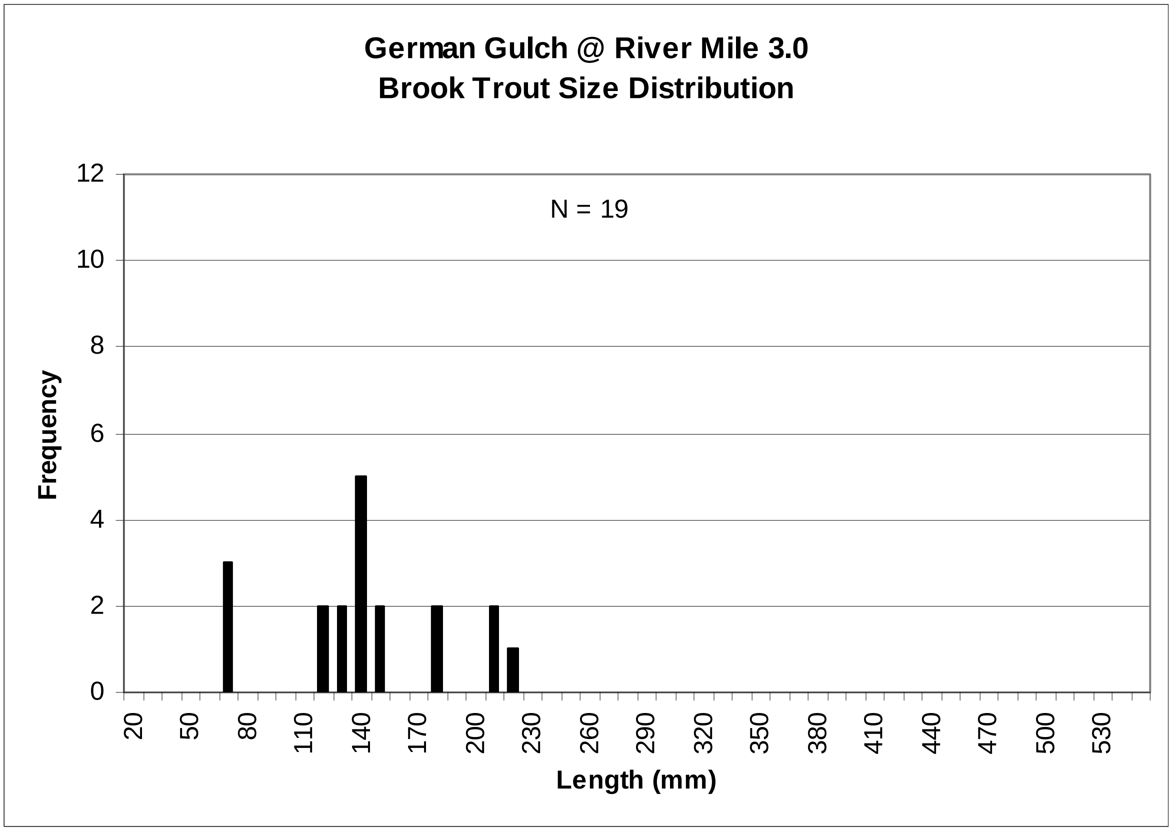
Silver Bow Creek Drainage

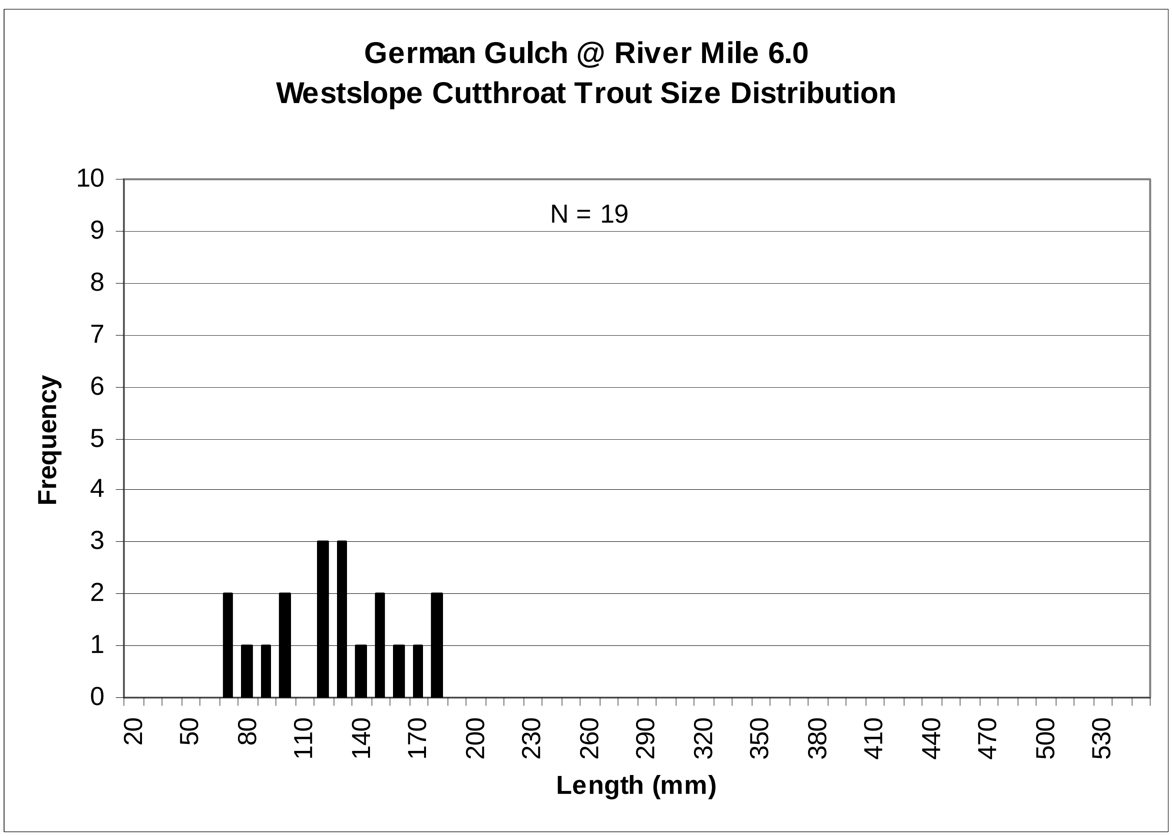
German Gulch



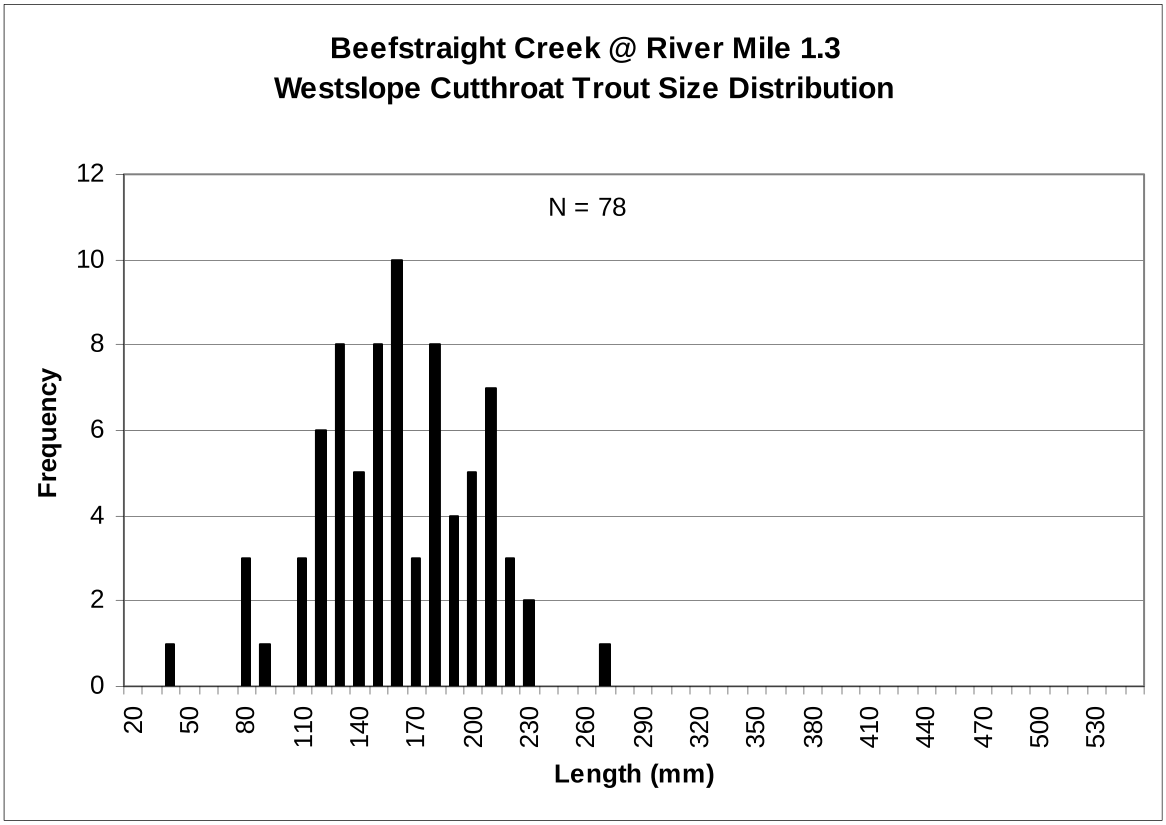

German Gulch @ River Mile 0.2
Brook Trout Size Distribution
N = 101
Frequency
0
3
6
9
12
15
18
21
24
27
30
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

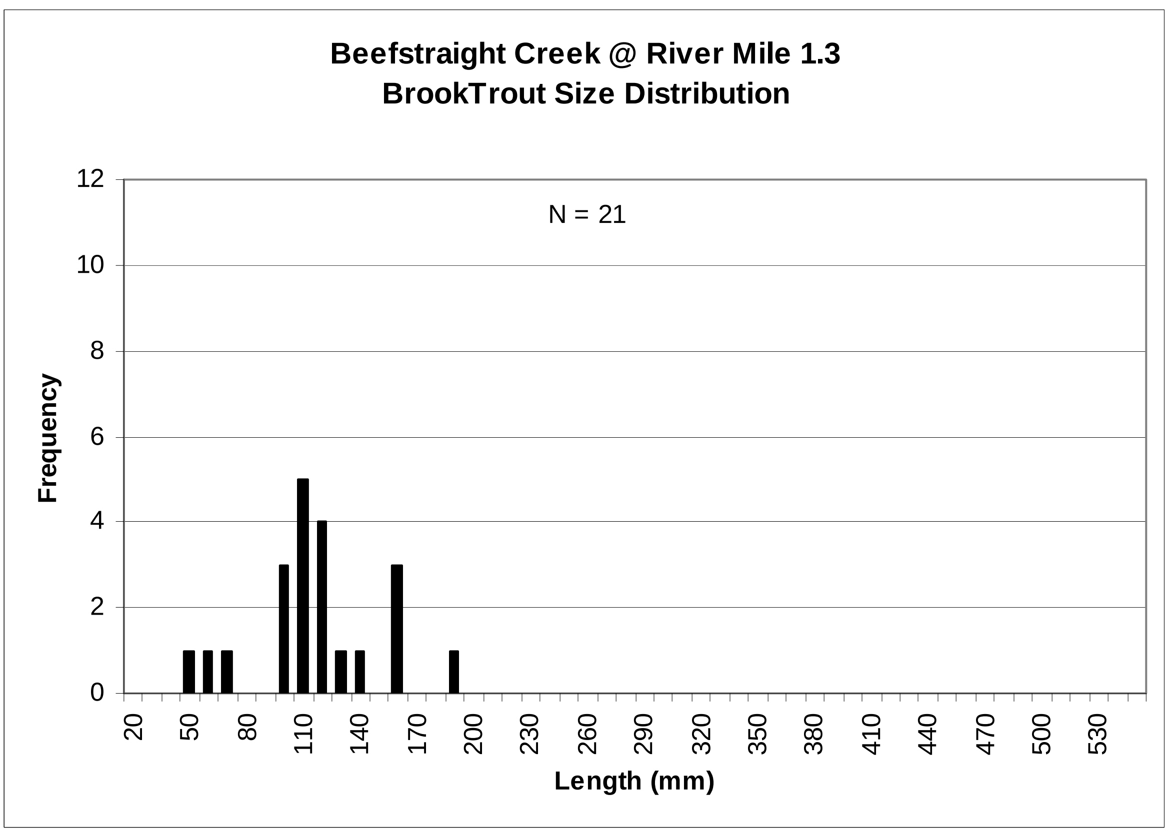

German Gulch @ River Mile 3.0
Westslope Cutthroat Trout Size Distribution
N = 49
Frequency
0
2
4
6
8
10
12
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

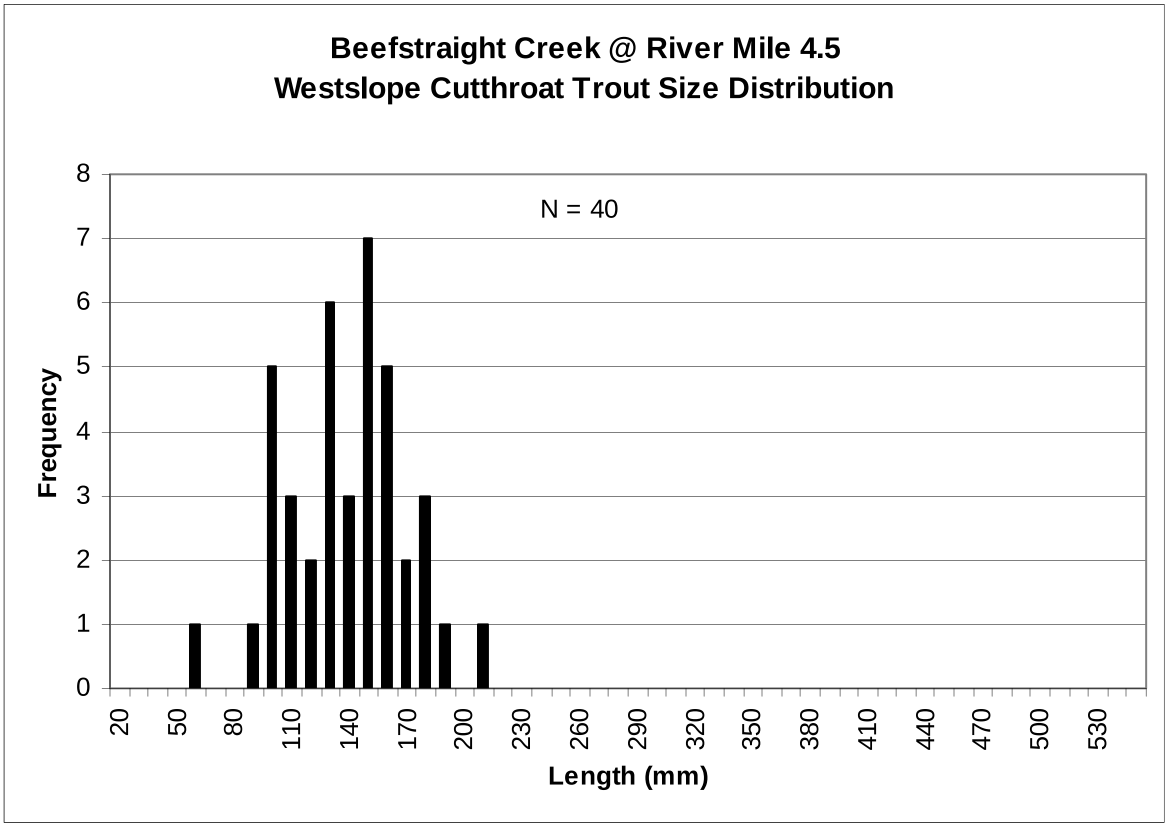

German Gulch @ River Mile 3.0
Brook Trout Size Distribution
N = 19
Frequency
0
2
4
6
8
10
12
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

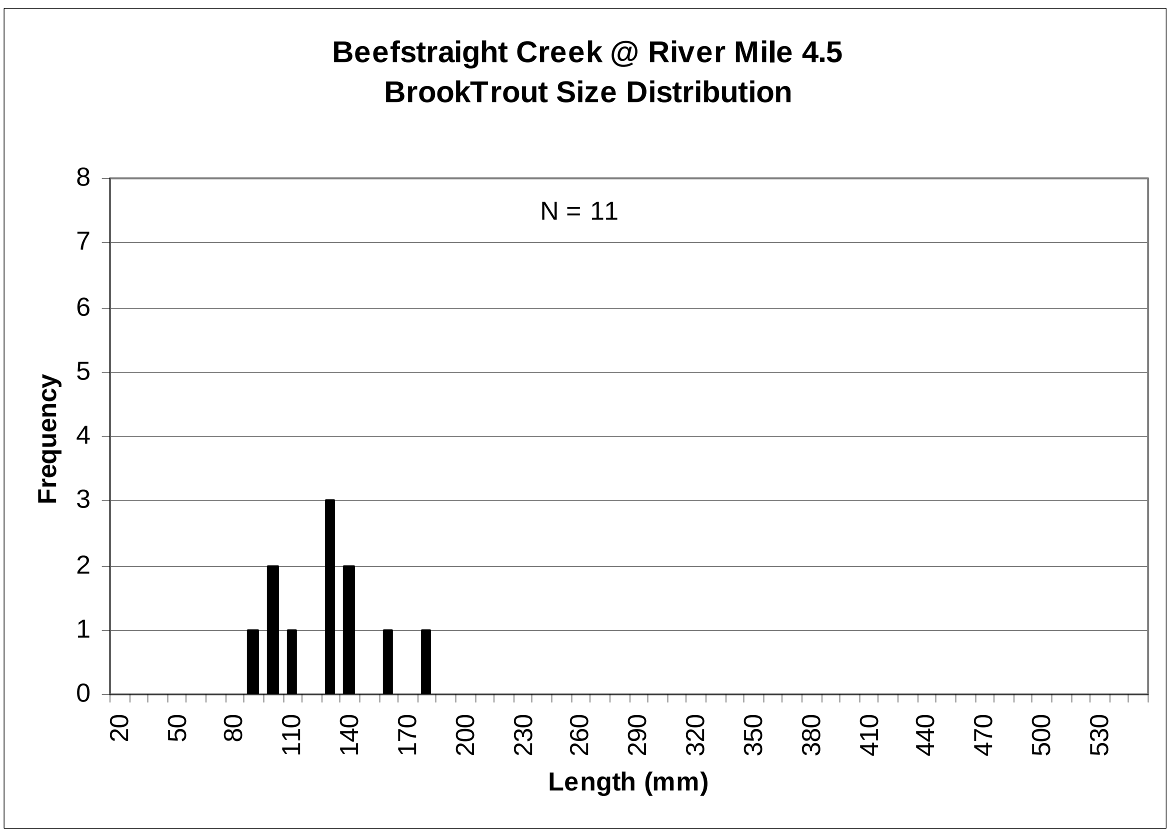

German Gulch @ River Mile 6.0
Westslope Cutthroat Trout Size Distribution
N = 19
Frequency
0
1
2
3
4
5
6
7
8
9
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

Beefstraight Creek

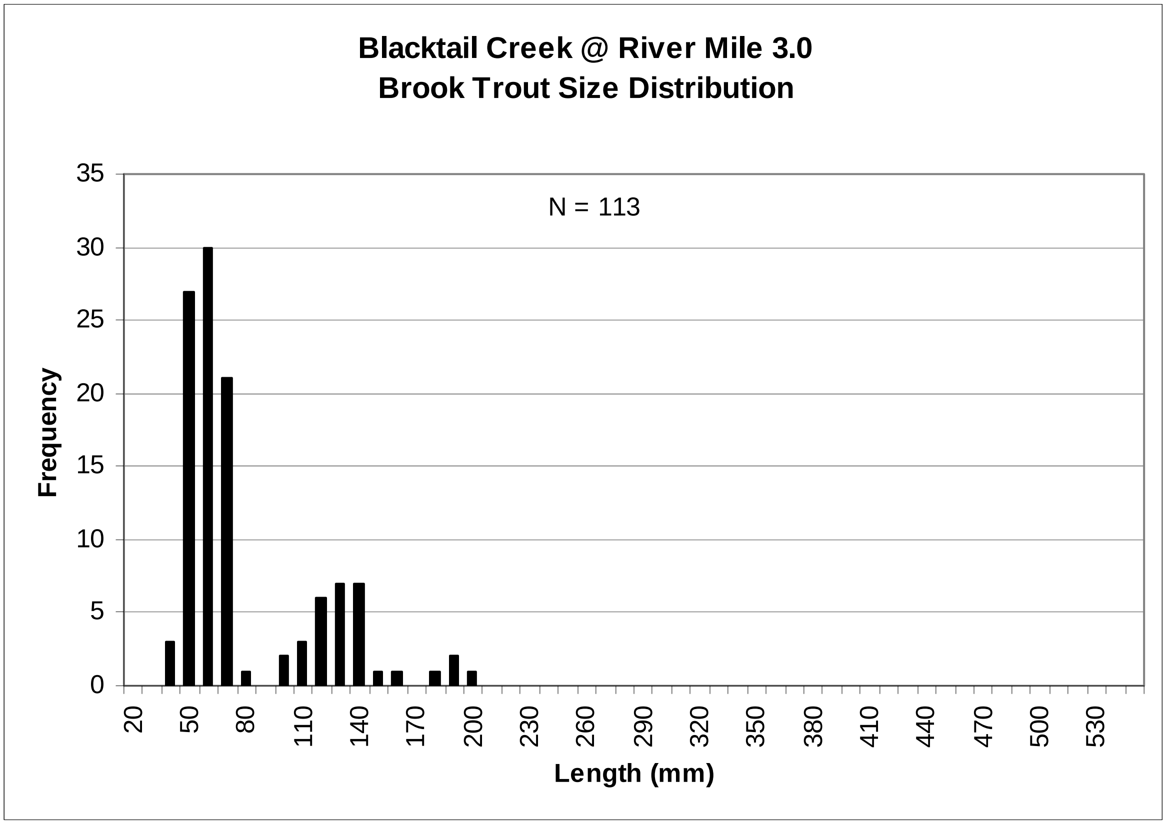


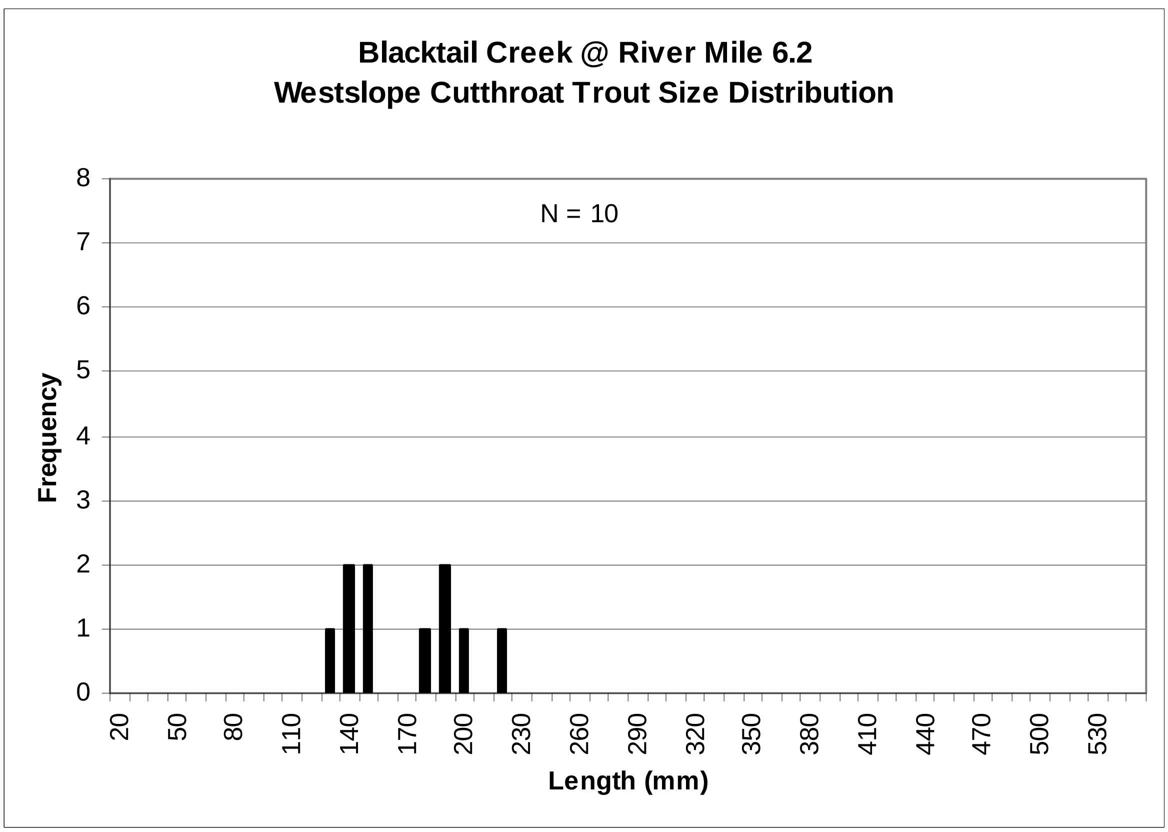


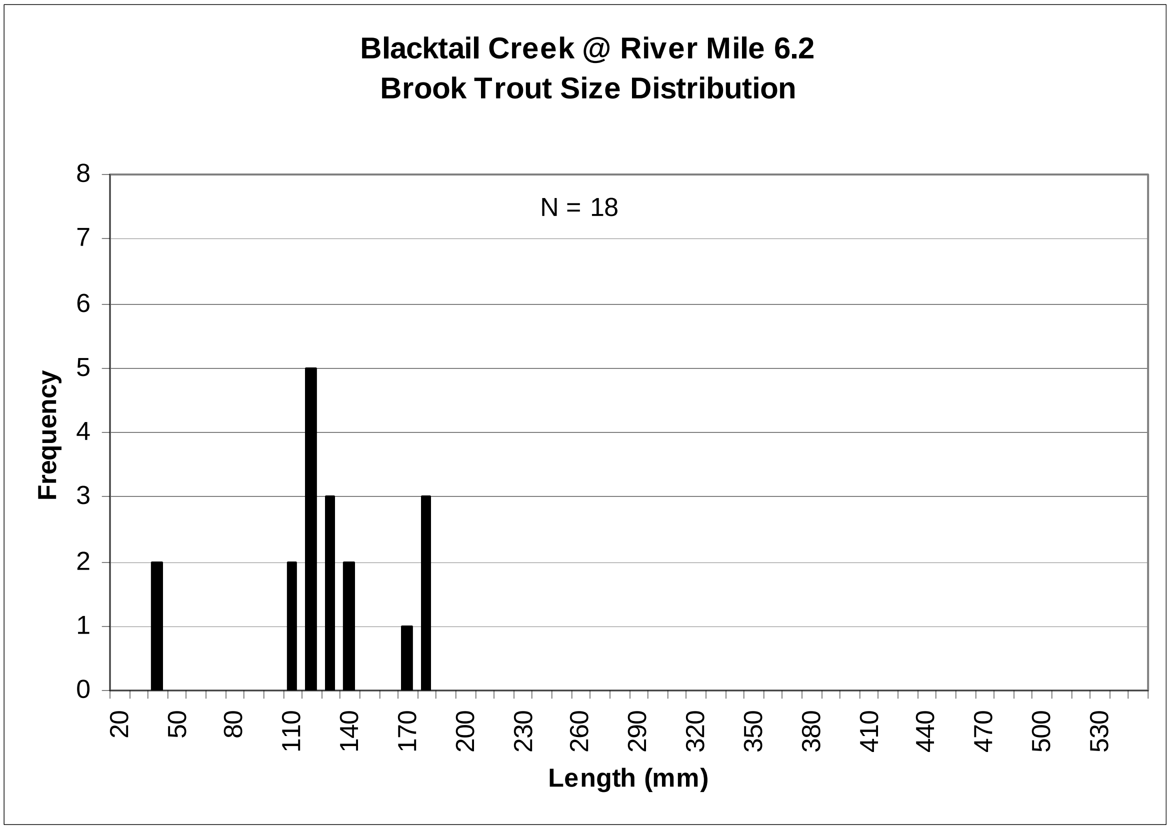

Beefstraight Creek @ River Mile 4.5
Westslope Cutthroat Trout Size Distribution
N = 40
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

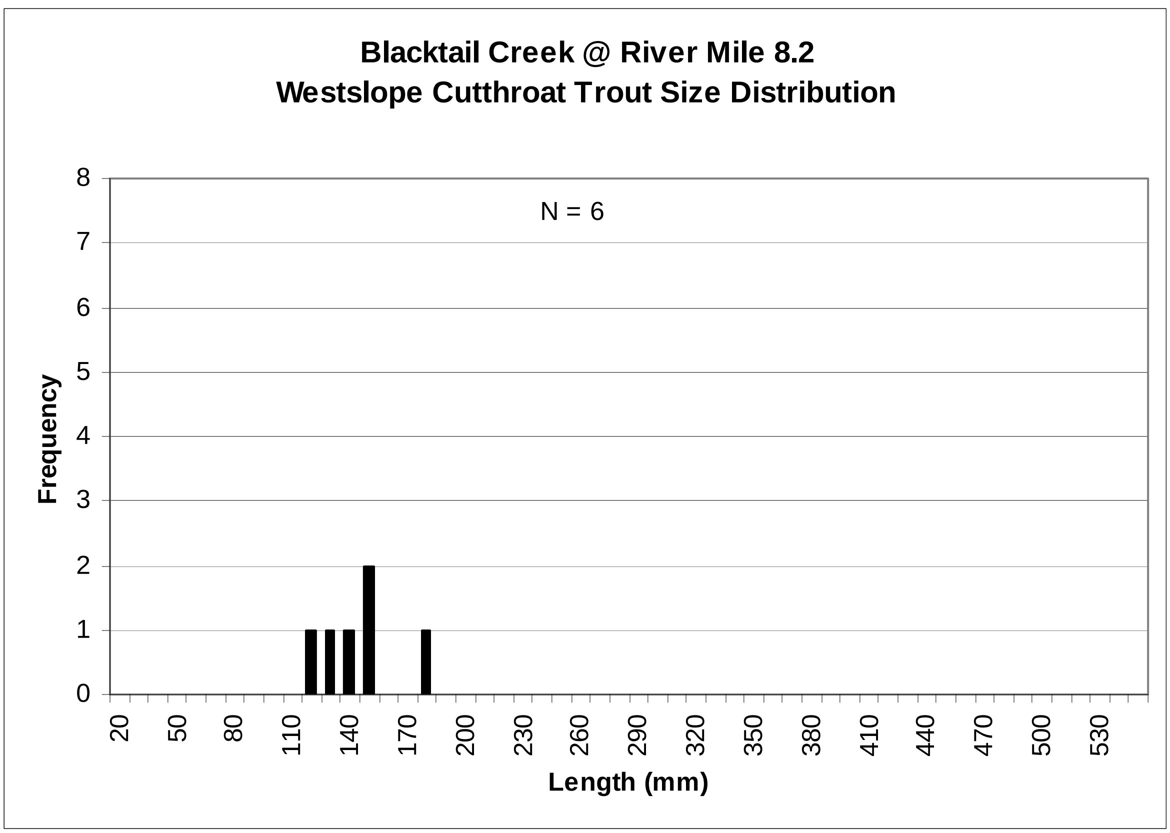

Beefstraight Creek @ River Mile 4.5
BrookTrout Size Distribution
N = 11
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

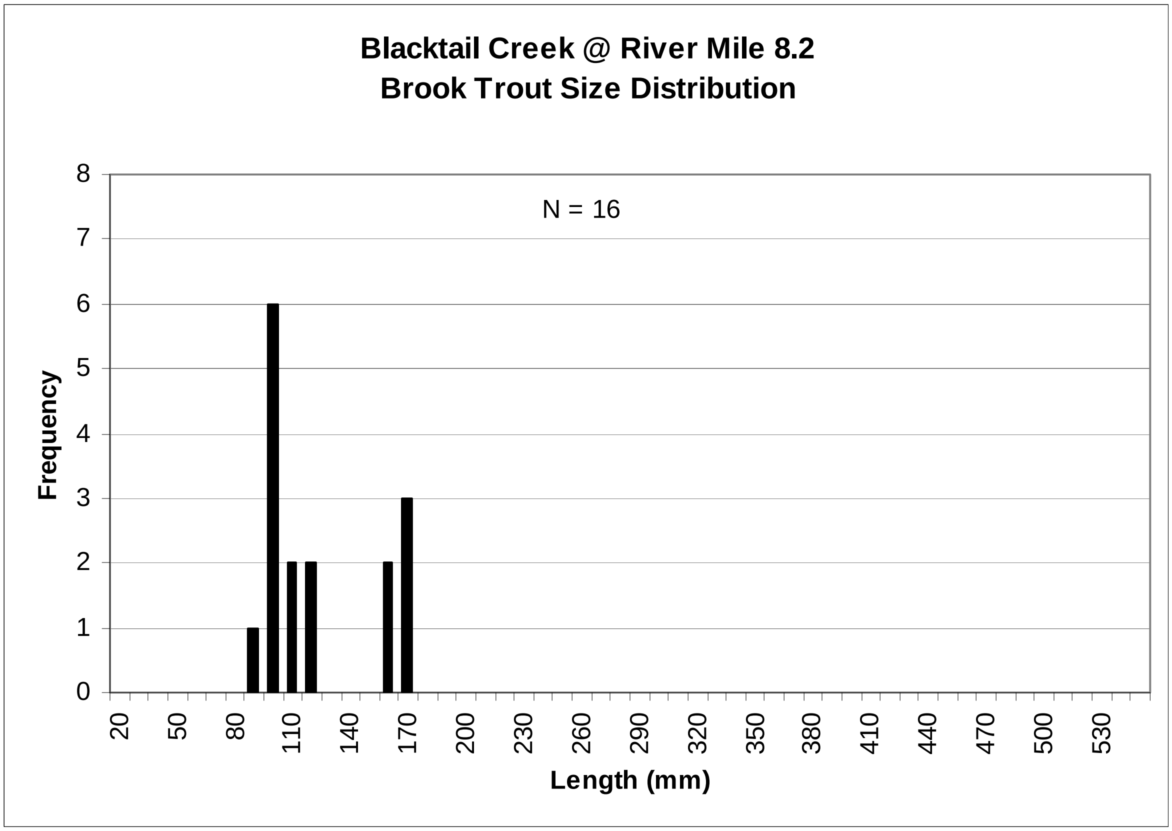
Blacktail Creek

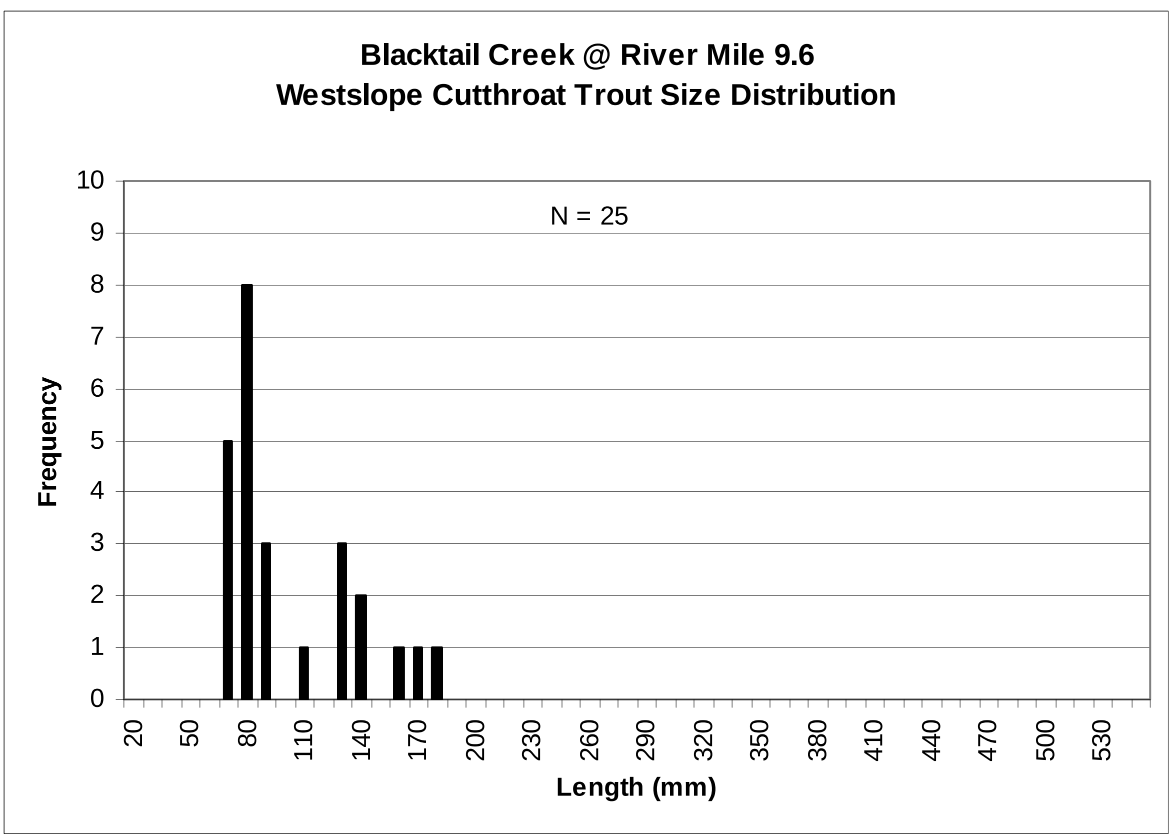


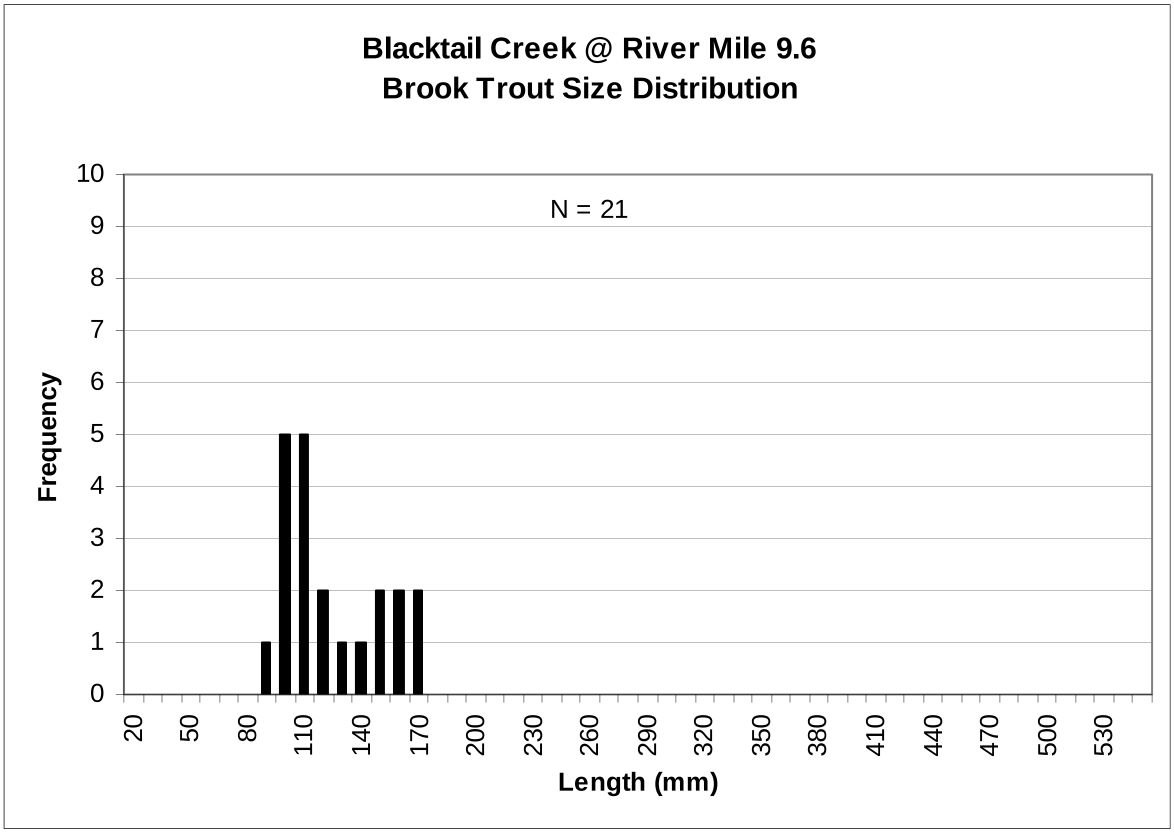


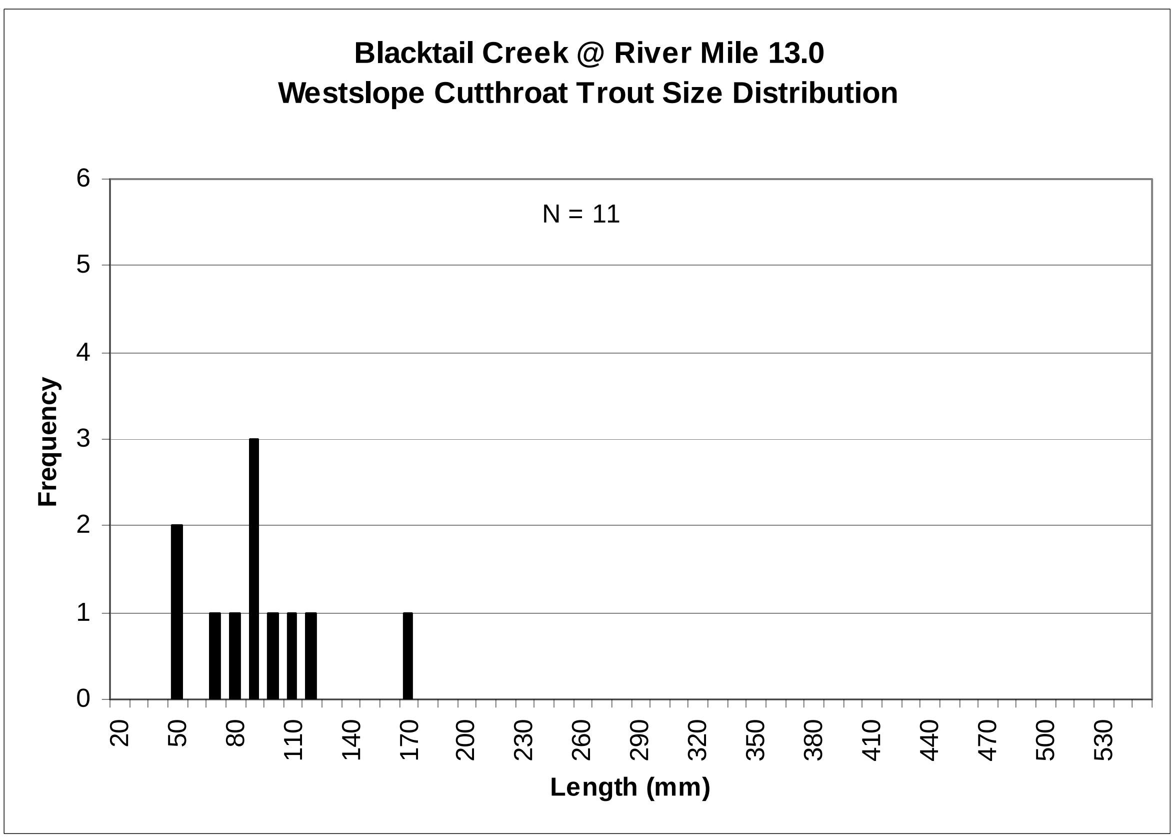

Blacktail Creek @ River Mile 6.2
Brook Trout Size Distribution
N = 18
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)


Blacktail Creek @ River Mile 8.2
Westslope Cutthroat Trout Size Distribution
N = 6
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)


Blacktail Creek @ River Mile 8.2
Brook Trout Size Distribution
N = 16
Frequency
0
1
2
3
4
5
6
7
8
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)


Blacktail Creek @ River Mile 9.6
Westslope Cutthroat Trout Size Distribution
N = 25
Frequency
0
1
2
3
4
5
6
7
8
9
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530
Length (mm)

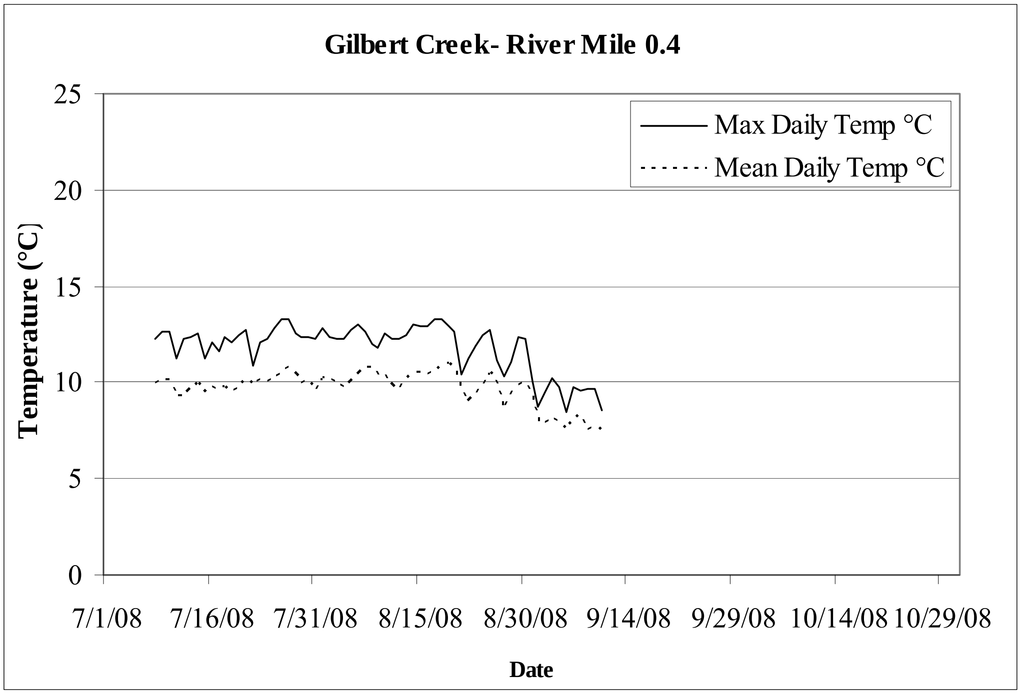

Blacktail Creek @ River Mile 9.6
Brook Trout Size Distribution
N = 21
Frequency
Length (mm)
0
1
2
3
4
5
6
7
8
9
10
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530


Blacktail Creek @ River Mile 13.0
Westslope Cutthroat Trout Size Distribution
N = 11
Frequency
Length (mm)
0
1
2
3
4
5
6
20
50
80
110
140
170
200
230
260
290
320
350
380
410
440
470
500
530

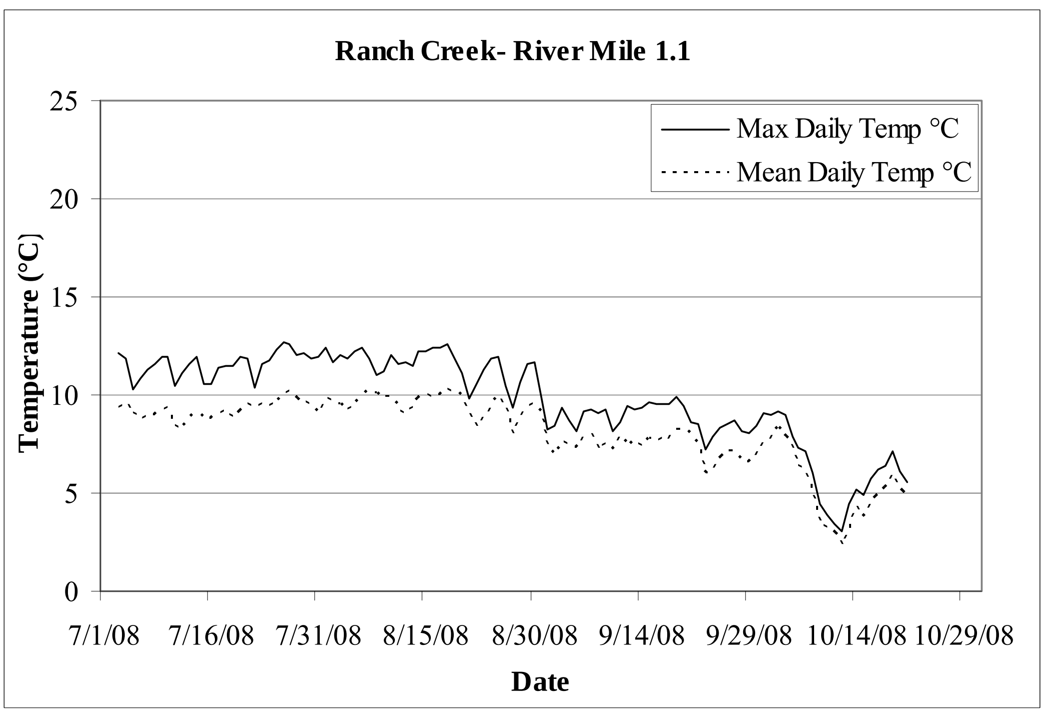
Appendix B

Rock Creek Drainage Drainage

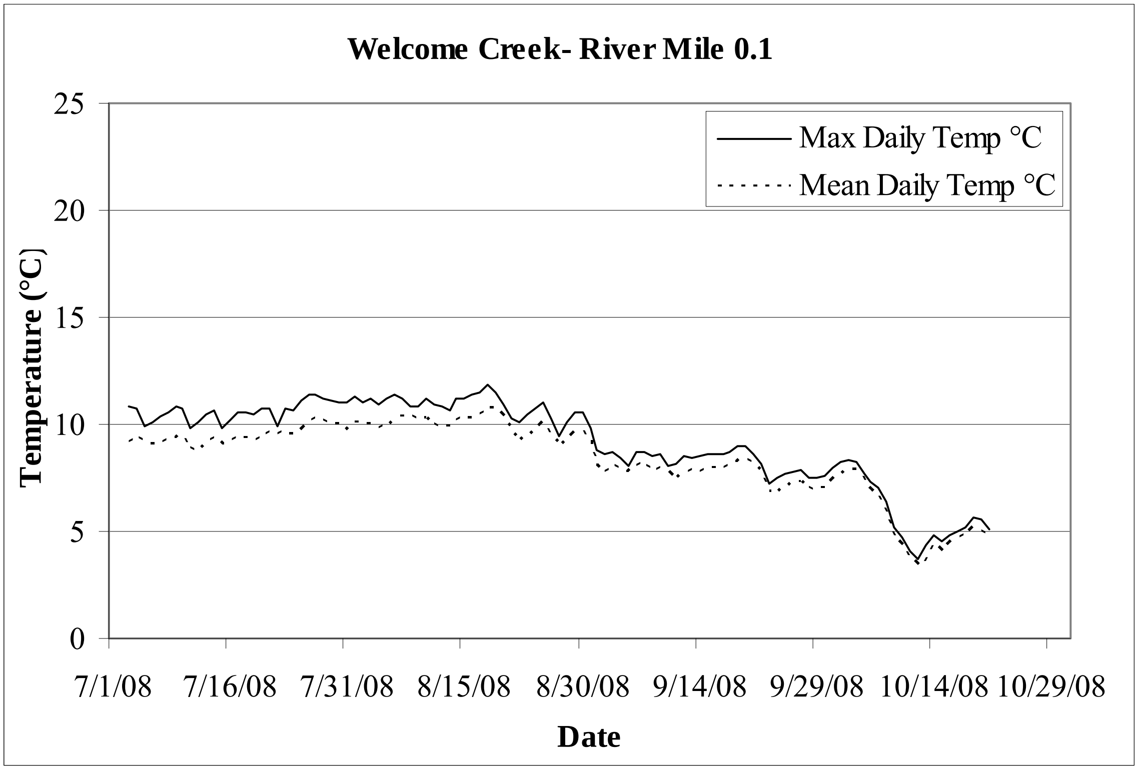
Gilbert Creek



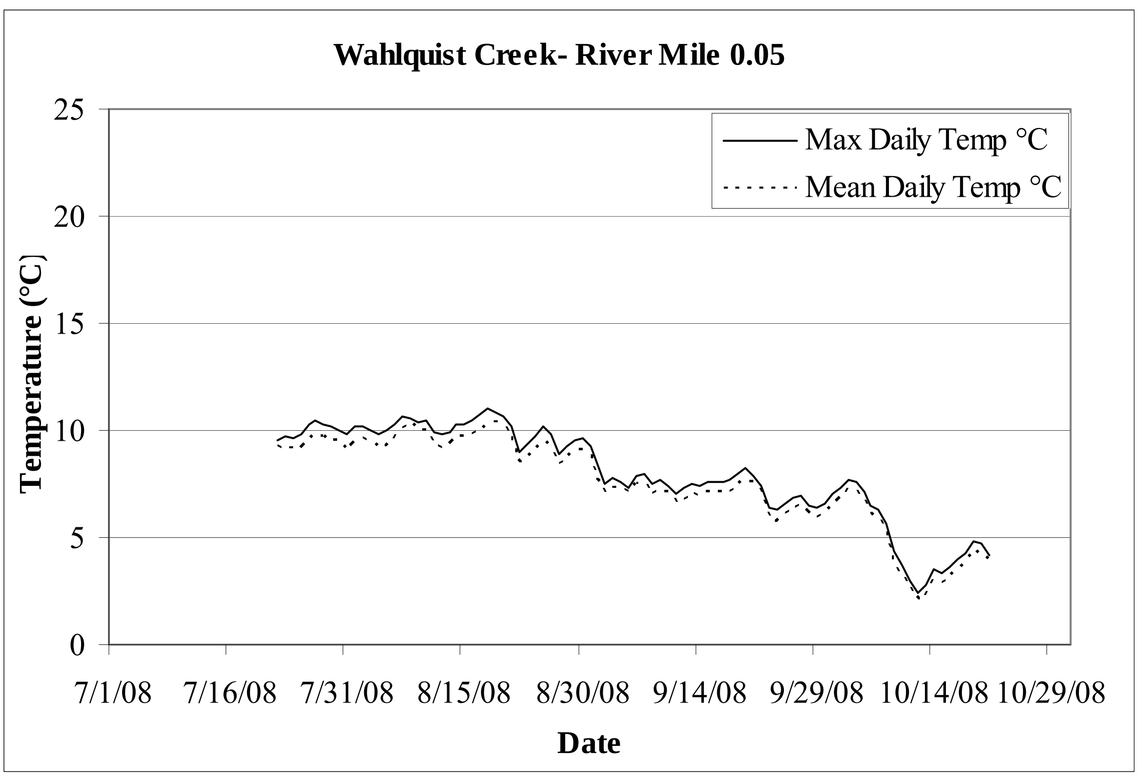
Ranch Creek



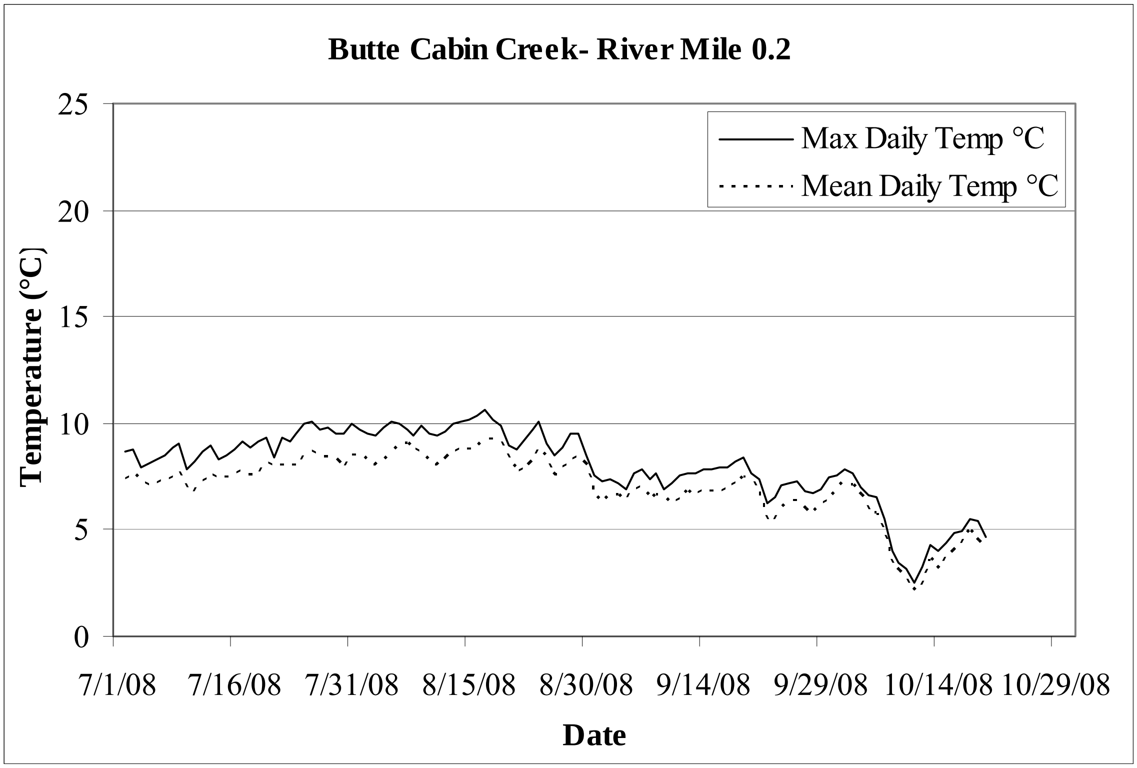
Welcome Creek



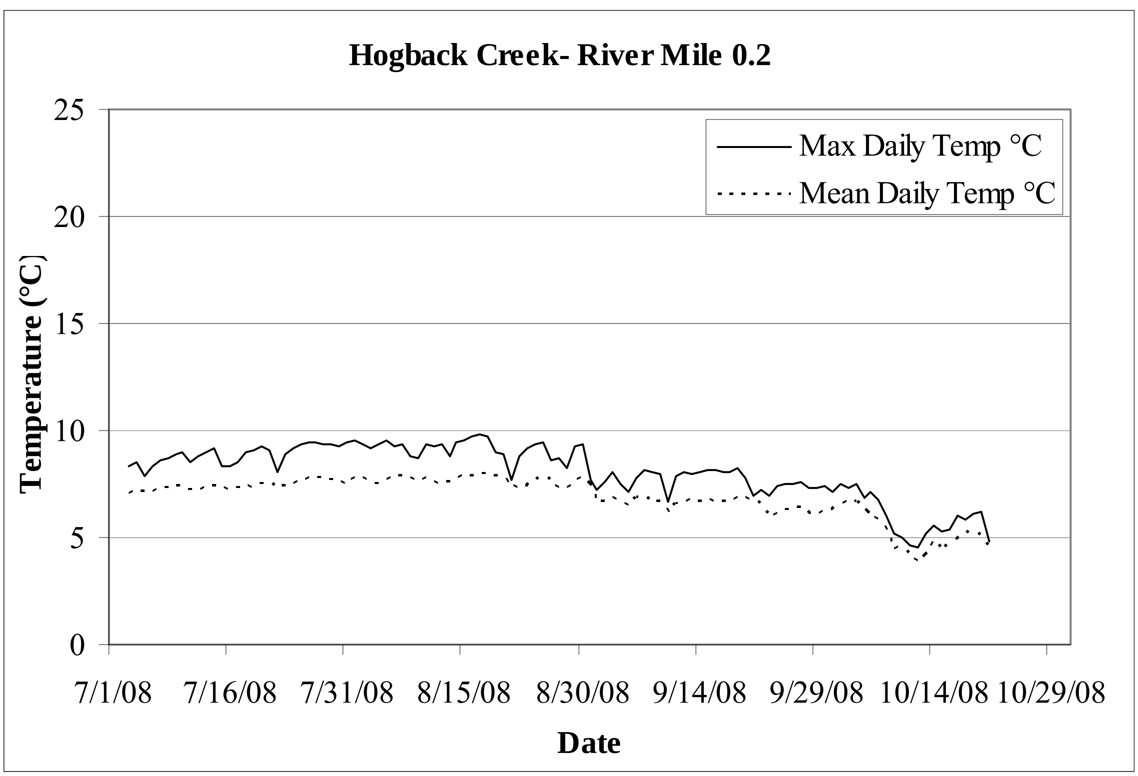
Wahlquist Creek



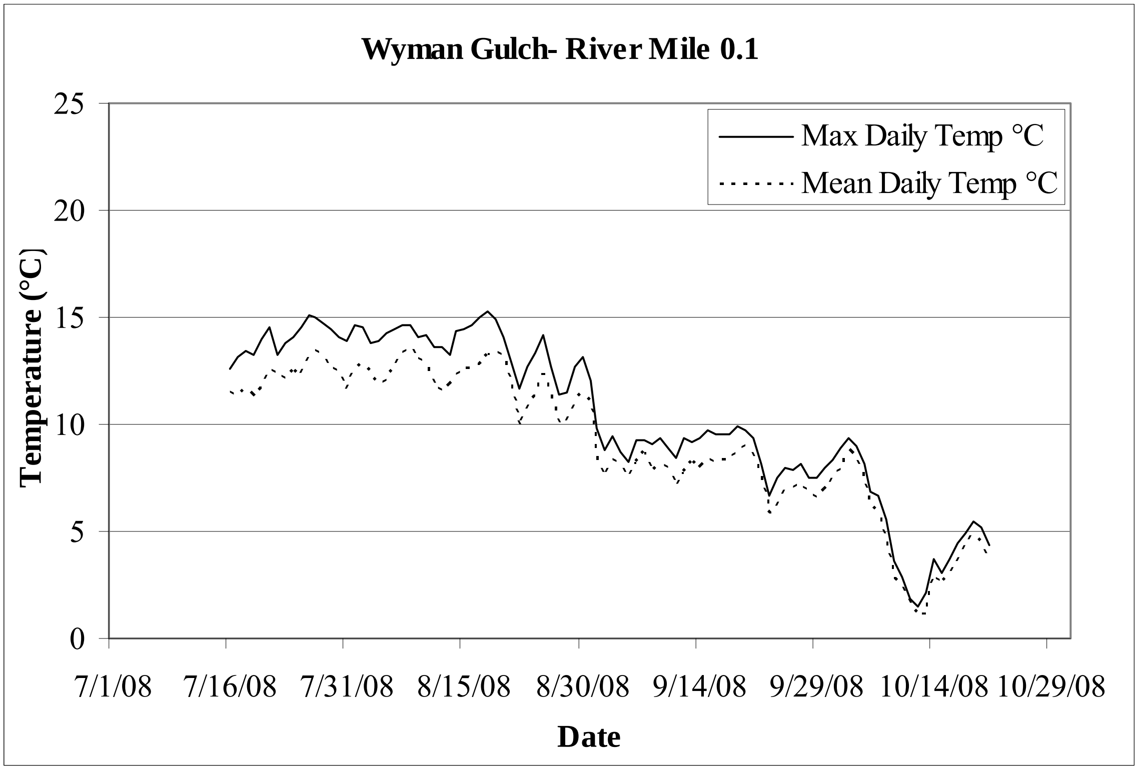
Butte Cabin Creek



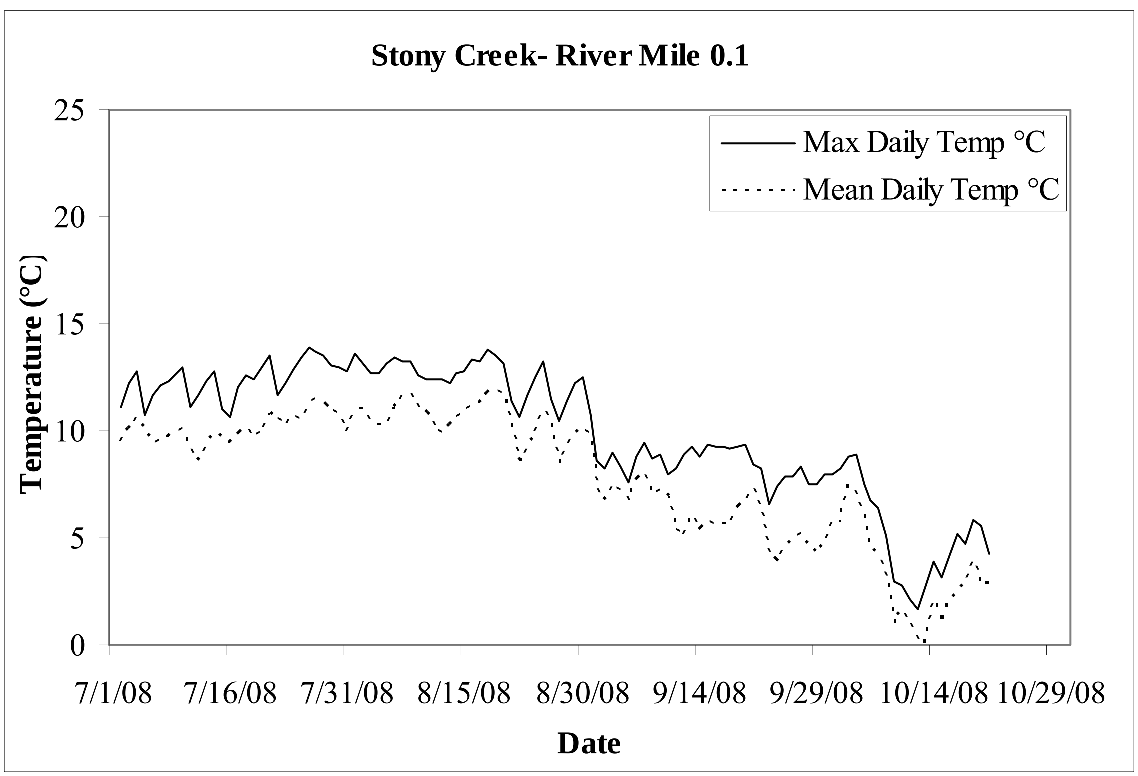
Hogback Creek



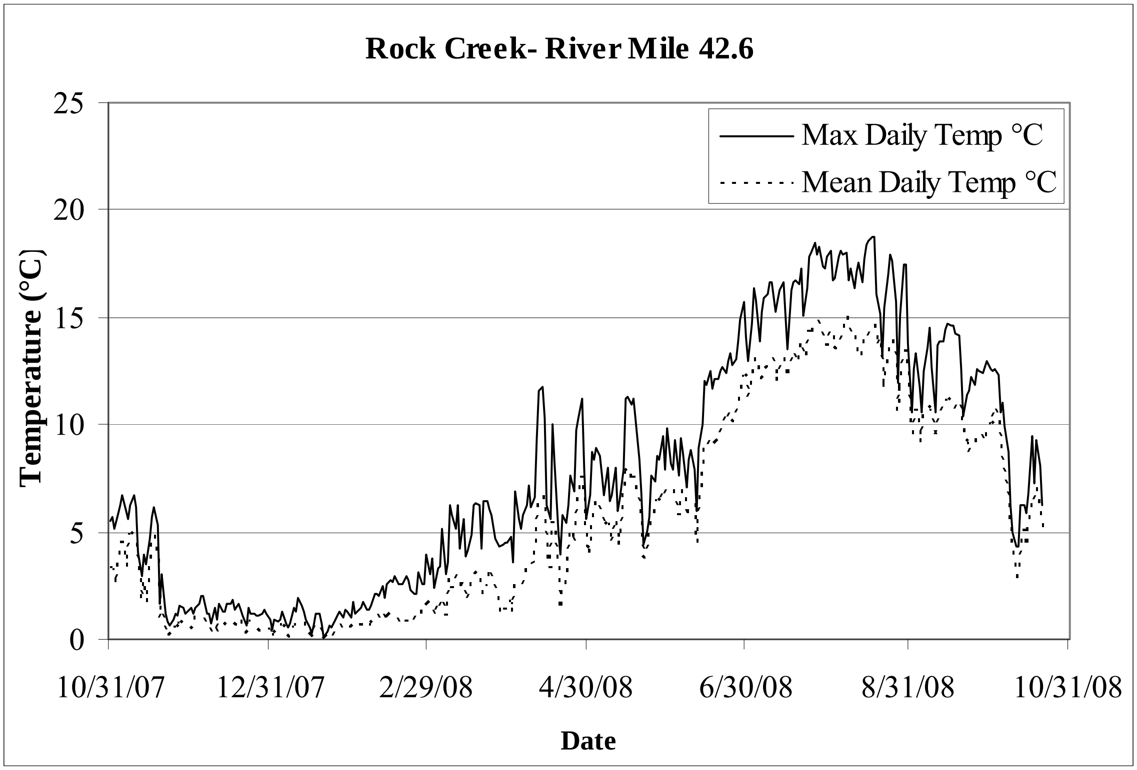
Wyman Gulch



Stony Creek

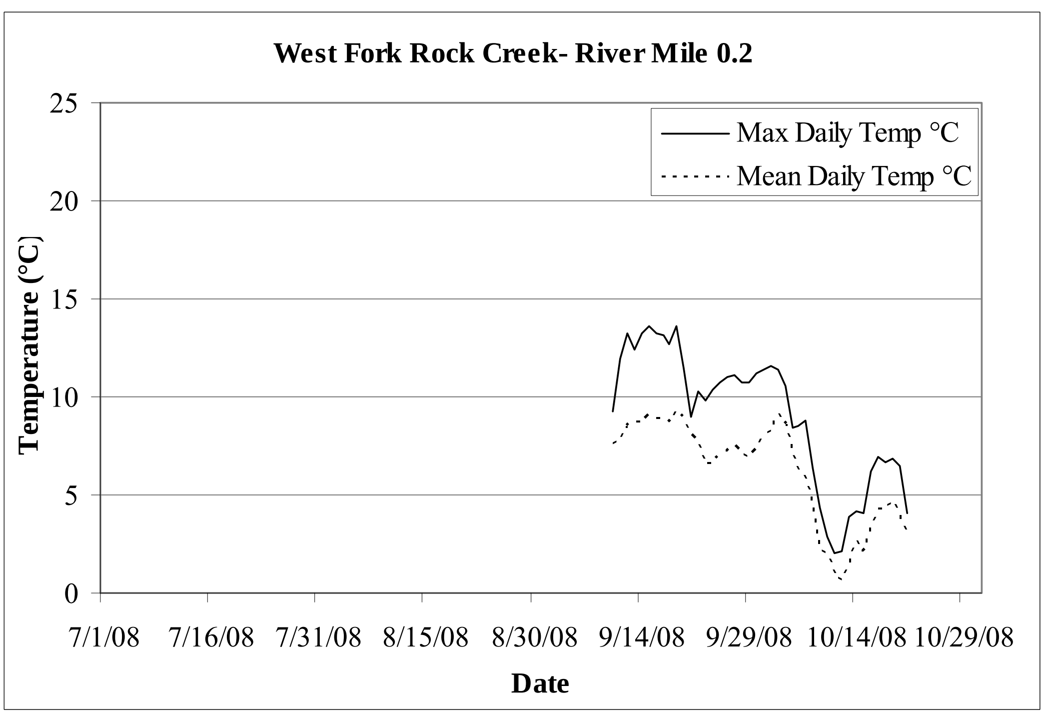


Rock Creek



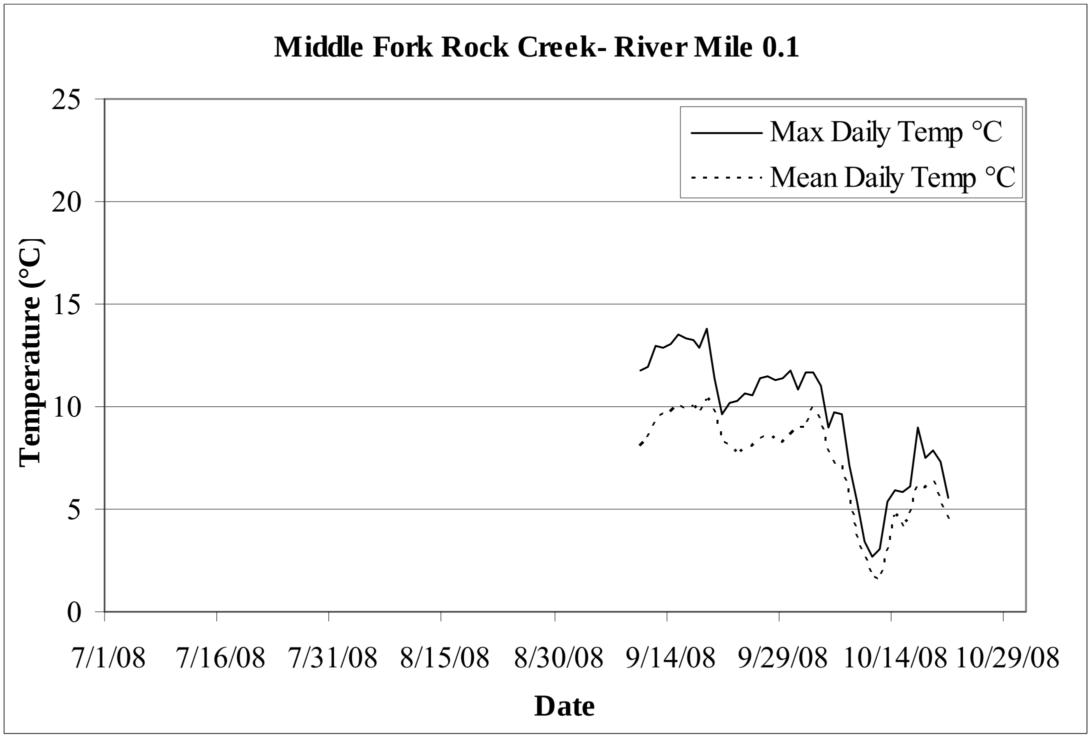
West Fork Rock Creek Drainage

West Fork Rock Creek

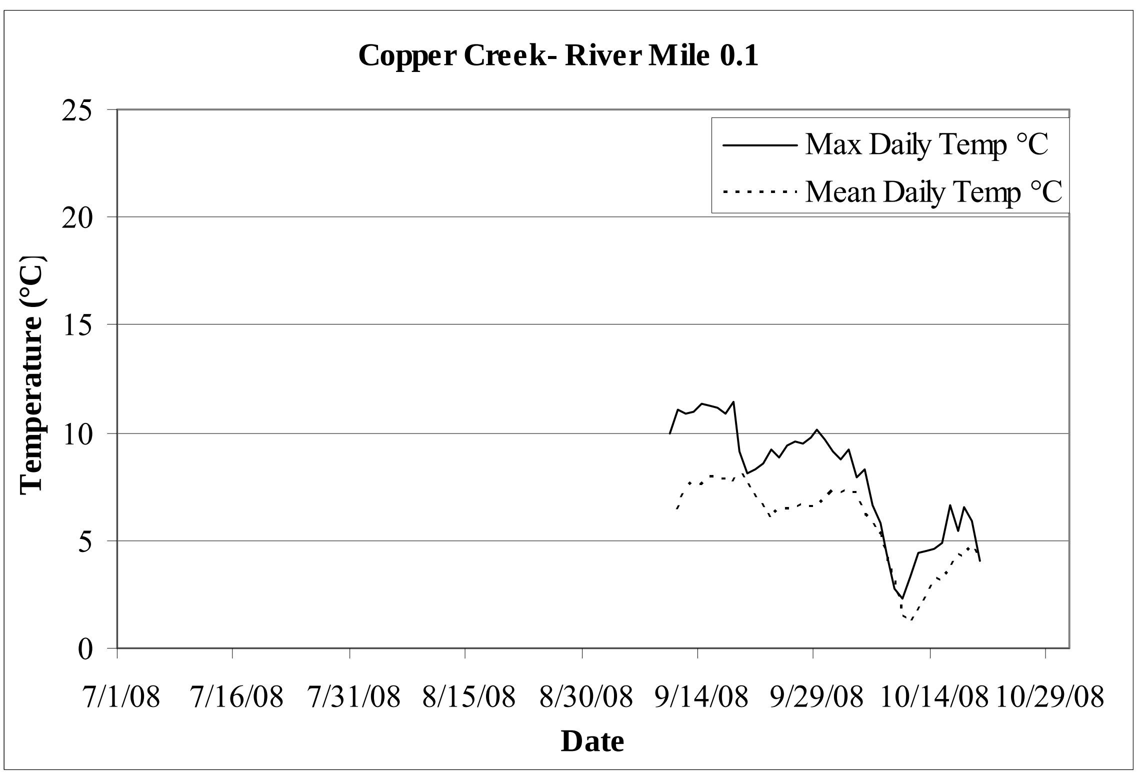


Middle Fork Rock Creek Drainage

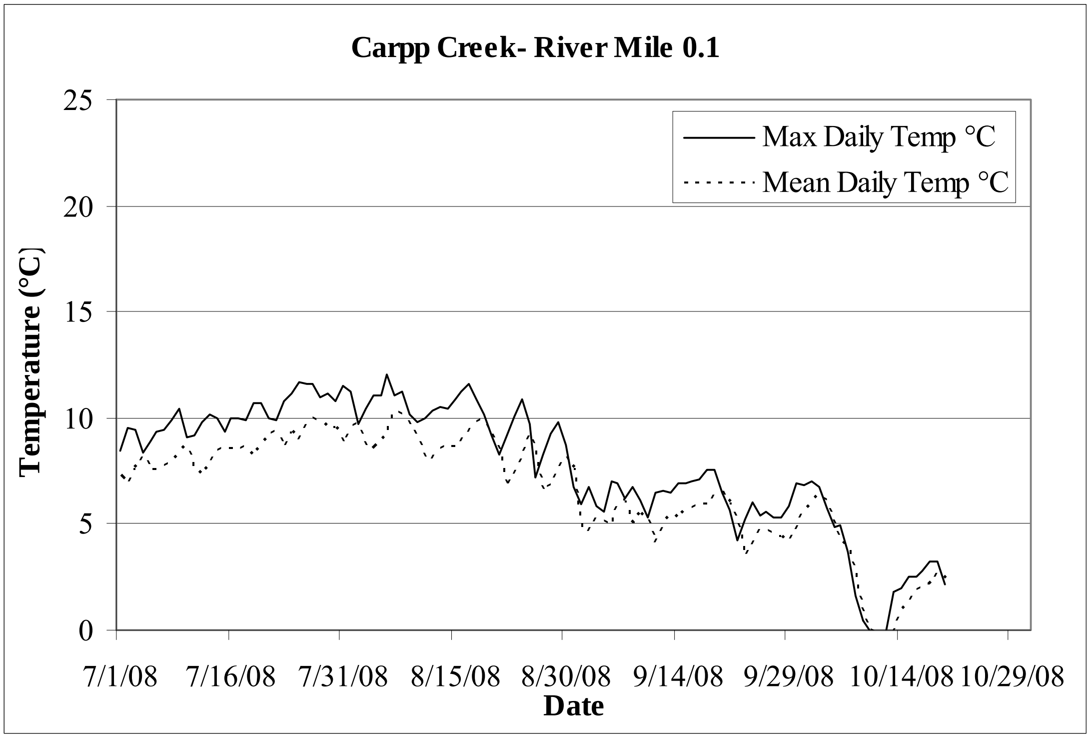
Middle Fork Rock Creek



Copper Creek

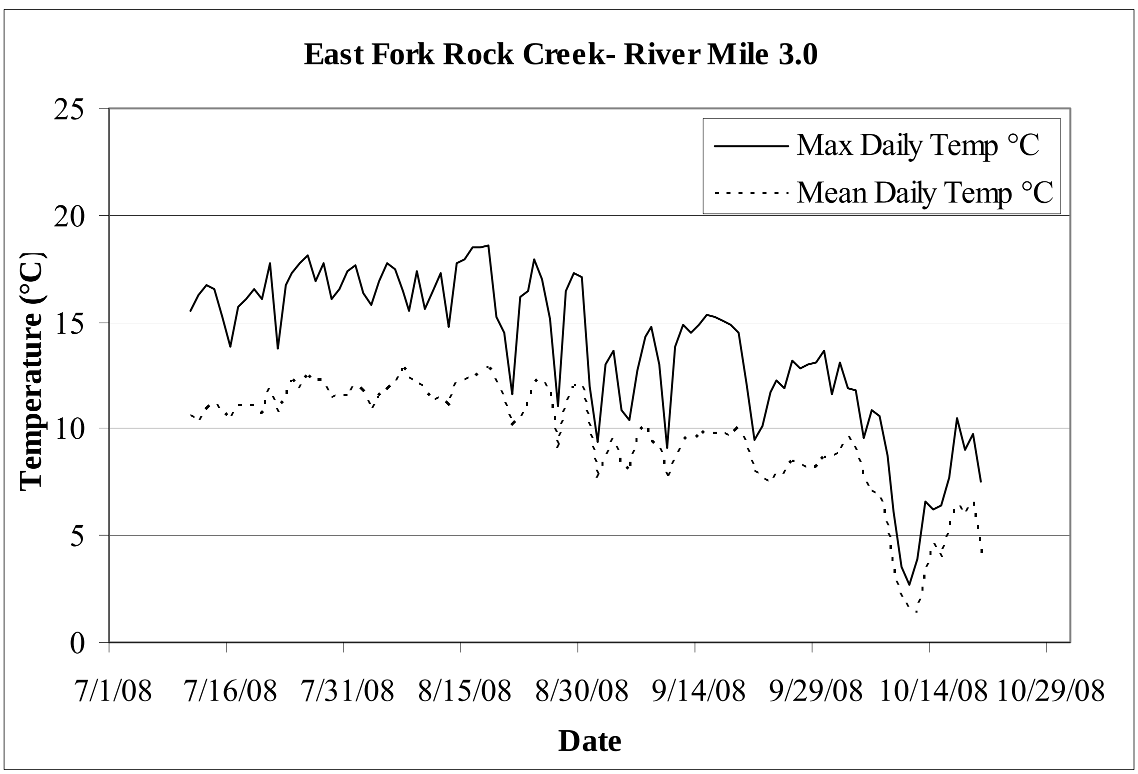


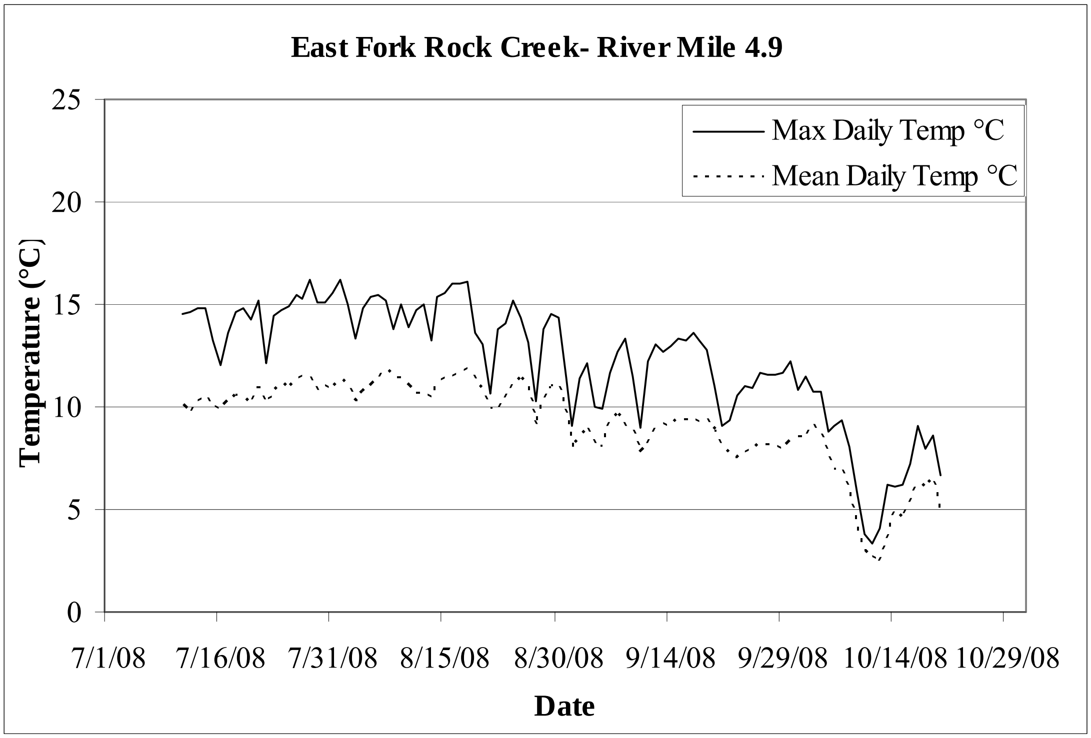
Carpp Creek

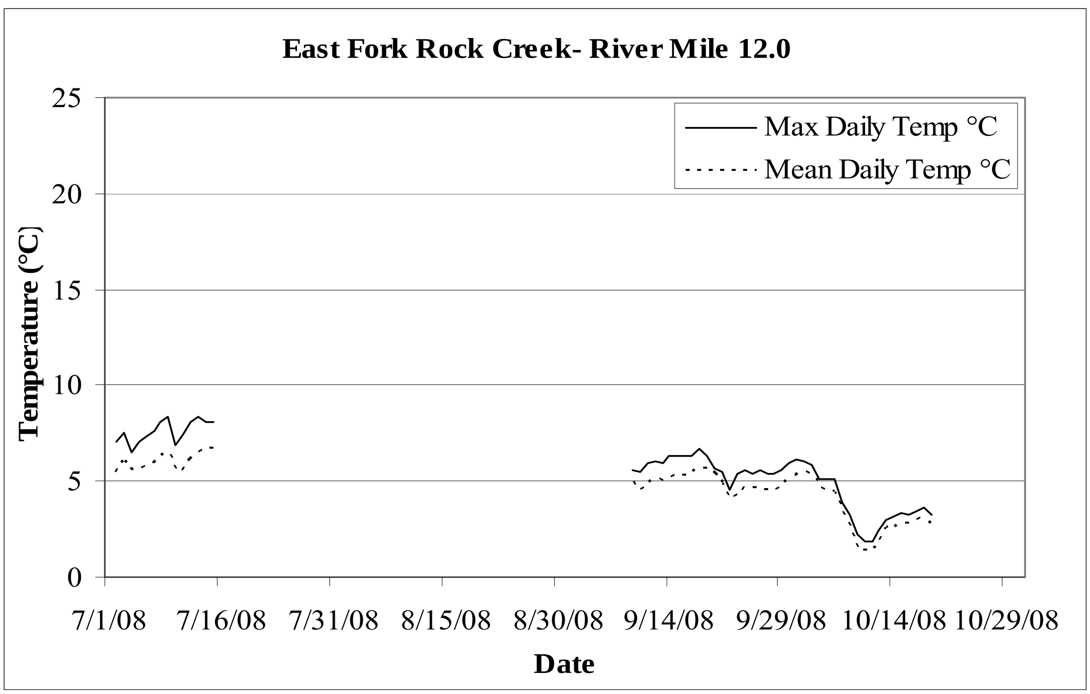


East Fork Rock Creek Drainage

East Fork Rock Creek

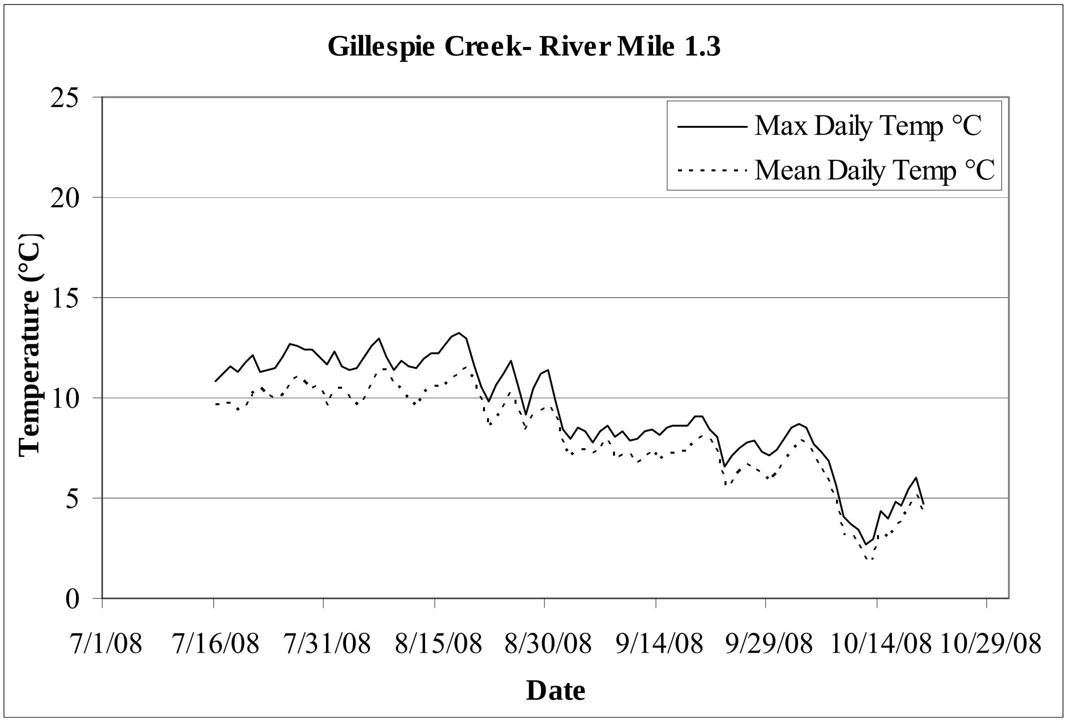



East Fork Rock Creek- River Mile 4.9
Max Daily Temp °C
Mean Daily Temp °C
Temperature (°C)
0
5
10
15
20
25
7/1/08
7/16/08
7/31/08
8/15/08
8/30/08
9/14/08
9/29/08
10/14/08
10/29/08
Date

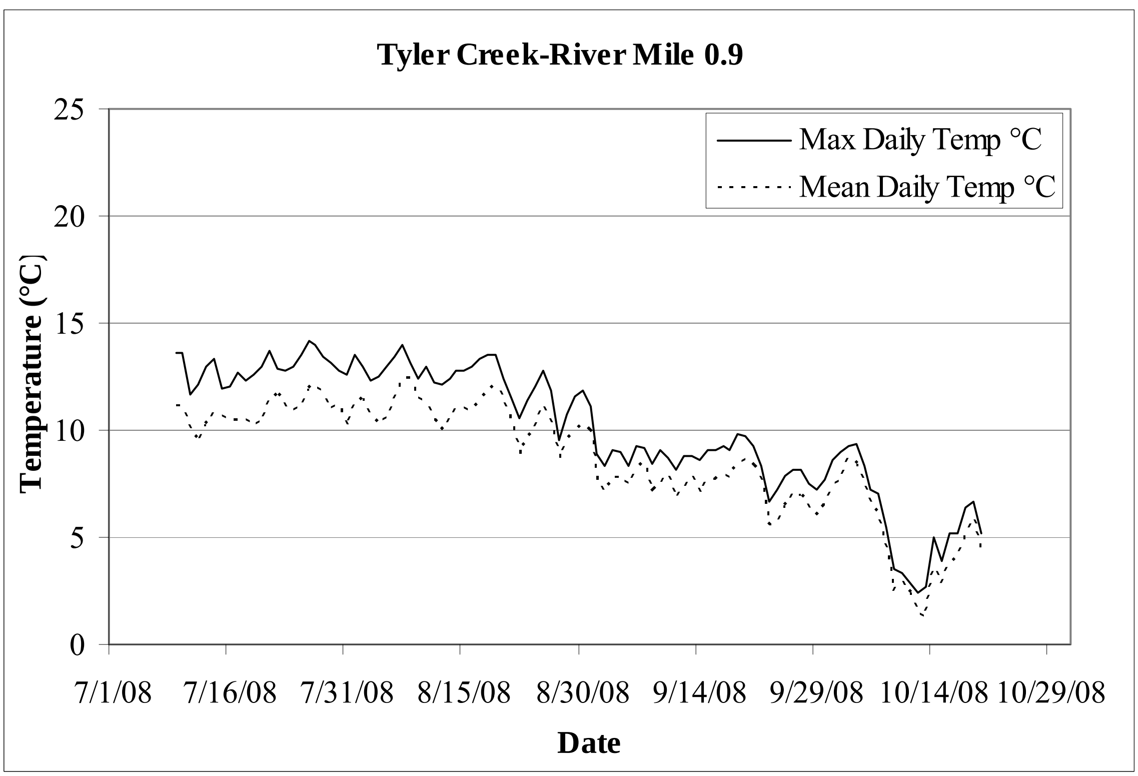

East Fork Rock Creek- River Mile 12.0
Max Daily Temp °C
Mean Daily Temp °C
Temperature (°C)
0
5
10
15
20
25
7/1/08
7/16/08
7/31/08
8/15/08
8/30/08
9/14/08
9/29/08
10/14/08
10/29/08
Date

Clark Fork River Drainage

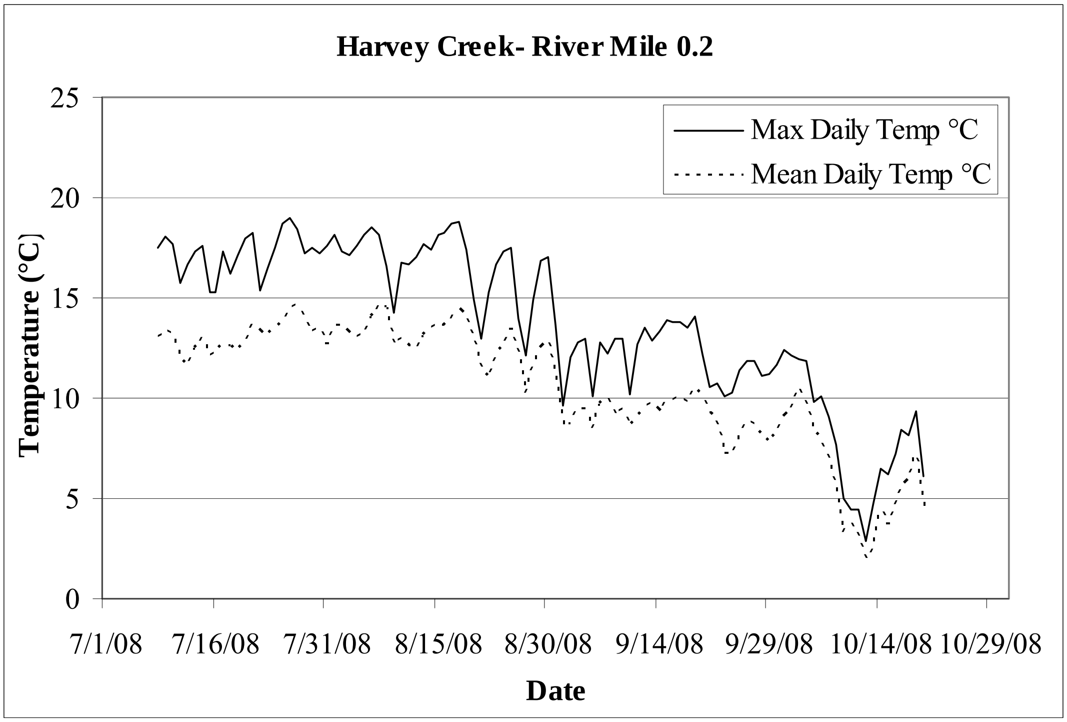
Gillespie Creek



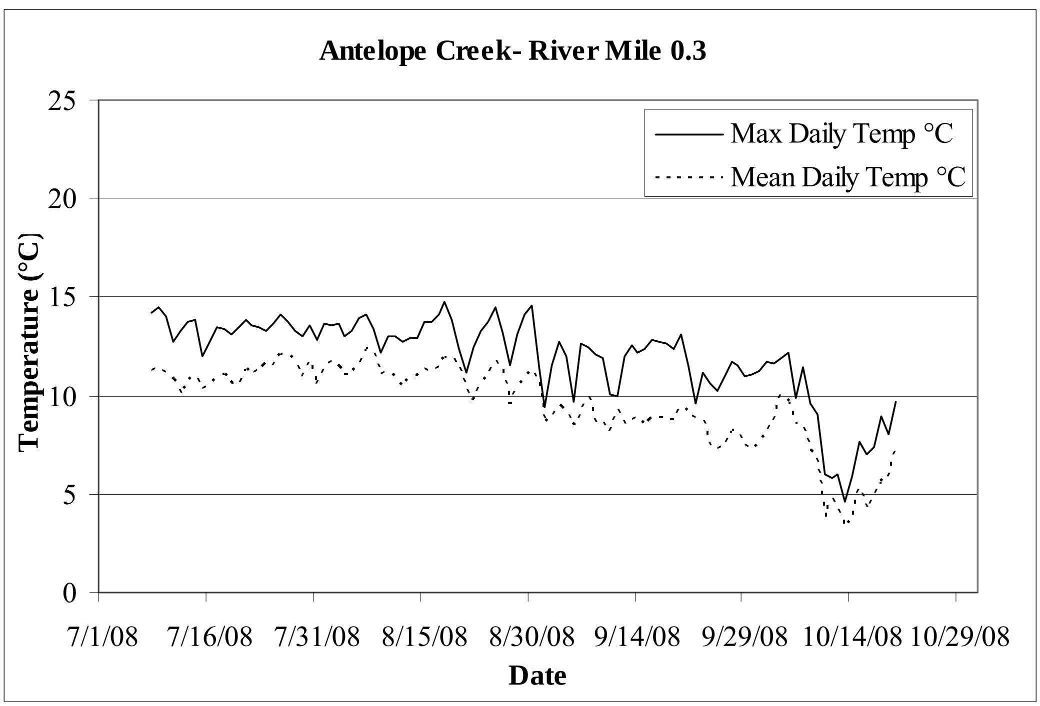
Tyler Creek



Harvey Creek

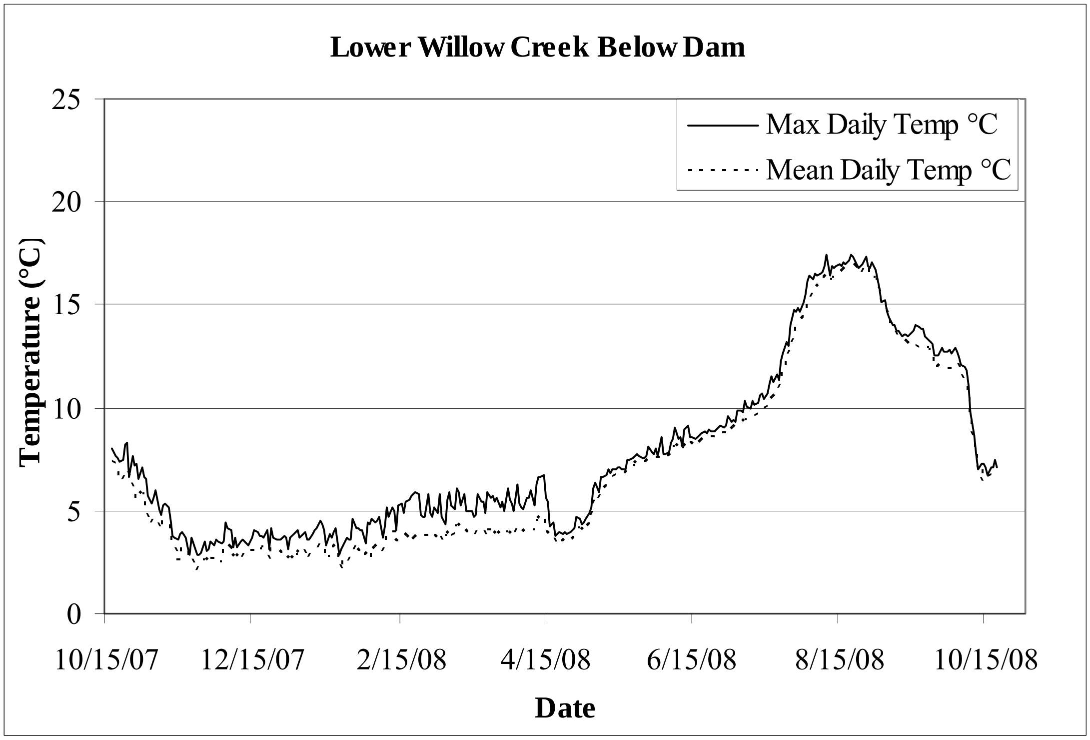


Antelope Creek

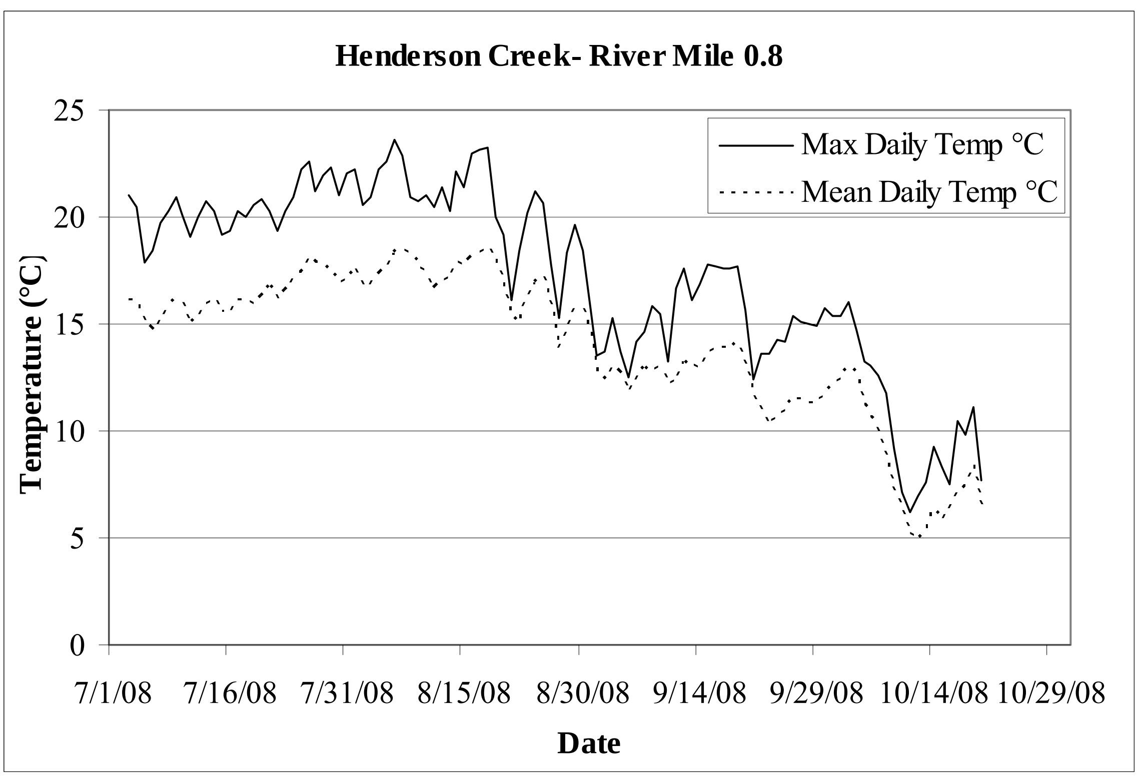


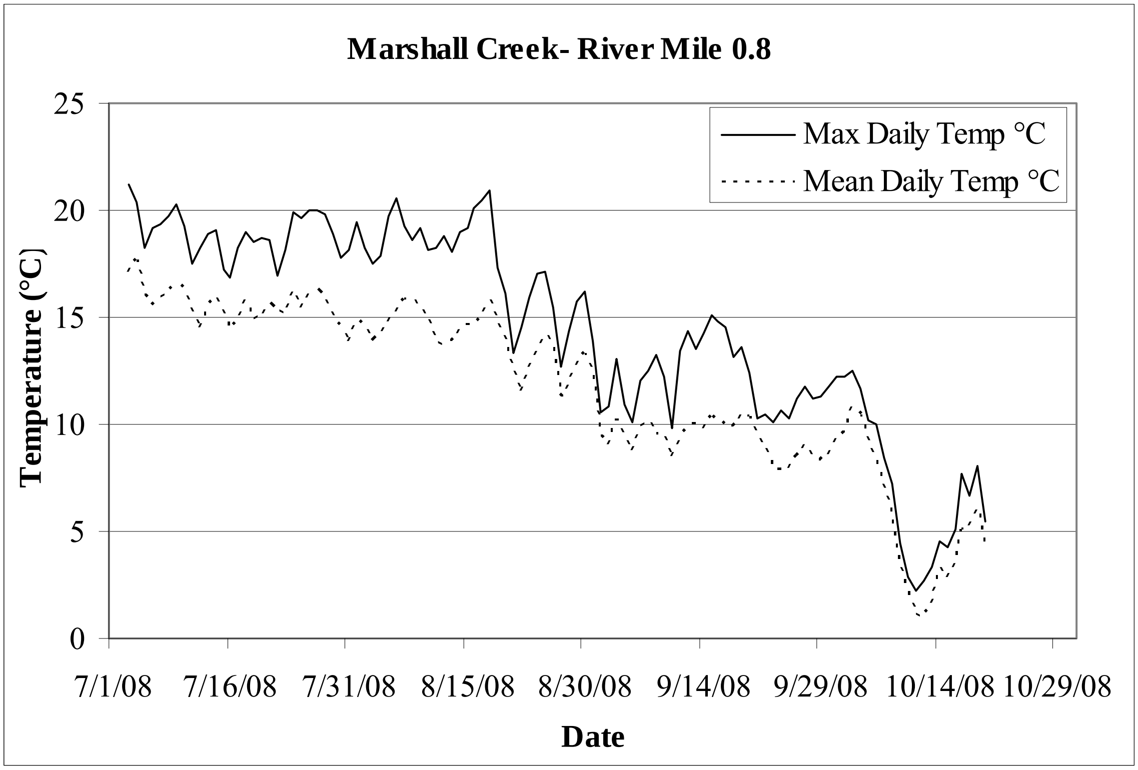
Flint Creek Drainage

Lower Willow Creek



Henderson Creek

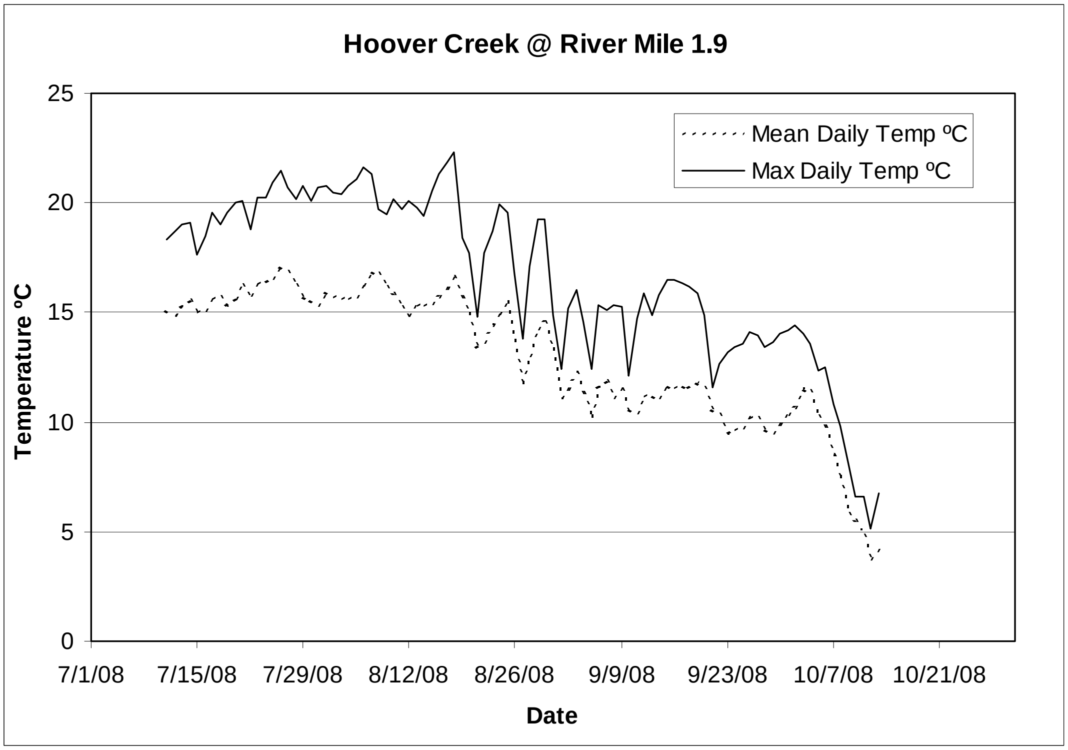




Marshall Creek- River Mile 0.8
Max Daily Temp °C
Mean Daily Temp °C
Temperature (°C)
25
20
15
10
5
0
7/1/08
7/16/08
7/31/08
8/15/08
8/30/08
9/14/08
9/29/08
10/14/08
10/29/08
Date

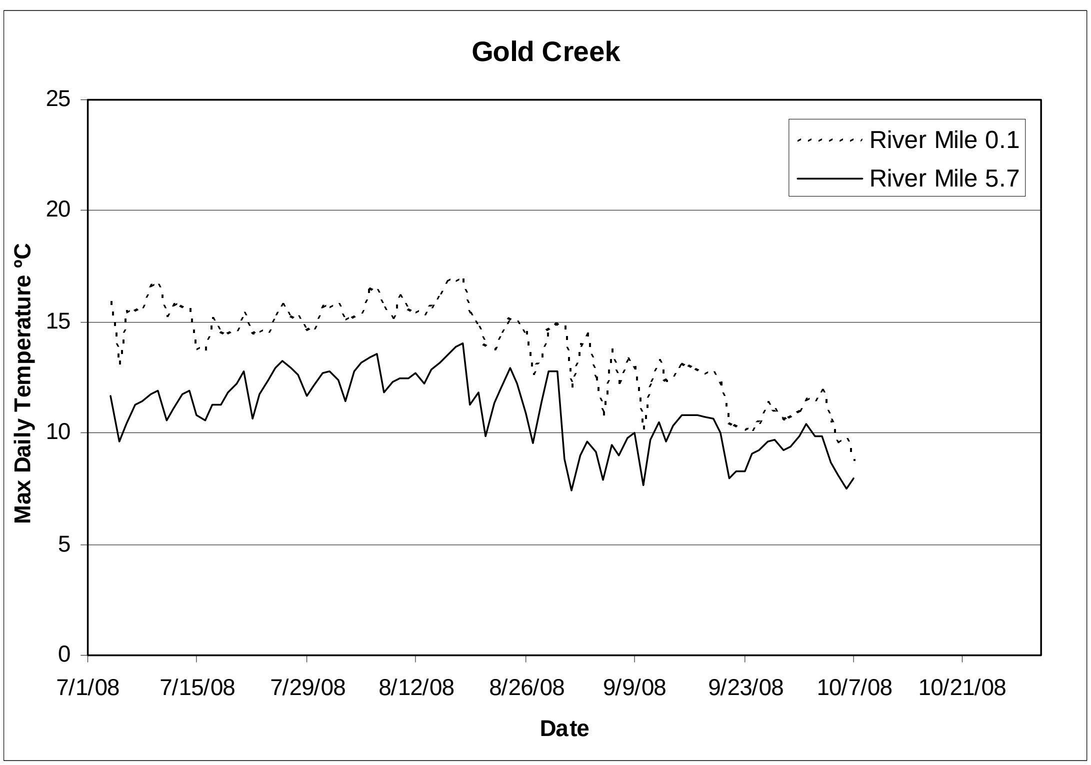
Hoover Creek Drainage

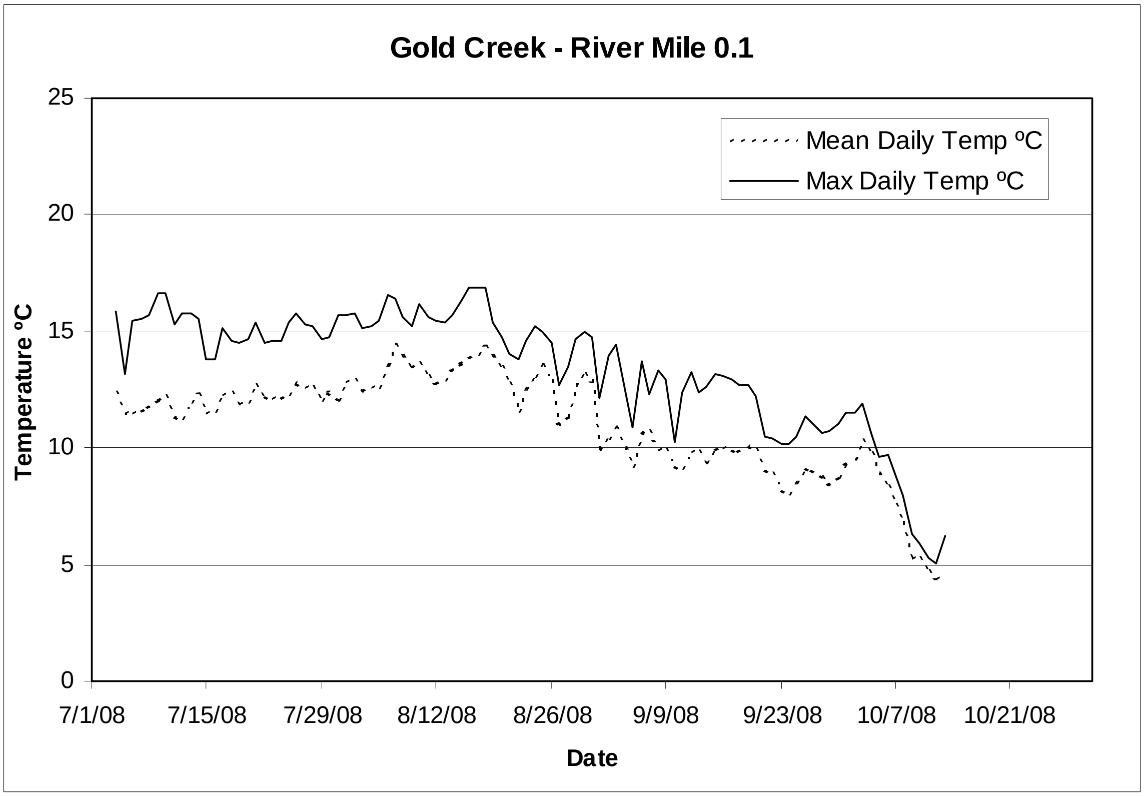
Hoover Creek

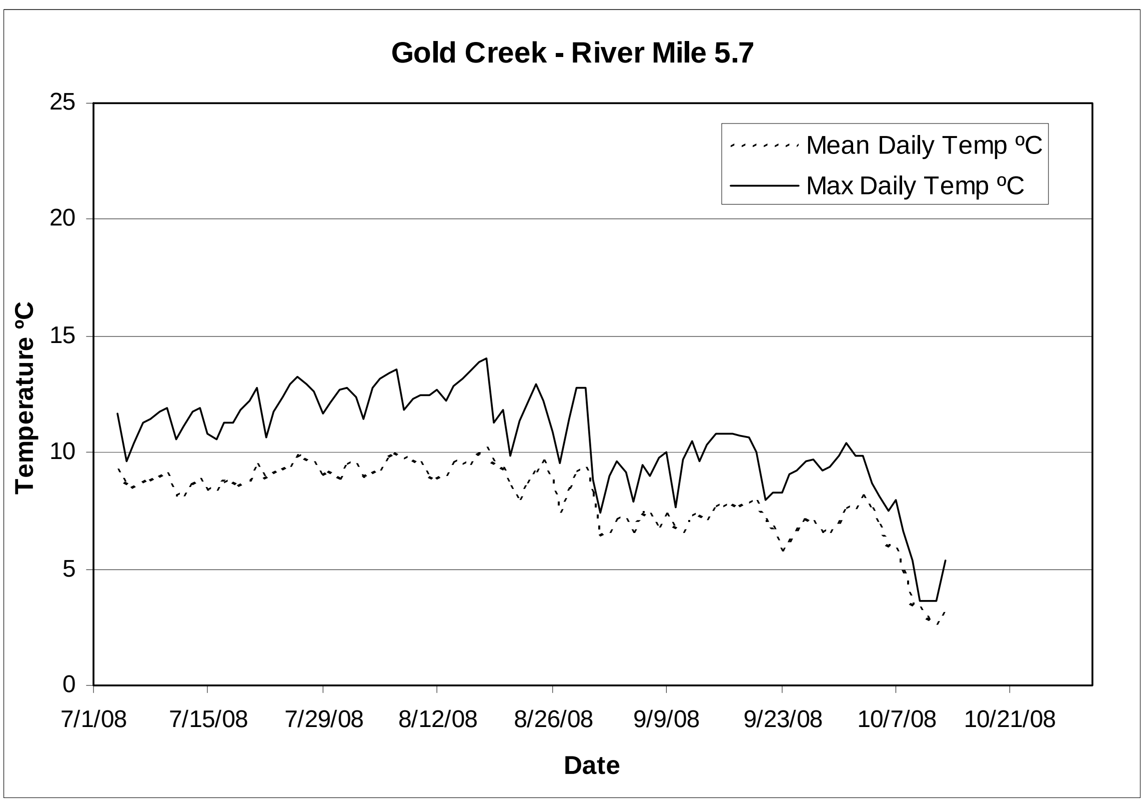


Gold Creek Drainage

Gold Creek

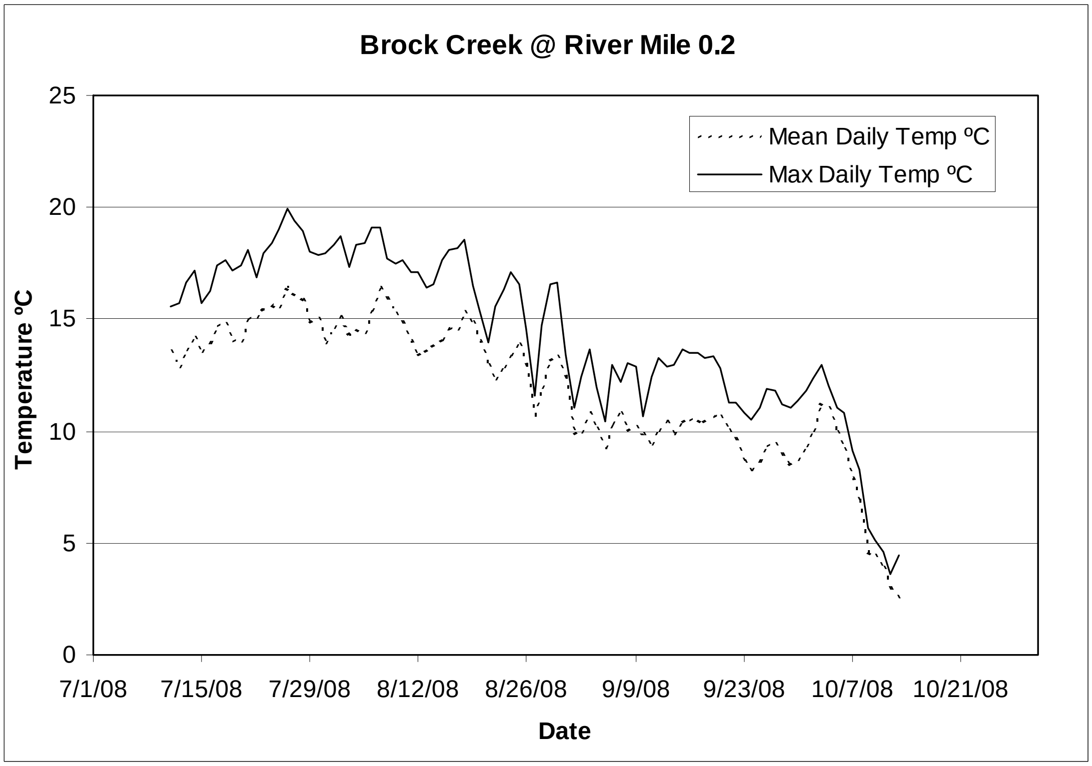



Gold Creek - River Mile 0.1
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date


Gold Creek - River Mile 5.7
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date

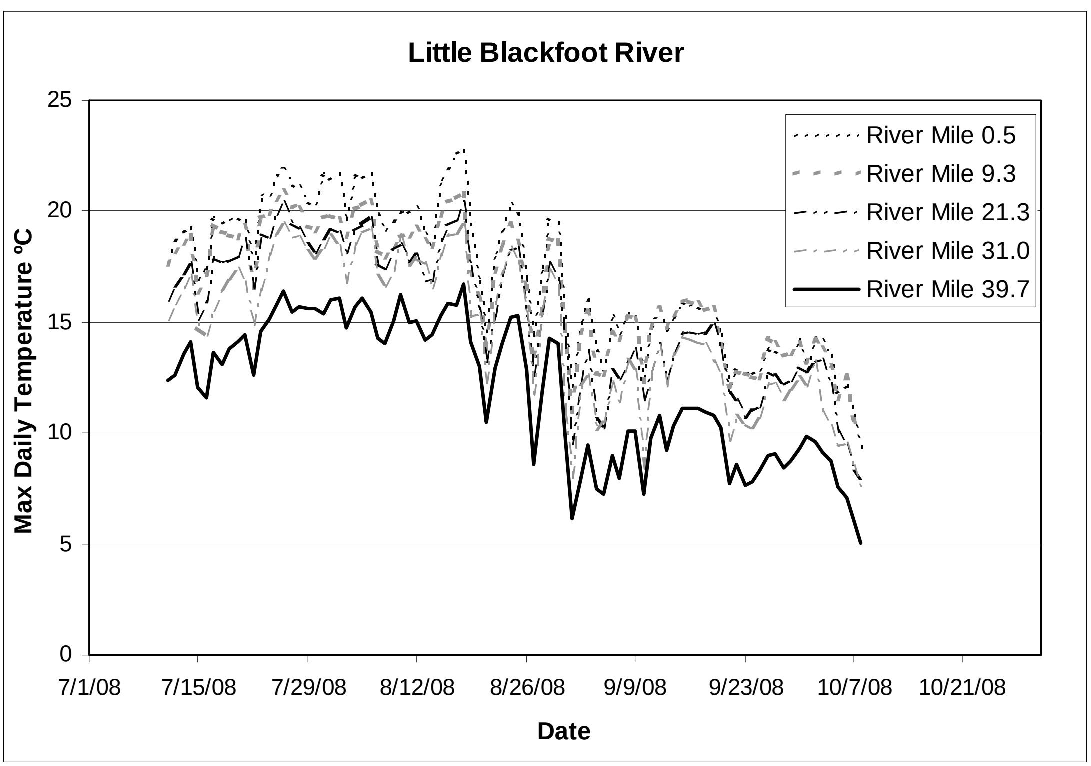
Brock Creek Drainage

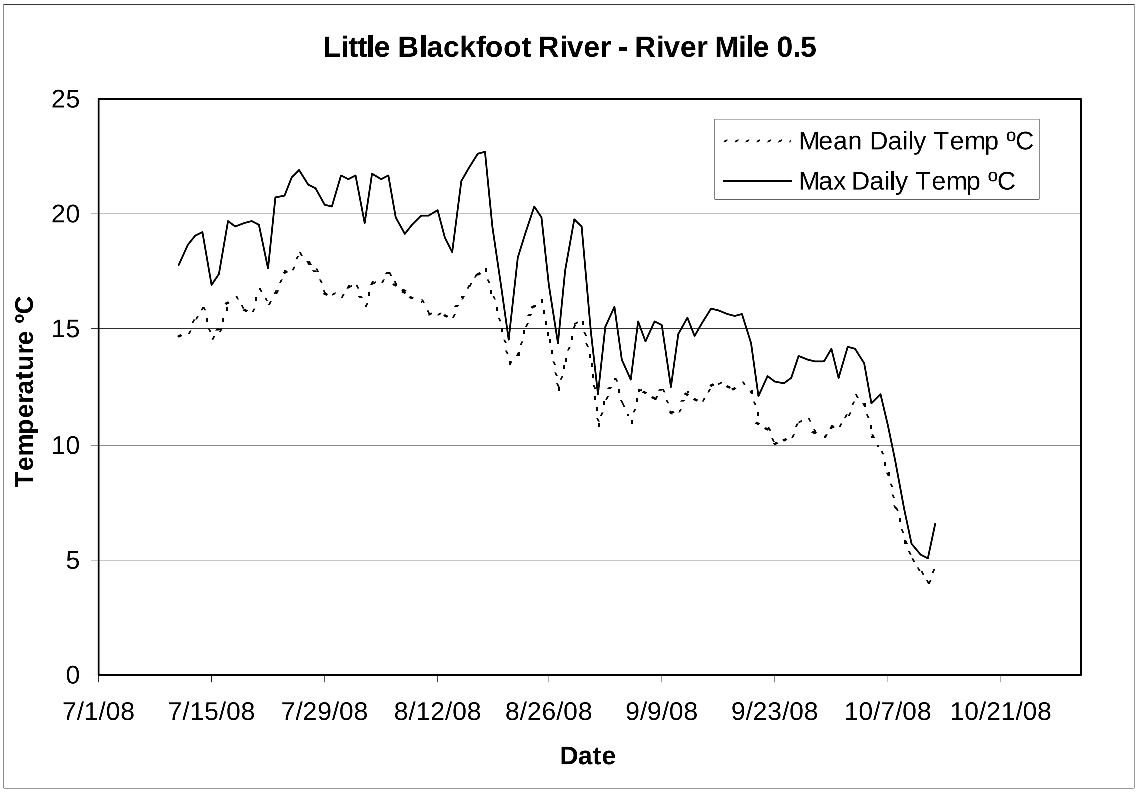
Brock Creek

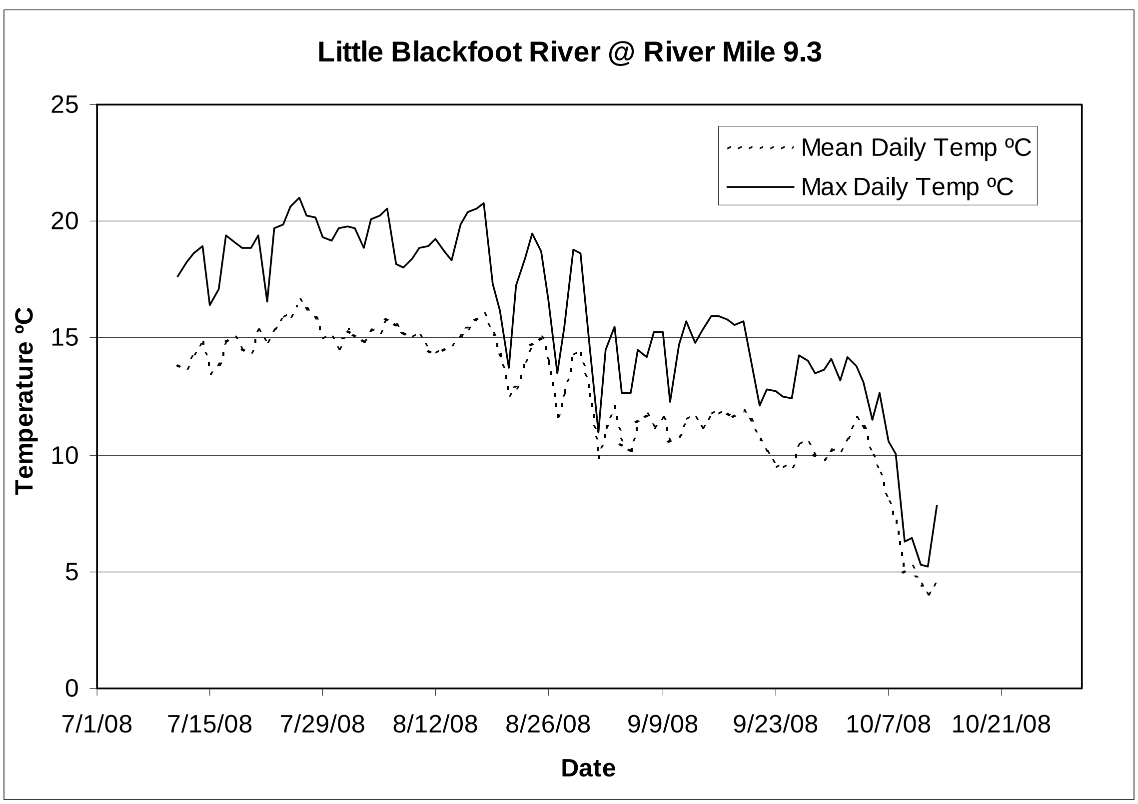


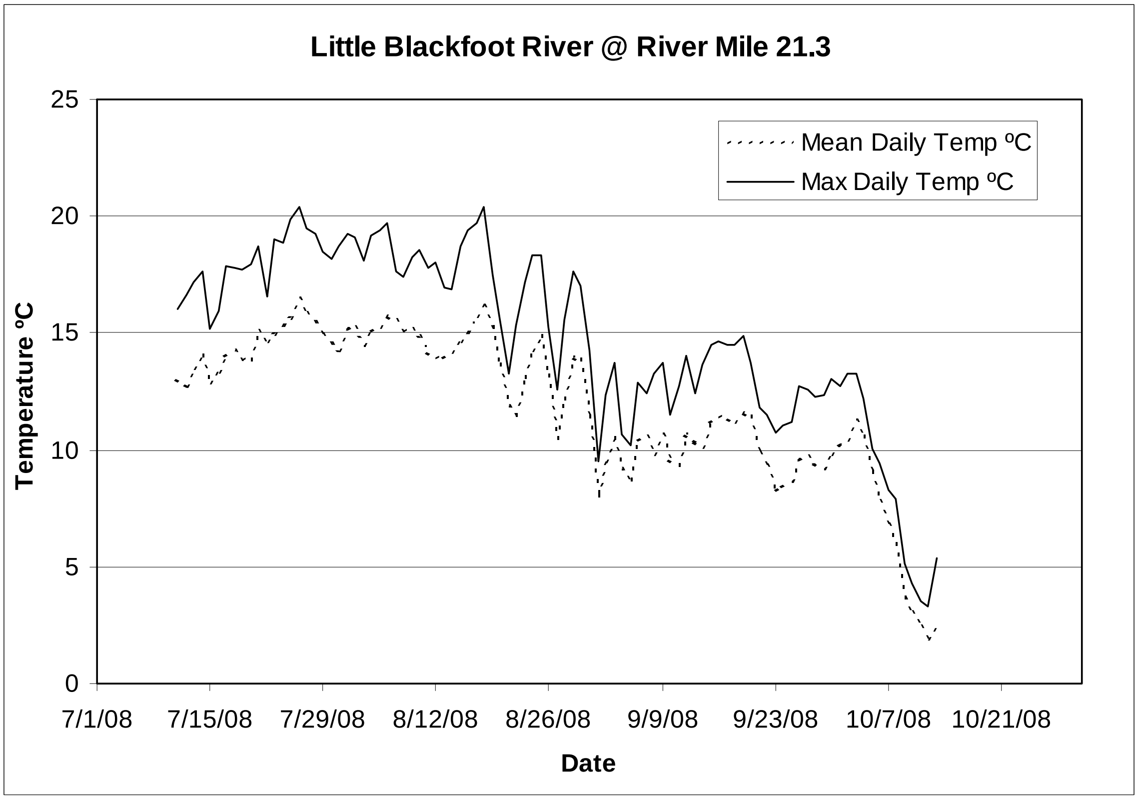
Little Blackfoot River Drainage

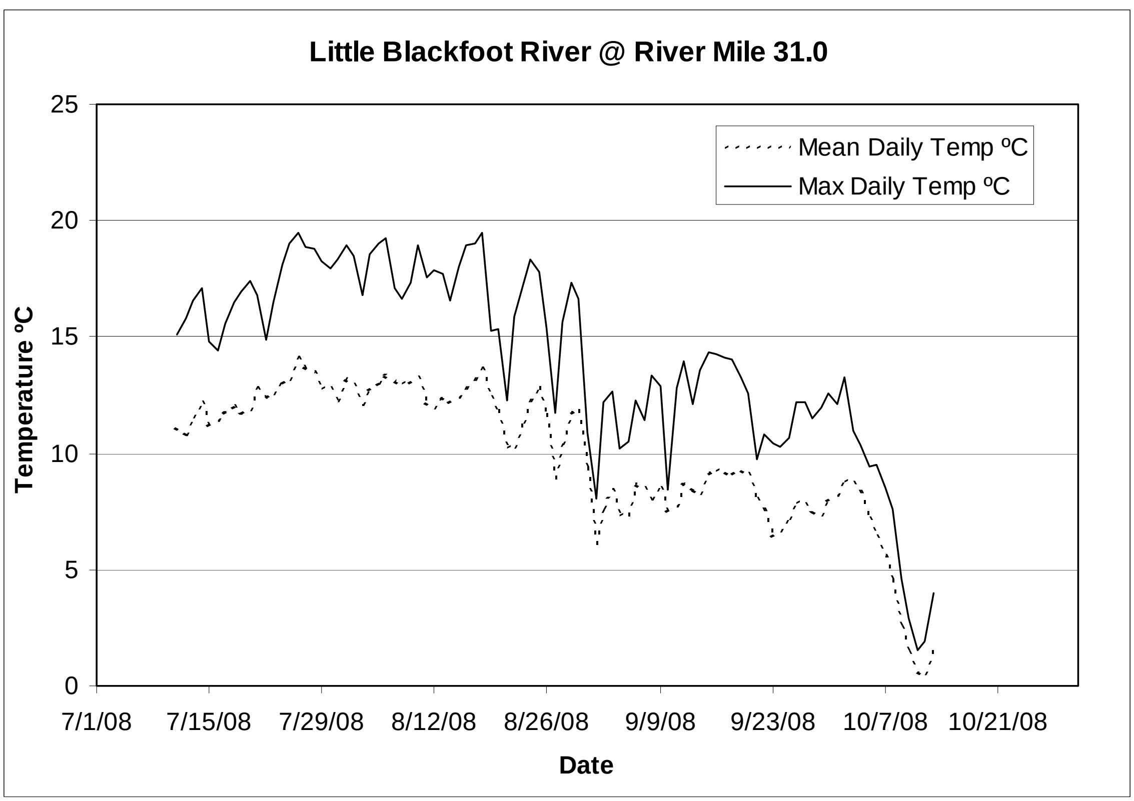
Little Blackfoot River

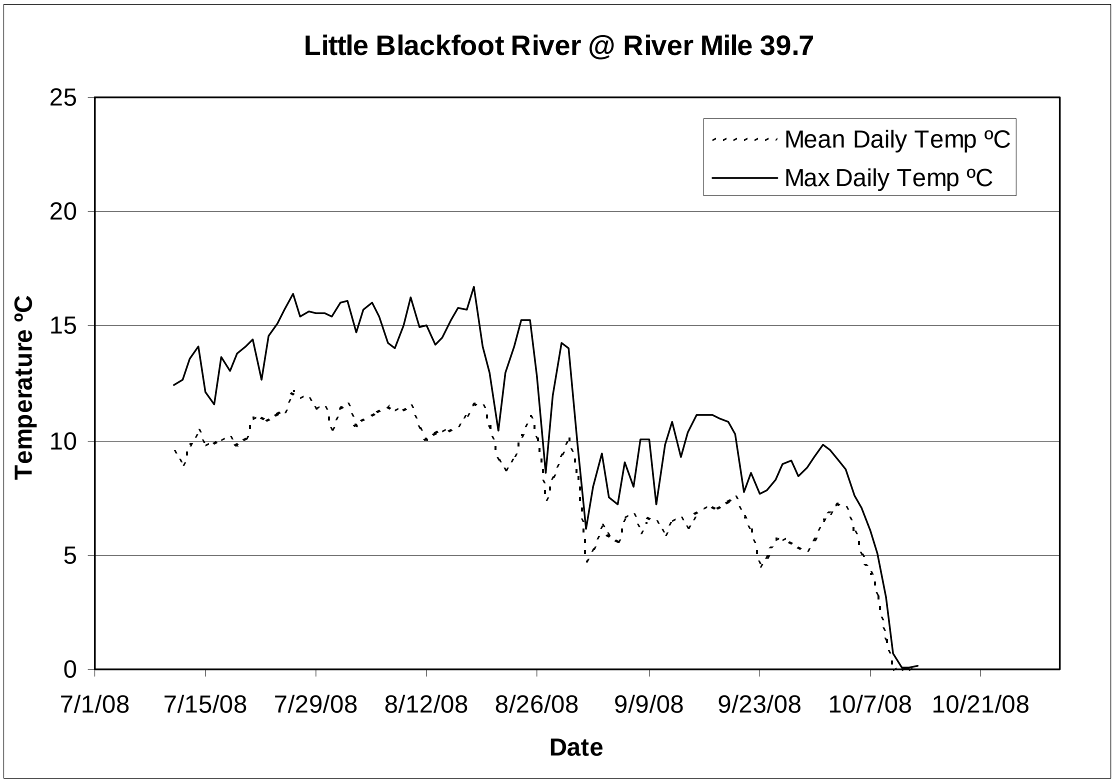



Little Blackfoot River - River Mile 0.5
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date

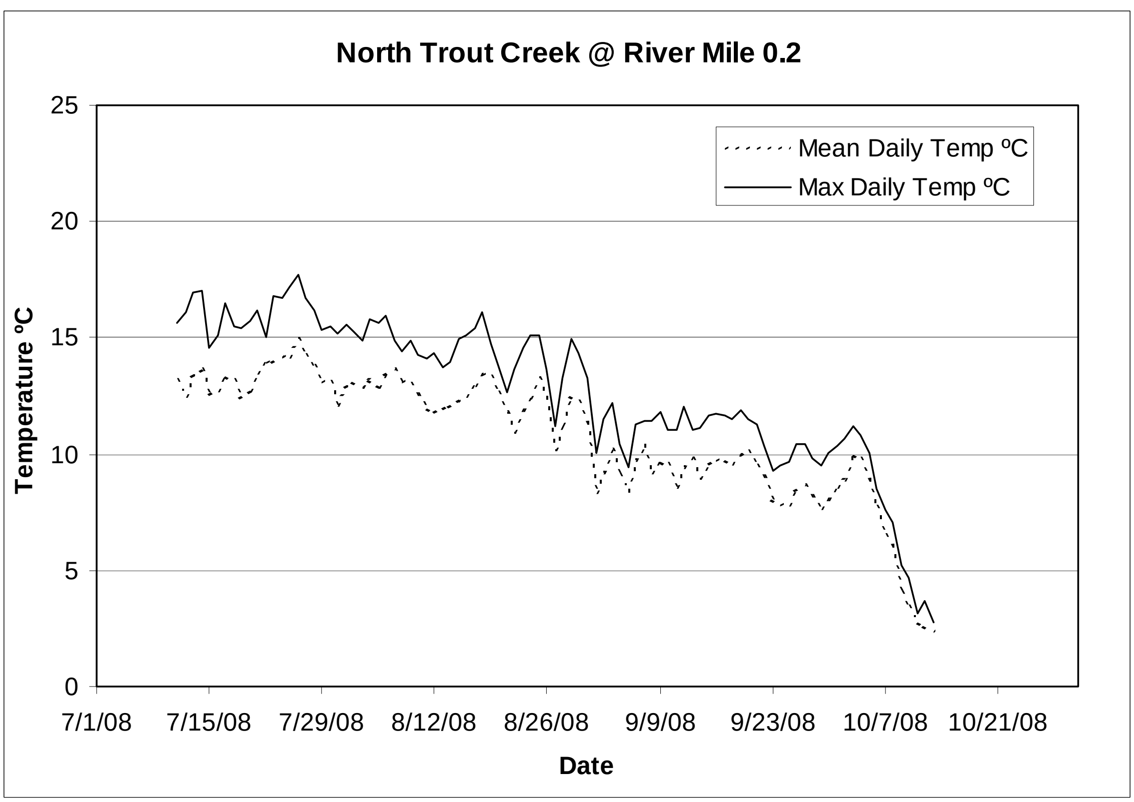

Little Blackfoot River @ River Mile 9.3
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date


Little Blackfoot River @ River Mile 21.3
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date

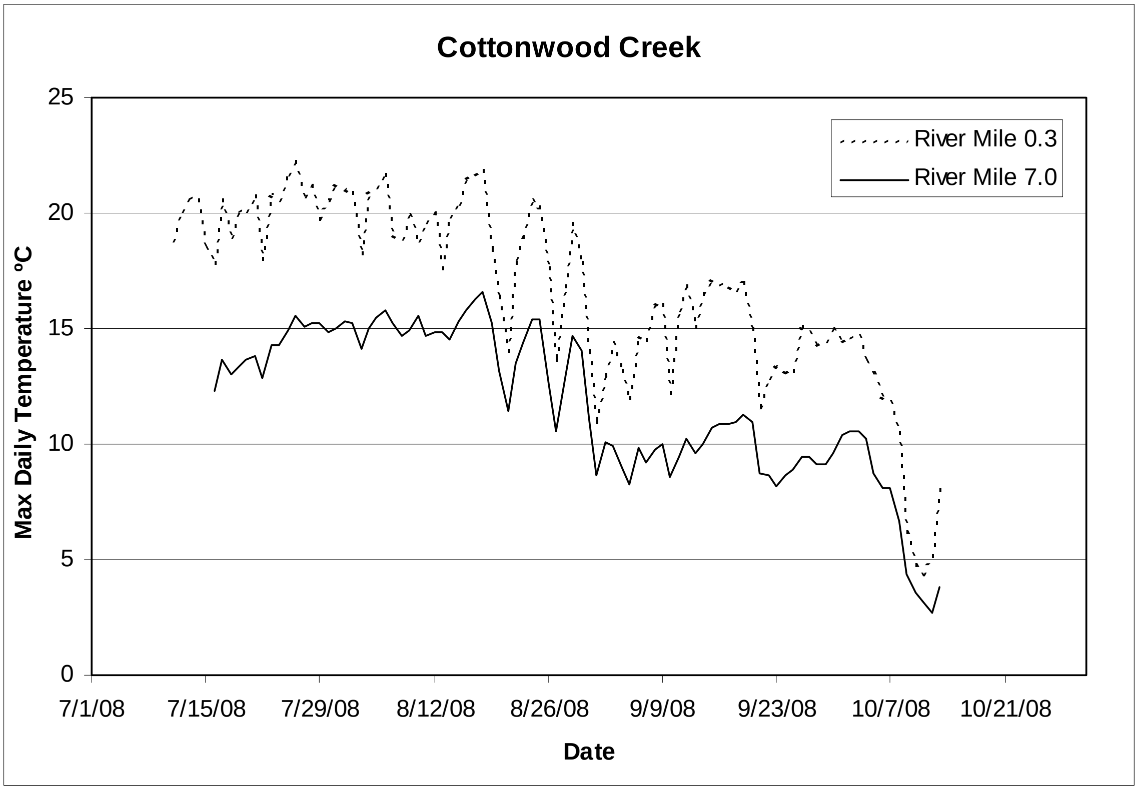

Little Blackfoot River @ River Mile 31.0
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date

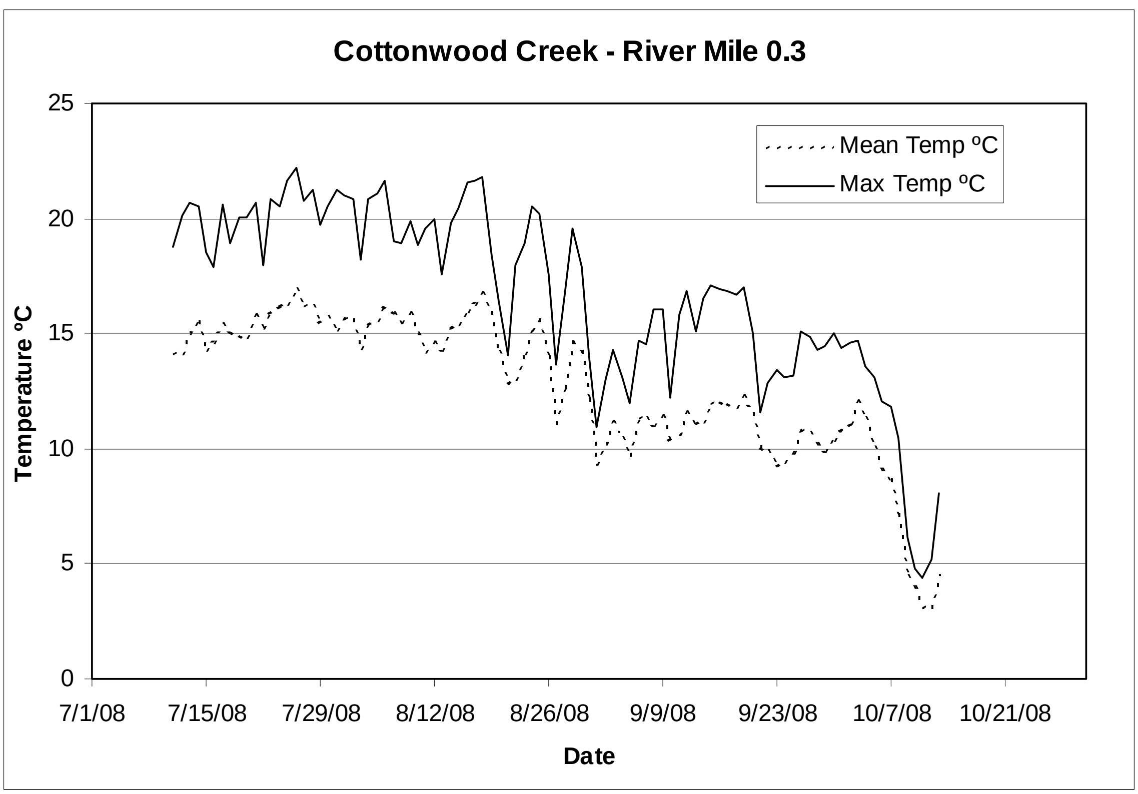


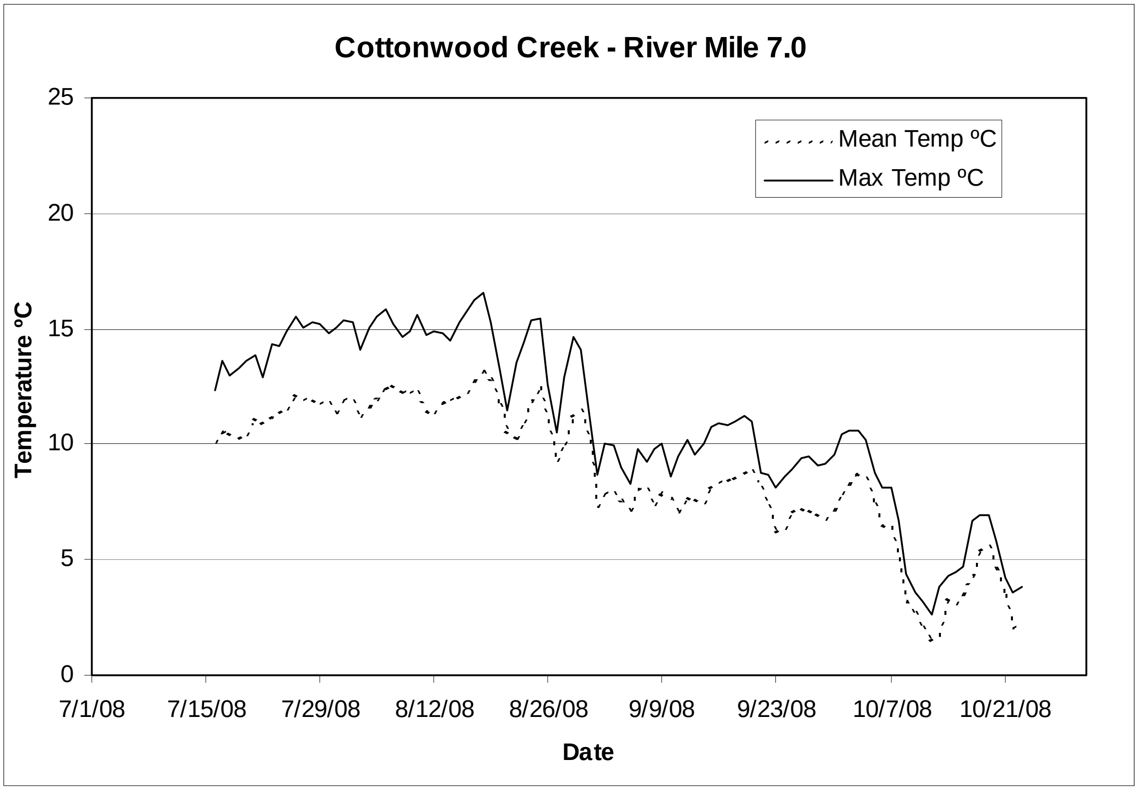
North Trout Creek



Cottonwood Creek

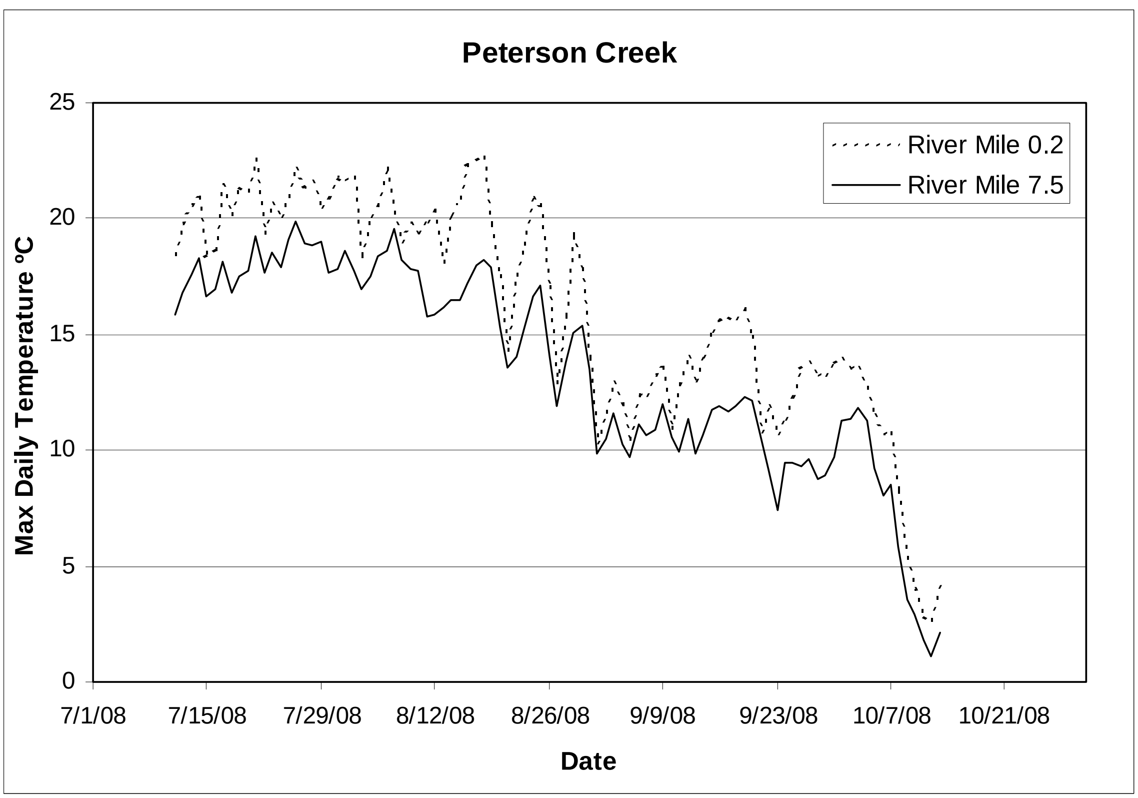


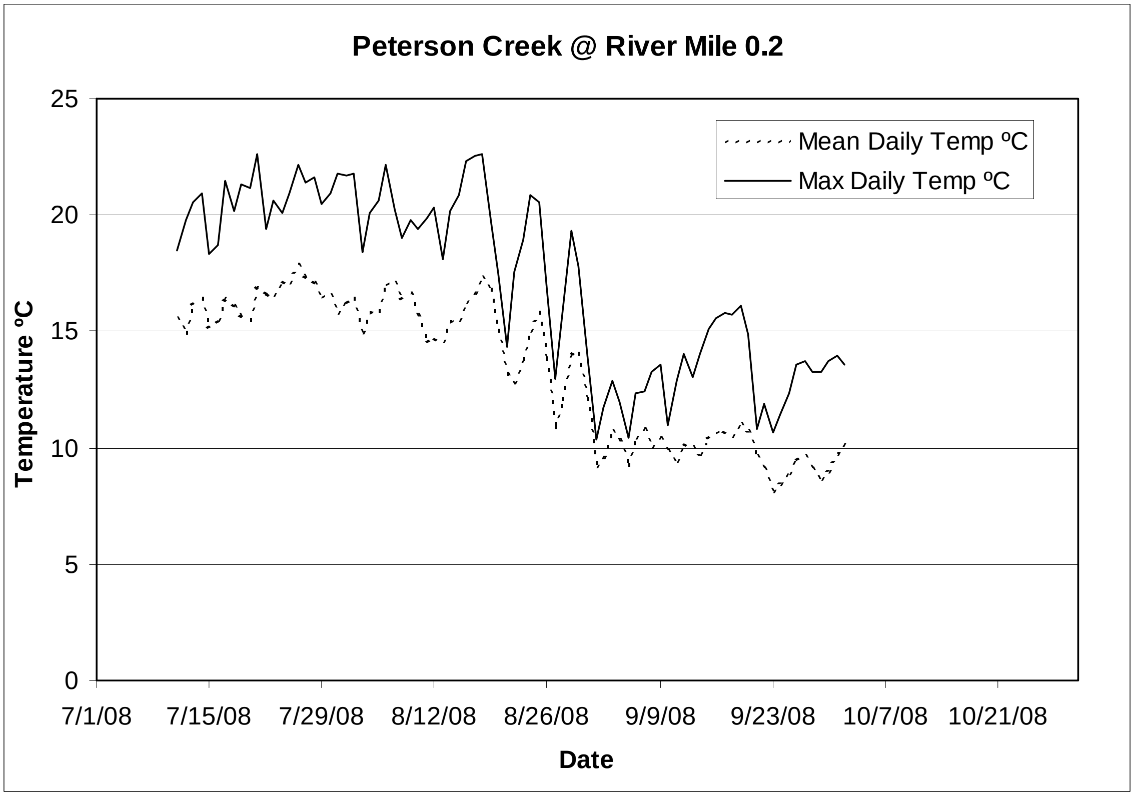


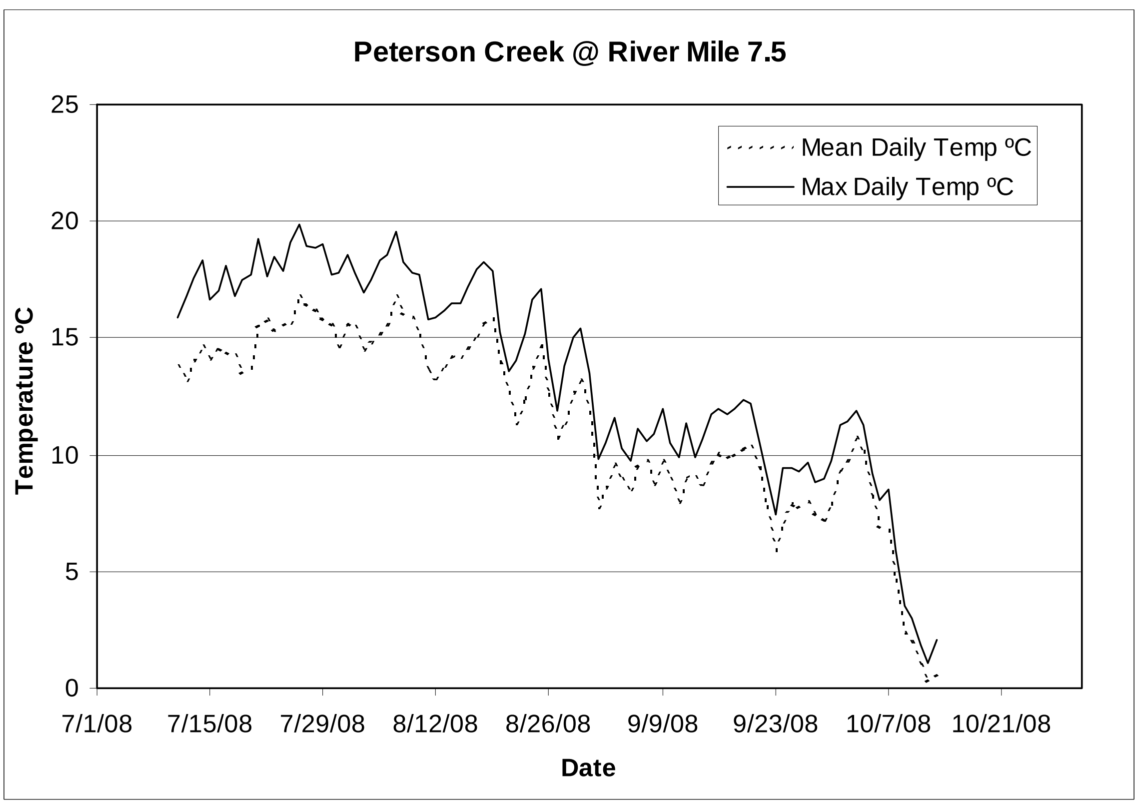


Peterson Creek Drainage

Peterson Creek

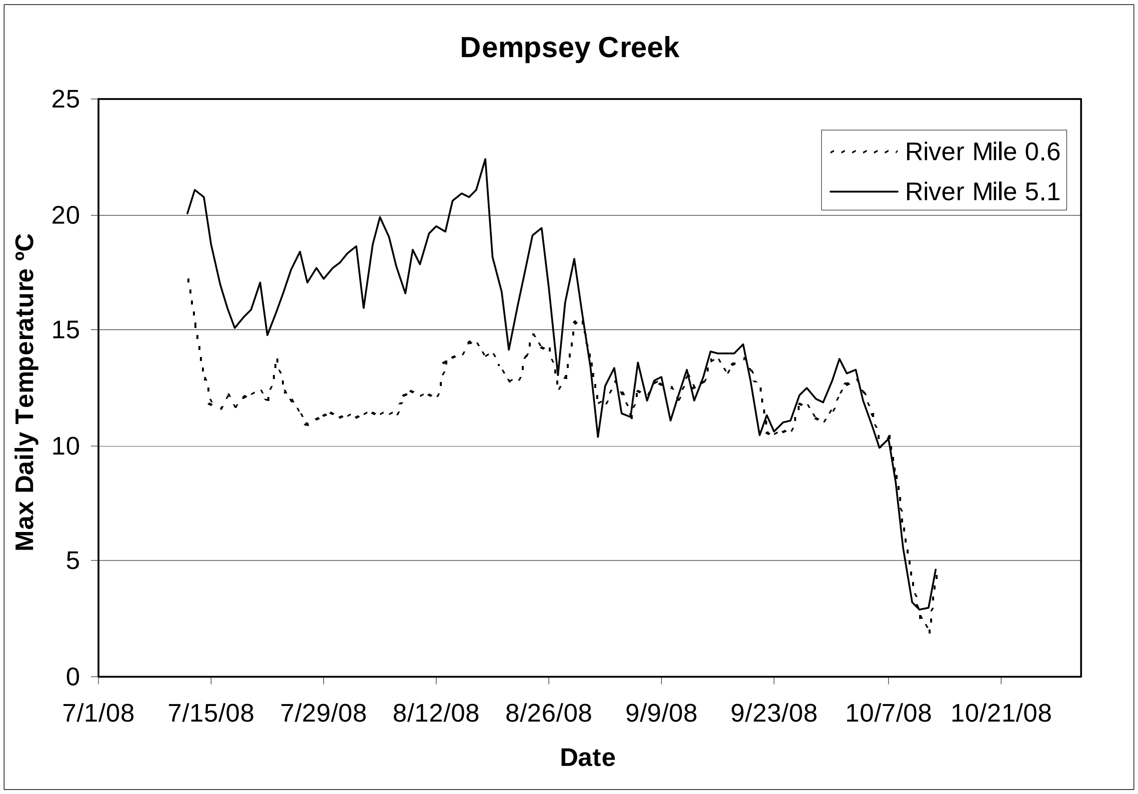


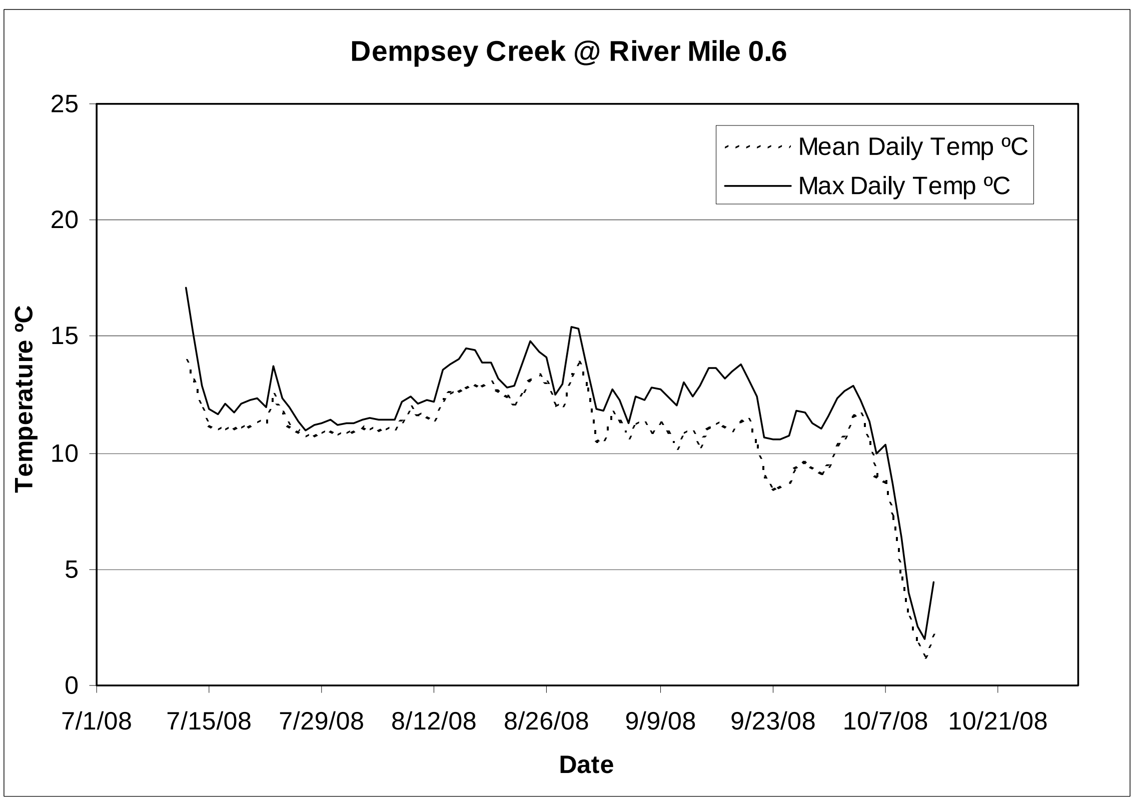

Peterson Creek @ River Mile 0.2
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date

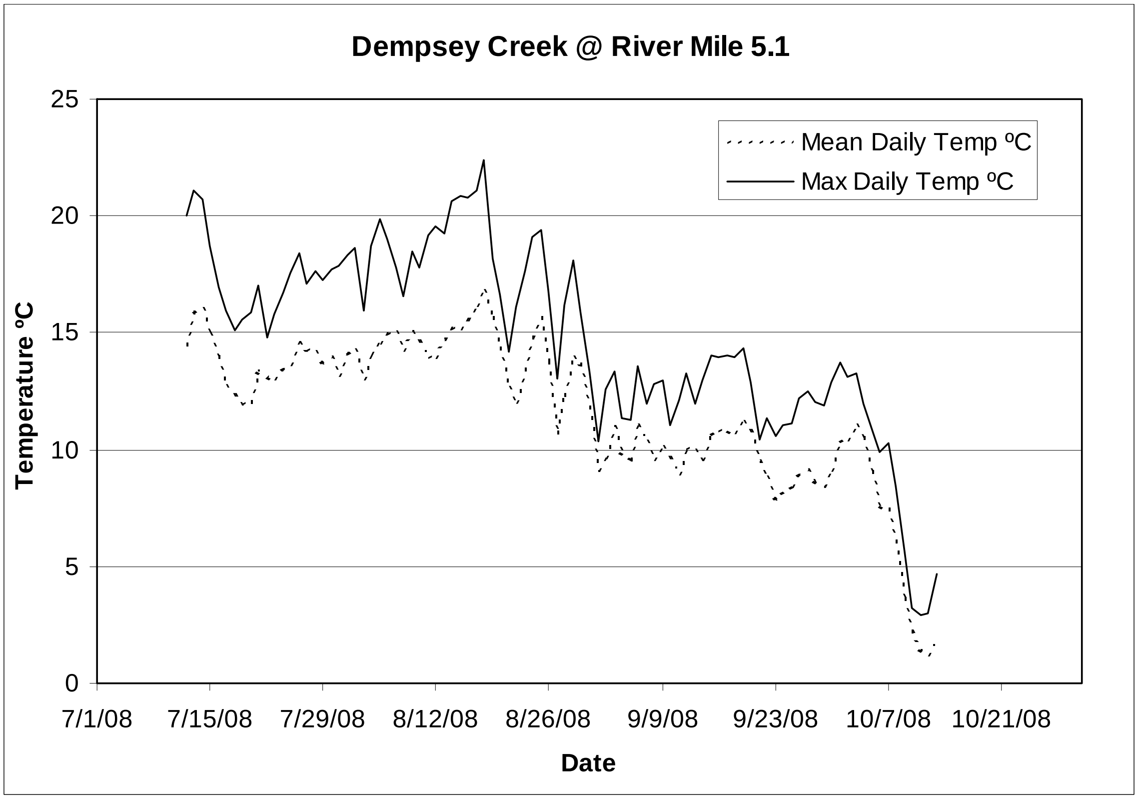

Peterson Creek @ River Mile 7.5
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date

Dempsey Creek Drainage

Dempsey Creek

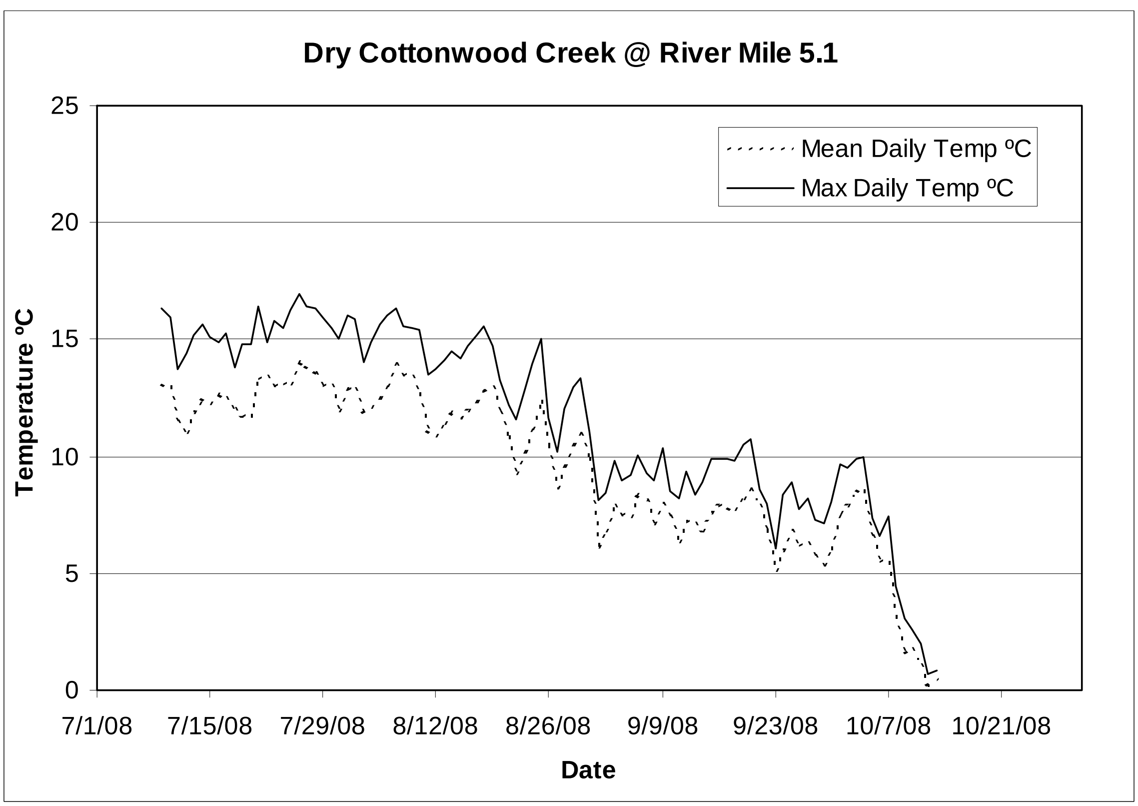






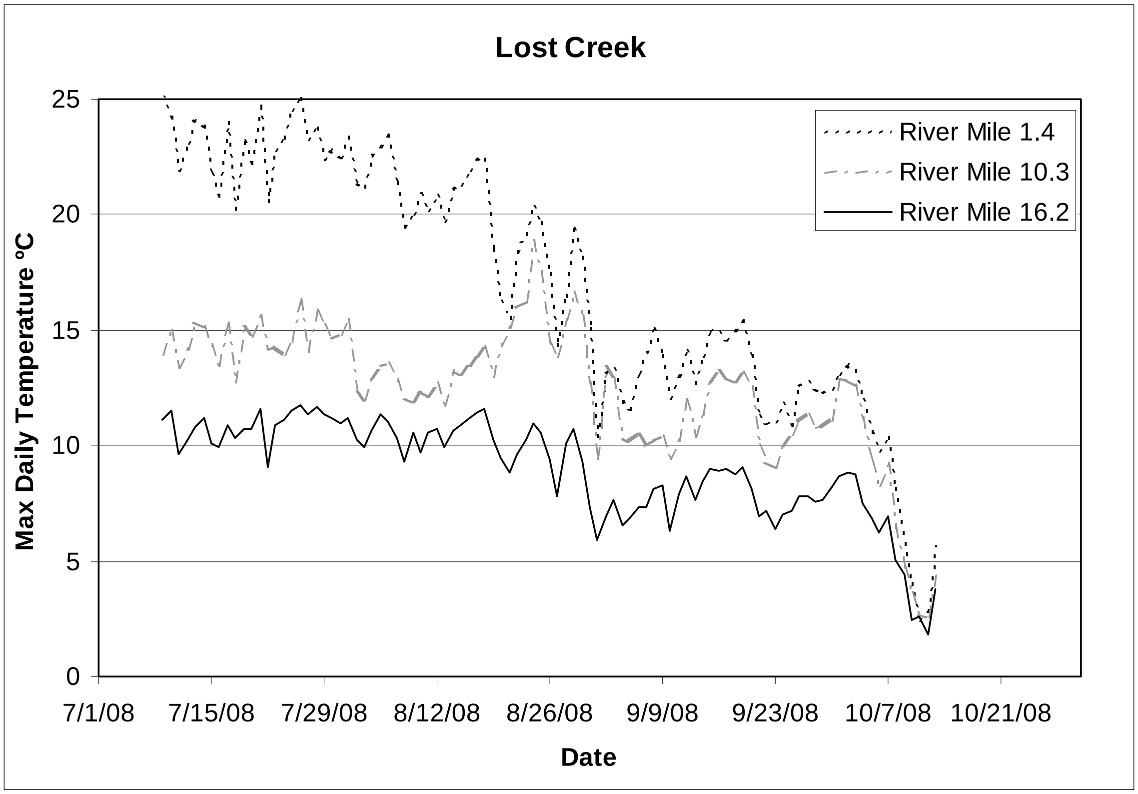
Dry Cottonwood Creek Drainage

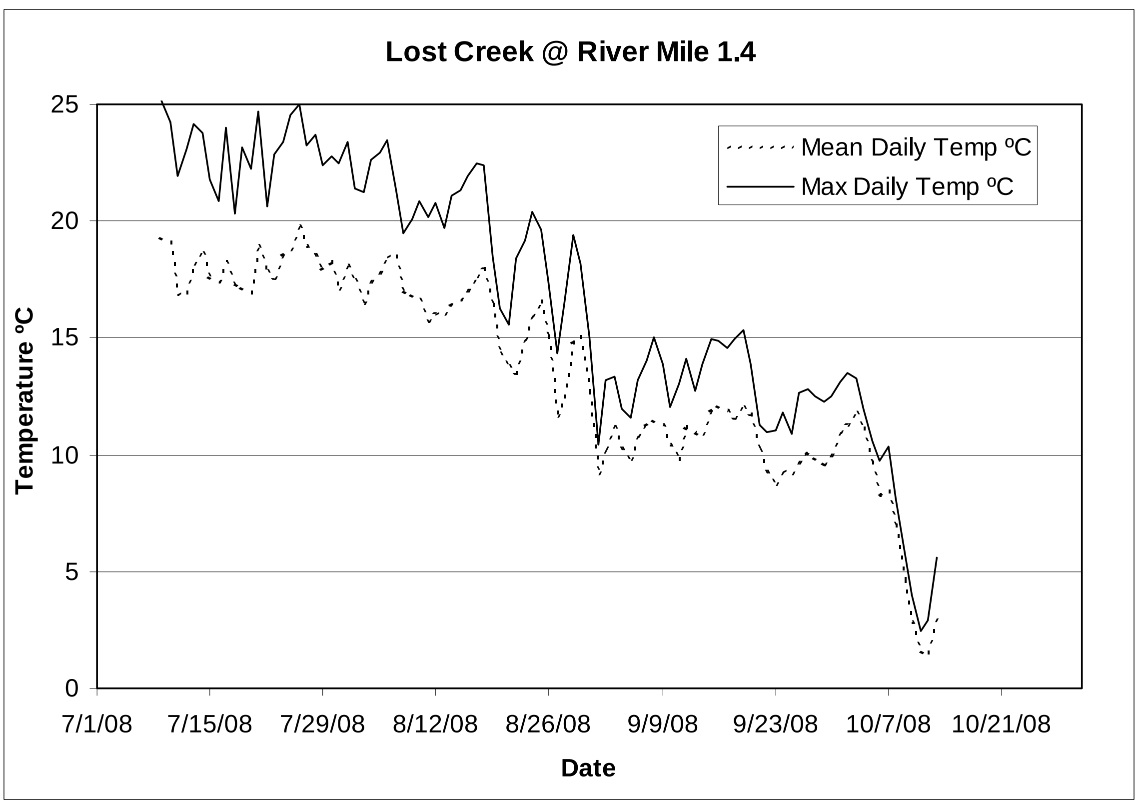
Dry Cottonwood Creek

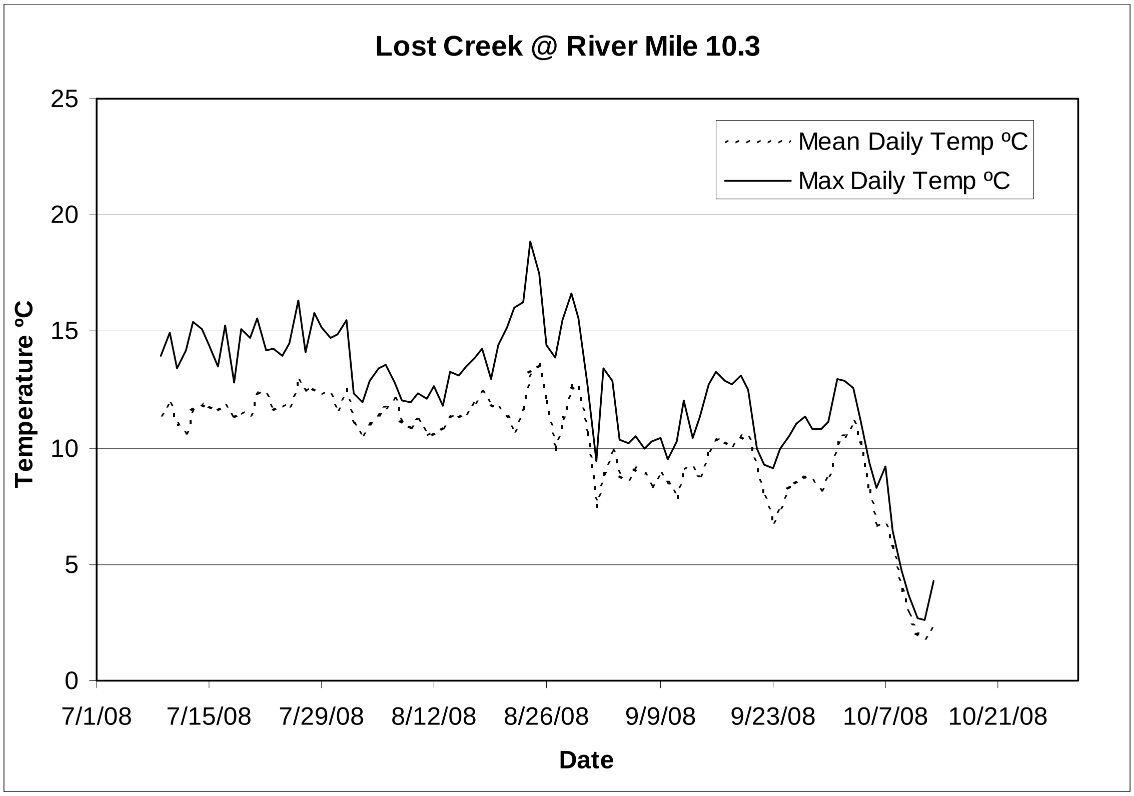


Lost Creek Drainage

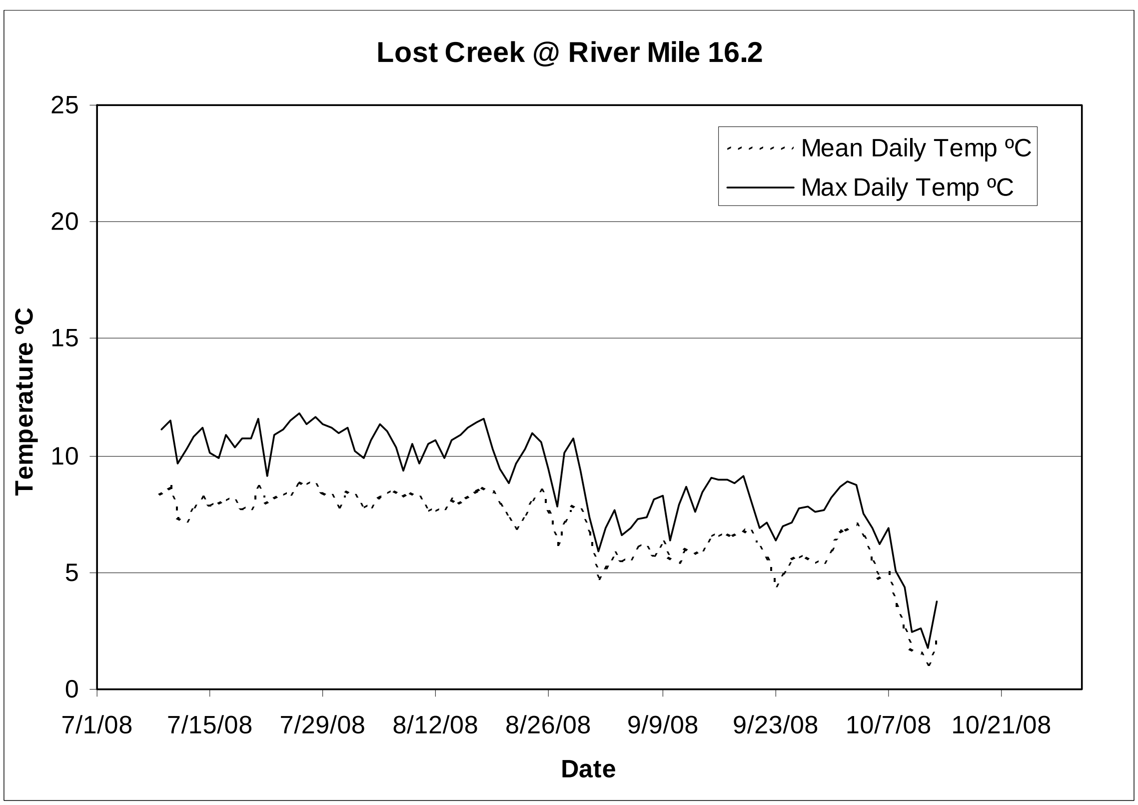
Lost Creek







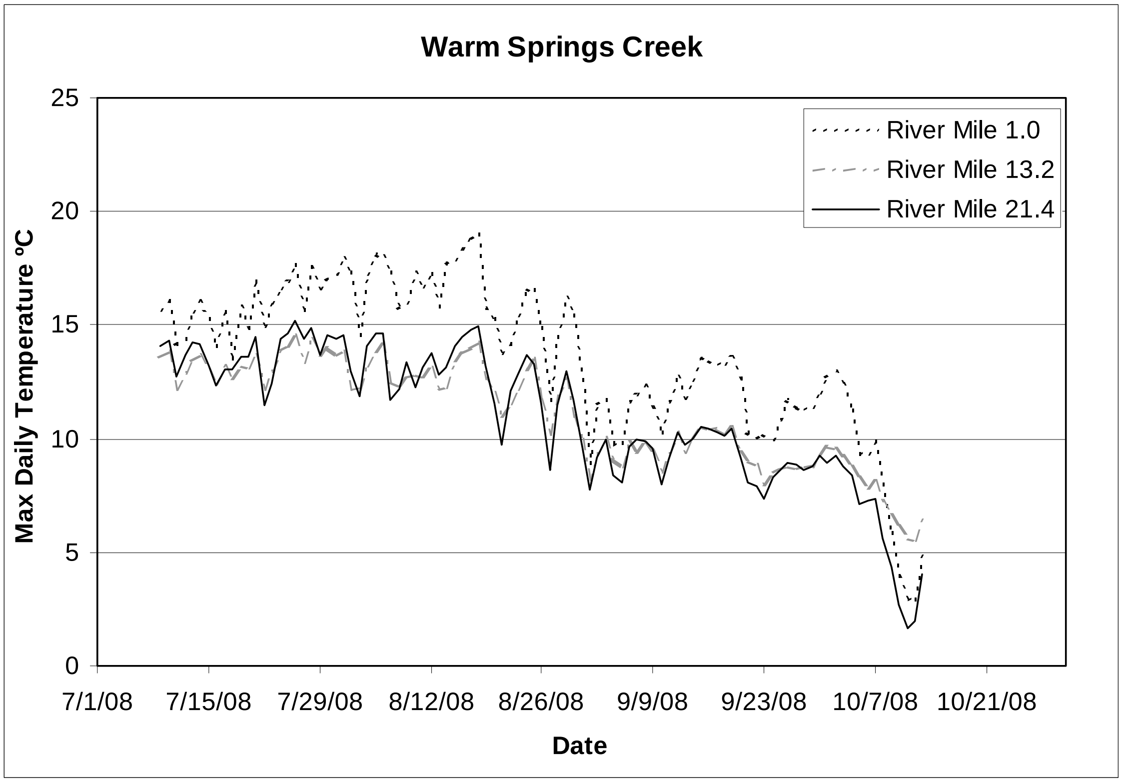
Lost Creek @ River Mile 10.3
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date

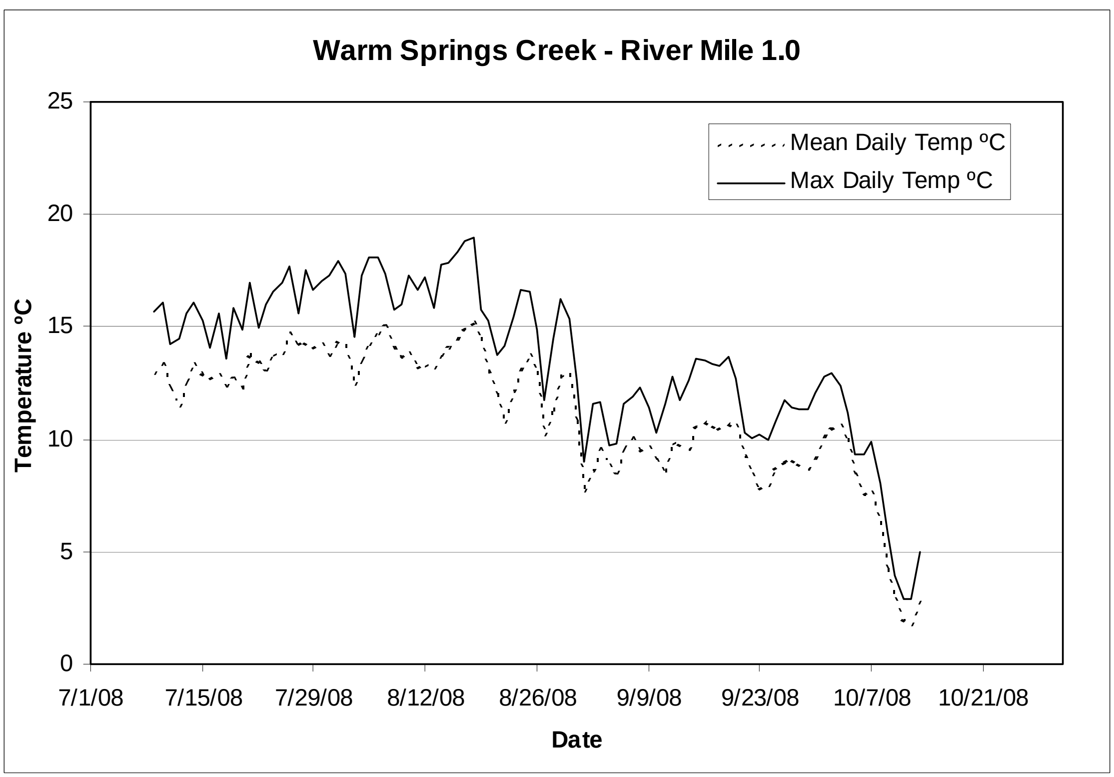


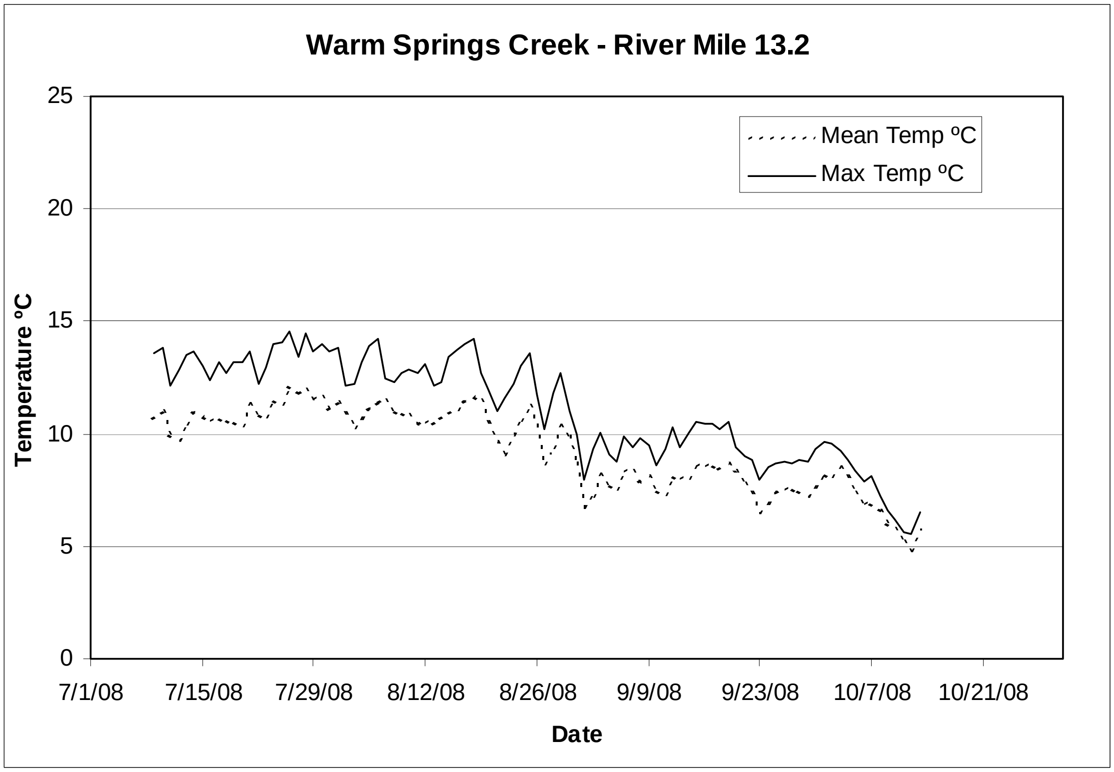
Lost Creek @ River Mile 16.2
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date

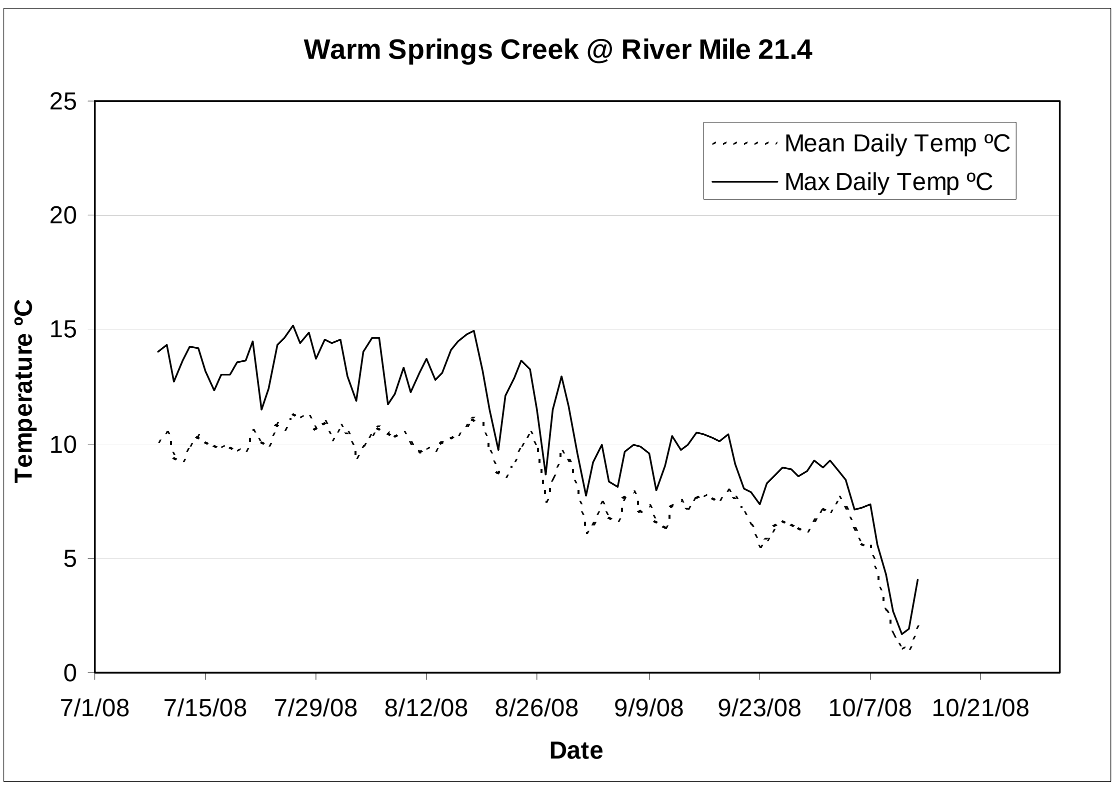
Warm Springs Creek Drainage

Warm Springs Creek



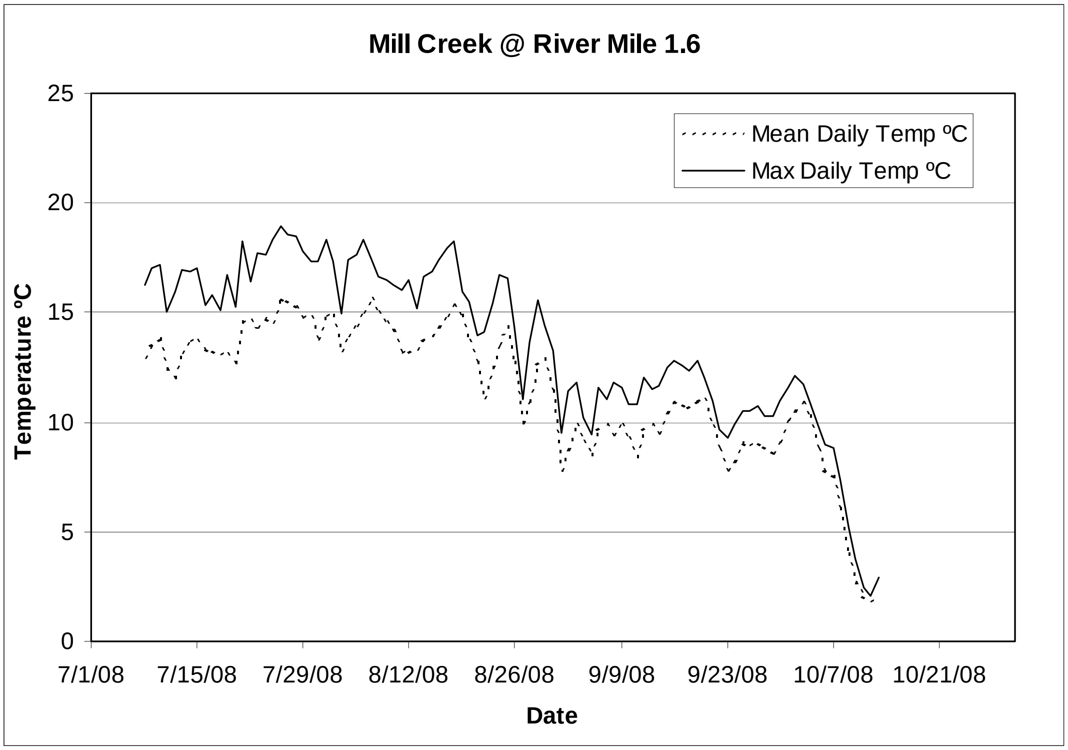



Warm Springs Creek - River Mile 13.2
Mean Temp ºC
Max Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date


Warm Springs Creek @ River Mile 21.4
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date

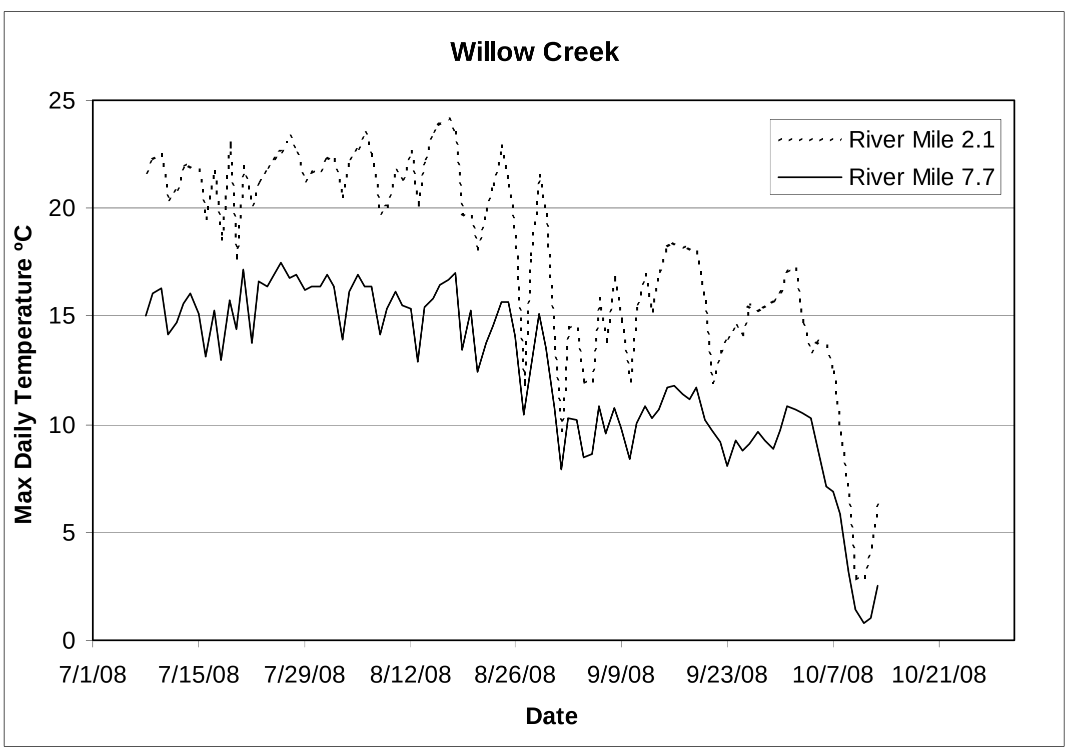
Mill Creek Drainage

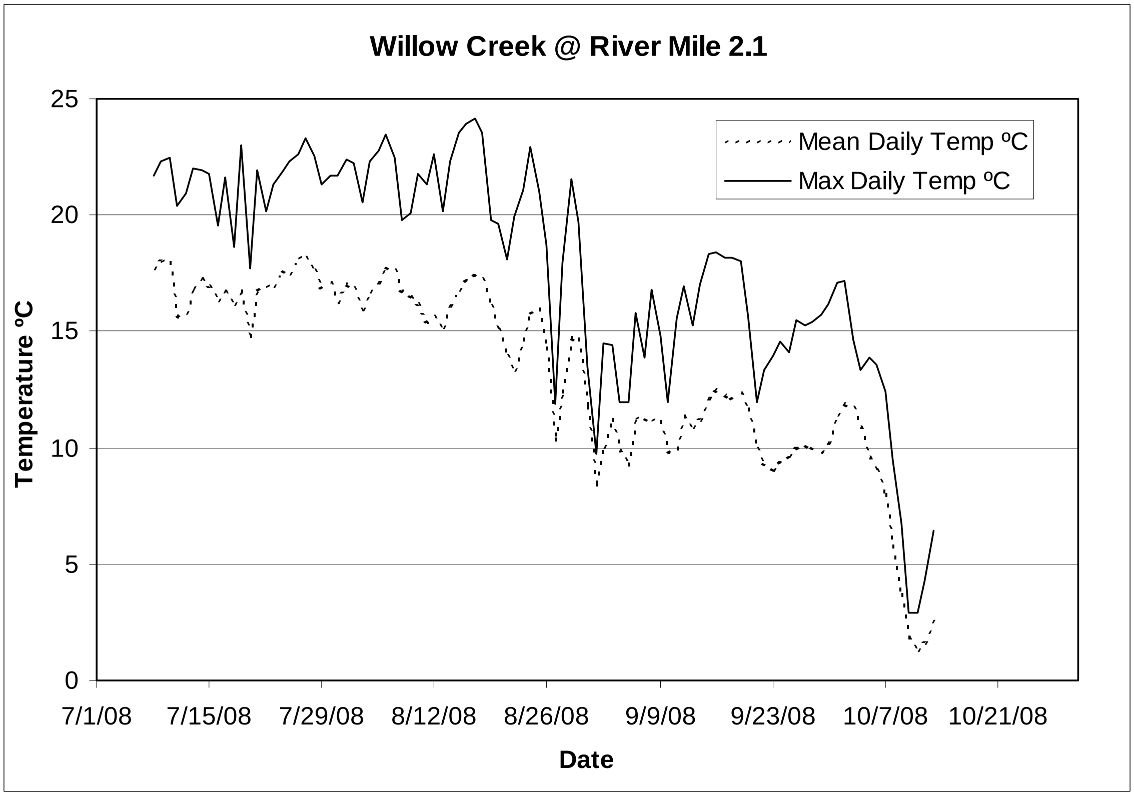
Mill Creek



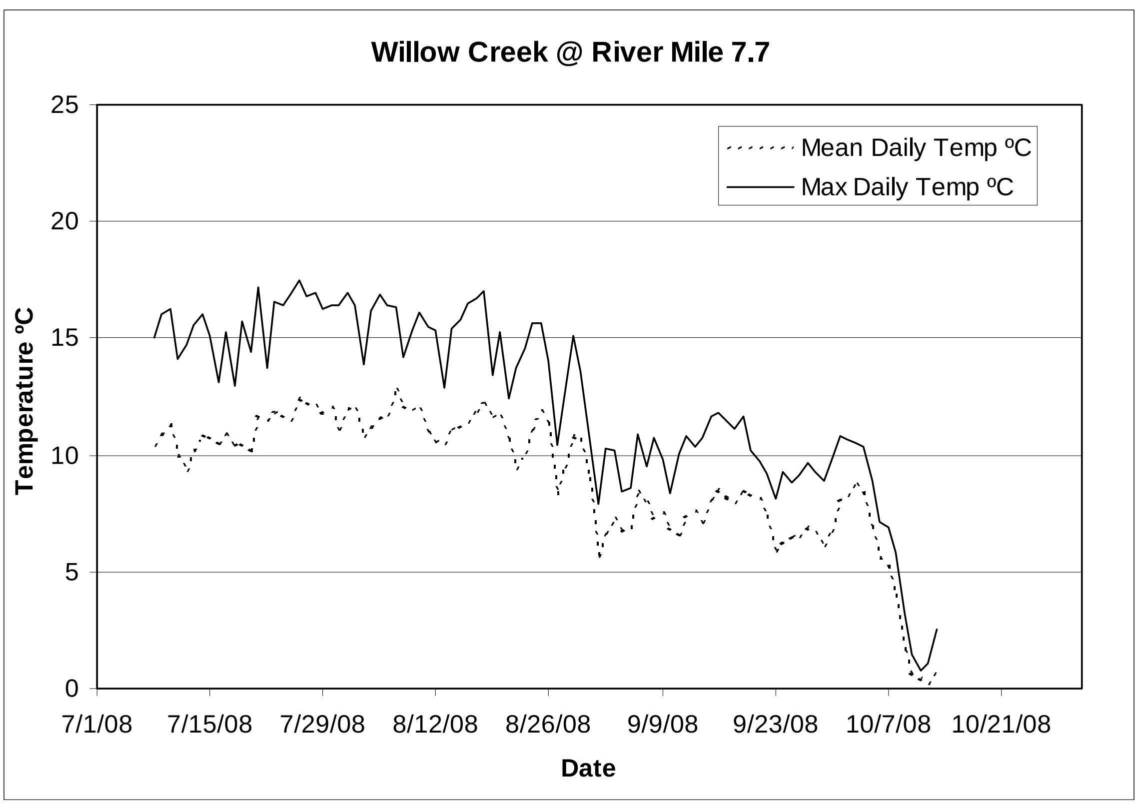
Willow Creek Drainage

Willow Creek





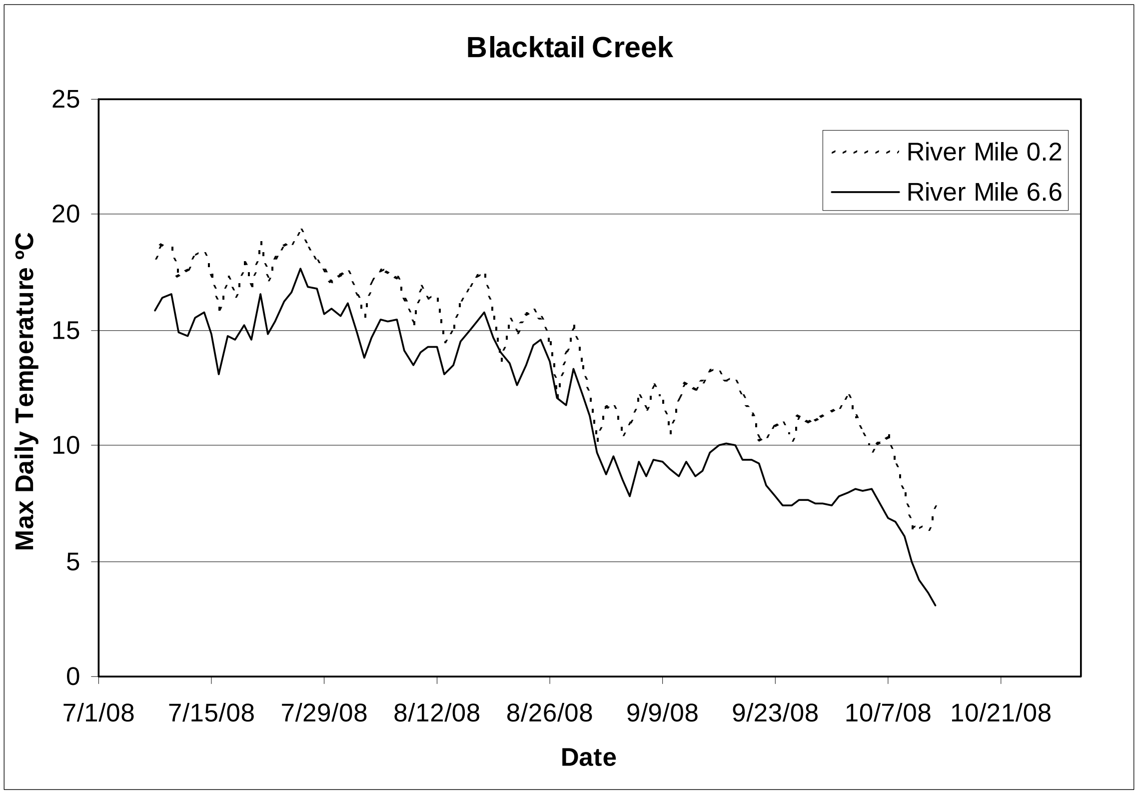
Willow Creek @ River Mile 2.1
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date

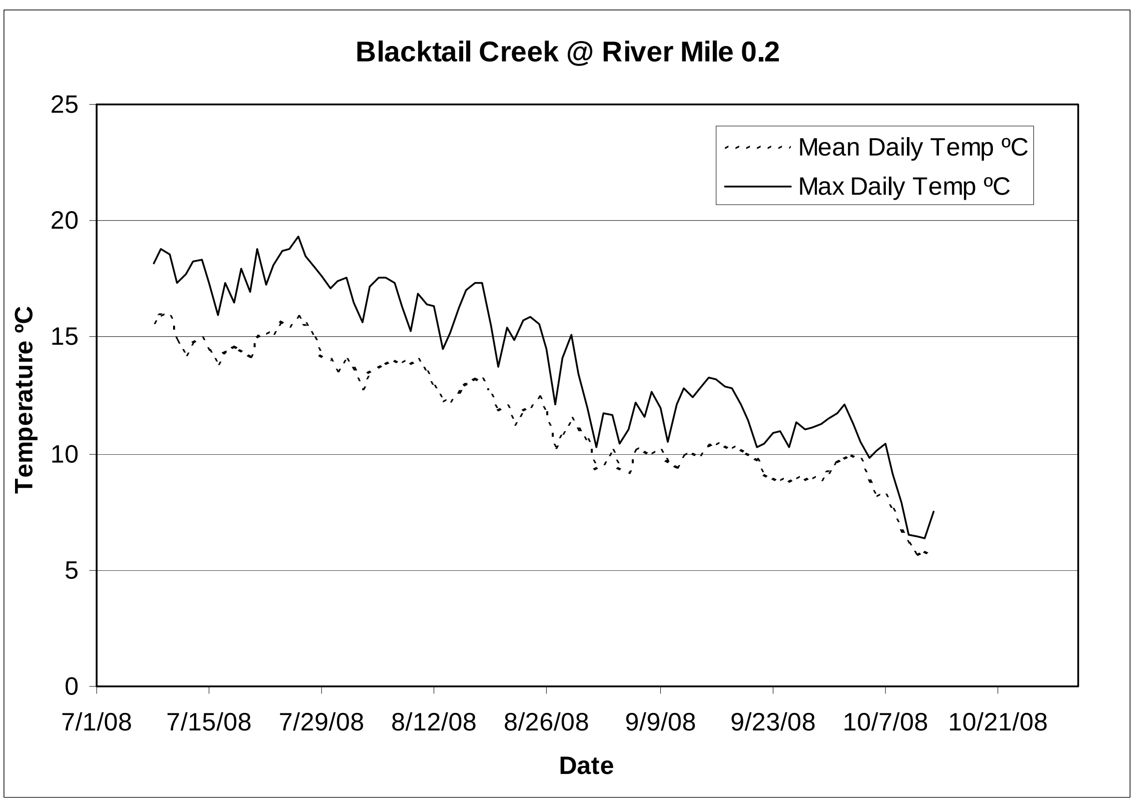


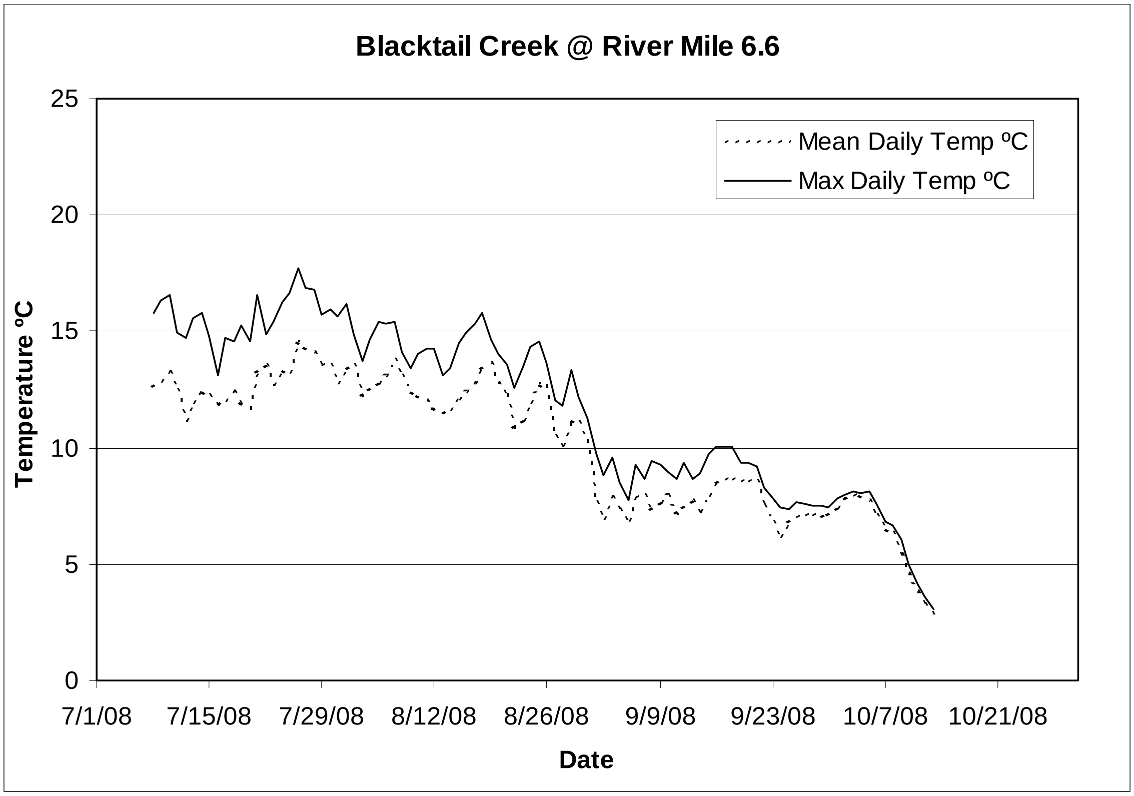
Willow Creek @ River Mile 7.7
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date

Silver Bow Creek Drainage

Blacktail Creek







Blacktail Creek @ River Mile 6.6
Mean Daily Temp ºC
Max Daily Temp ºC
Temperature ºC
25
20
15
10
5
0
7/1/08
7/15/08
7/29/08
8/12/08
8/26/08
9/9/08
9/23/08
10/7/08
10/21/08
Date

Appendix C

Environment Worksheet MT-1A
UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

RIPARIAN ASSESSMENT WORKSHEET

NAME OF STREAM: REACH LOC OR ID:
DATE: ID TEAM/OBSERVERS:
LENGTH OF REACH: LAT/LONG - BEGIN/END:
MAP OR QUAD NAME: ______________________ PHOTO #S:____________ PRIMARY LAND USE:___________________________
PLANT COMMUNITY: ROSGEN CHANNEL TYPE:
BFDEPTH:______ BFWIDTH:_______
WIDTH/DEPTH RATIO: CHANNEL SUBSTRATE:

Geomorphic Considerations

Question 1. Stream Incisement (Downcutting):
8 = Channel stable, no active downcutting occurring; or, old downcutting apparent but a new, stable riparian area has formed within the incised channel. There is perennial riparian vegetation well established in the riparian area (Stage 1 and 5, Schumm's Model Figure 2).
6 = Channel has evidence of old downcutting that has begun stabilizing, vegetation is beginning to establish, even at the base of the falling banks, soil disturbance evident (Stage 4, Schumm's Model Figure 2).
4 = Small headcut, in early stage, is present. Immediate action may prevent further degradation (Early Stage 2, Schumm's Model Figure 2).
2 = Unstable, channel incised, actively widening, limited new riparian area/floodplain, floodplain not well vegetated. The vegetation that is present is mainly pioneer species. Bank failure is common (Stage 3, Schumm's Model Figure 2).
0 = Channel deeply incised, resembling a gully, little or no riparian area, active downcutting is clearly occurring. Only occasional or rare flood events access the flood plain. Tributaries will also exhibit downcutting or signs of downcutting (Stage 2, Schumm's Model Figure 2).
The presence of active headcuts should nearly always keep the stream reach from being rated Sustainable.
SCORE: Potential ____________Actual______________
Please clarify the rationale for your score, including comments regarding potential and capability and document with photograph if appropriate.
Comments:

Question 2. Streambanks with Active Lateral Cutting (inspect banks on both sides of the stream):
8 = Lateral bank erosion is in balance with the stream and its setting.
5 = There is a minimal amount of human-induced, active lateral bank erosion occurring, primarily limited to outside banks.
3= There is a moderate amount of human-induced active lateral bank erosion occurring on either or both outside and inside banks.

0 = There is extensive human-induced lateral bank erosion occurring on outside and inside banks and straight sections.
SCORE: Potential ___________ Actual______________
Please clarify the rationale for your score, including comments regarding potential and capability and document with photograph if appropriate.
Comments:

Question 3. The Stream is in Balance with the Water and Sediment Supplied by the Watershed:
6 = The width to depth ratio appears to be appropriate for the stream type and its geomorphic setting. There is no evidence of excess sediment removal or deposition. There are no indications that the stream is widening or getting shallower. There may be some well-washed gravel and cobble bars present. Pools are common. Rosgen "B" and naturally occurring "D" channel types are exceptions.
4 = The stream has widened and/or has become shallower due to disturbances that have caused the banks to become unstable or from dewatering which reduces the amount of water and energy needed to effectively move the sediment through the channel. (Note: Sediment sources may also be from offsite sources.) Point bars are often enlarged by gravel with silt and sand common, and new bars are forming. Pools are common, but may be shallow. Rosgen "B" and naturally occurring "D" channel types are exceptions.
2 = The width to depth ratio exceeds what is appropriate for the stream type. Point bars are enlarged by gravel with abundant sand and silt, and new bars are forming that often force lateral movement of the stream. Mid channel bars are often present. For prairie streams there is often a deep layer of sediment on top of the gravel substrate. The frequency of pools is low. Rosgen "B" and naturally occurring "D" channel types are exceptions.
0 = The stream has poor sediment transport capability which is reflected by poor channel definition. The channel is often braided having at least 3 active channels. Naturally occurring Rosgen "D" channels types are exceptions. Pools are filled with sediment or are not existent.
SCORE: Potential_______________ Actual_____________________
Please clarify the rationale for your score, including comments regarding potential and capability and document with photograph if appropriate.
Comments:

Vegetative Considerations

Question 4. Streambank with Vegetation (Kind) having a Deep, Binding Rootmass:
Note: For stream types where riparian vegetation is not required for sustainability, this question can be skipped and given an N/A, with an explanatory note or comment. Be sure to adjust the potential score if this question is skipped.
(See Appendix I for stability ratings for most riparian, and other, species.)
6 = The streambank vegetative communities are comprised of at least four plant species with deep, binding root masses.
4 = The streambank vegetative communities are comprised of at least three plant species with deep, binding root masses.
2 = The streambank vegetative communities are comprised of two plant species with deep, binding root masses.

0 = The streambank vegetative communities are comprised of one or no plant species with deep, binding root masses.
SCORE: Potential_______________ Actual_____________________
Please clarify the rationale for your score, including comments regarding potential and capability and document with photograph if appropriate.
Comments:

Question 5. Riparian/Wetland Vegetative Cover (Amount) in the Riparian/Floodplain Area:
Note: For stream types where riparian vegetation is not required for sustainability, this question can be skipped and given an N/A, with an explanatory note or comment. Be sure to adjust the potential score if this question is skipped.
6 = More than 85% of the riparian/wetland canopy cover has a stability rating > 6
4 =75%-85% of the riparian/wetland canopy cover has a stability rating > 6
2 =65%-75% of the riparian/wetland canopy cover has a stability rating > 6
0 = Less than 65% of the riparian/wetland canopy cover has a stability rating > 6
NOTE: A low score for this item may be enough to keep the stream reach from being rated Sustainable
SCORE: Potential_______________ Actual_____________________
Please clarify the rationale for your score, including comments regarding potential and capability and document with photograph if appropriate.
Comments:

Question 6. Noxious Weeds in the Riparian Area:
3 = None of the riparian area has noxious weeds present.
2 = Up to 5% of the riparian area has noxious weeds (a few are present).
1 = Up to 10% of the riparian area has noxious weeds present (abundant).
0 = Over 10% of the riparian area has noxious weeds (very apparent and extensive distribution).
SCORE: Potential_______________ Actual_____________________
Please clarify the rationale for your score, including comments regarding potential and capability and document with photograph if appropriate.
Comments: (NOTE: List all noxious weed species)

Question 7. Disturbance-Caused Undesirable Plants in the Riparian Area:
3 = 5% or less of the riparian area with undesirable plants (very few present).
2 = 5-10% of the riparian area with undesirable plants (few are present).
1 = 10-15% of the riparian area with undesirable plants (commonly distributed).
0 = Over 15% of the riparian area with undesirable plants (abundant over much of the area).
SCORE: Potential_______________ Actual_____________________
Please clarify the rationale for your score, including comments regarding potential and capability and document with photograph if appropriate.
Comments: (NOTE: List all nuisance weeds and undesirable plants)

Question 8. Woody Species Establishment and Regeneration: Note: For stream types where riparian vegetation is not required for sustainability, this question can be skipped and given an N/A, with an explanatory note or comment. Be sure to adjust the potential score if this question is skipped.

8 = All age classes of desirable woody riparian species present (see Table 3).
6 = One age class of desirable woody riparian species is clearly absent, all others well represented. Often, it will be the middle age group(s) absent. For sites with potential for both trees and shrubs there may be one age class of each absent. Having mature individuals and at least one younger age class present indicates the potential for recovery.
4 = Two age classes (seedlings and saplings) of native riparian shrubs and/or two age classes of native riparian trees are clearly absent, or the stand is comprised of mainly mature species. Other age classes well represented.
2 = Disturbance induced, (i.e. facultative, facultative upland species such as rose, or snowberry) or non-riparian species dominate. Woody species present consist of decadent/dying individuals. (Refer back to Question 1 if this is the situation. The channel may have incised.)
0 = A few woody species are present (<10% canopy cover), but herbaceous species dominate (at this point, the site potential should be re-evaluated to ensure that it has potential for woody vegetation); or, the site has at ≥ 5% canopy cover of Russian olive and/or salt cedar. On sites with long-term manipulation or disturbance, woody species potential is easily underestimated.
SCORE: Potential________________ Actual______________________
Please clarify the rationale for your score, including comments regarding potential and capability and document with photograph if appropriate.
Comments:

Functional Considerations

Question 9. Utilization of Trees and Shrubs: Note: For stream types where riparian vegetation is not required for sustainability, this question can be skipped and given an N/A, with an explanatory note or comment. Be sure to adjust the potential score if this question is skipped.
4 = 0-5% of the available second year and older stems are browsed.
3 = 5%-25% of the available second year and older stems are browsed (lightly).
2 = 25%-50% of the available second year and older stems are browsed (moderately..
1 = More than 50% of the available second year and older stems are browsed (heavily). Many of the shrubs have either a “clubbed” growth form, or they are high-lined or umbrella shaped .
0 = There is noticeable use (10% or more) of unpalatable and normally unused woody species
SCORE: Potential________________ Actual______________________
Please clarify the rationale for your score, including comments regarding potential and capability and document with photograph if appropriate
Comments:

Question 10. Floodplain Characteristics for Dissipating Energy and Capturing Sediment.
8 = Active flood or overflow channels exist in the floodplain. Large rock, woody debris, and/or riparian vegetation appropriate for the setting are sufficient to adequately dissipate stream energy and trap sediment on the floodplain. There is little evidence of excessive erosion or disturbance that reduces energy dissipation and sediment capture on the floodplain. There are no headcuts where either overland flow and/or flood channel flows return to the main channel.
6 = The floodplain meets the characteristics of the description in Question 8 above, but demonstrates slight limitations in the kind and amount of large rock, woody debris, and/or riparian vegetation present. Riparian vegetation structure is below that required to dissipate

energy. There may be occasional evidence of surface erosion and disturbance, but generally not extensive enough to have affected channel development.
4 = Large rock, woody debris, and/or riparian vegetation is present, but generally insufficient (quality or quantity) to fully dissipate stream energy. Some sediment may be captured, but greater evidence of incipient erosion and/or headcuts is readily present.
2 = Inadequate Large rock, woody debris, and/or riparian vegetation is available for dissipation of energy or sediment capture. There is very little evidence of sediment capture. There is some streambank erosion due to human disturbance or alterations, and occasional headcuts where overland flows or flood channel flows return to the main channel.
0 = Floodplain area reflects the following conditions: 1) The floodplain area is very limited or not present and is inadequate to dissipate energy; 2) flood or overflow channels do not exist; and 3) large rock, woody debris, and/or riparian vegetation is not adequate to dissipate stream energy and trap sediment on the floodplain. Streambank and/or floodplain erosion and/or evidence of human alteration are common. “G”- and “F”-type channels (Rosgen) typically reflect these conditions.
SCORE: Potential_______________ Actual______________________
Please clarify the rationale for your score, including comments regarding potential and capability and document with photograph if appropriate.
Comments:

SUMMARY SCORE
POTENTIAL /ACTUAL /POSSIBLE
QUESTION 1: Stream Incisement 0, 2, 4, 6, 8
QUESTION 2: Lateral Cutting 0, 3, 5, 8
QUESTION 3: Stream Balance 0, 2, 4, 6
QUESTION 4: Deep, Binding Rootmass N/A, 0, 2, 4, 6
QUESTION 5: Riparian/Wetland Vegetative Cover * N/A, 0, 2, 4, 6
QUESTION 6: Noxious Weeds 0, 1, 2, 3
QUESTION 7: Undesirable Plants 0, 1, 2, 3
QUESTION 8: Woody Species Establishment N/A, 0, 2, 4, 6, 8
QUESTION 9: Browse Utilization N/A, 0, 1, 2, 3, 4
QUESTION 10: Riparian Area/Floodplain Characteristics * N/A, 0, 2, 4, 6, 8
TOTAL (60 total possible)
(POTENTIAL SCORE FOR MOST BEDROCK OR BOULDER STREAMS) (36)
(questions 1, 2, 3, 6, 7, 10)
(POTENTIAL SCORE FOR MOST LOW ENERGY “E” STREAMS) (48)
(questions 1 – 7, 10)
RATING: = Actual Score X 100 = % rating
Potential Score
80-100% = SUSTAINABLE
50-80% = AT RISK
LESS THAN 50% = NOT SUSTAINABLE
* Only in certain, specific situations can both of these receive an "N/A".
Please clarify the rationale for your rating, including comments regarding potential. Can the limitations be addressed by the decisionmaker?

NOTES

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TREND: Does the reach appear to be improving or declining? Explain.

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NRCS, MT
September 2004

FISH HABITAT ASSESSMENT WORKSHEET

Name of Stream __________________________________ Reach Loc or ID ______________________

Date ____________ Reach Length __________ Observer(s) _____________________________

Question 1. Fish habitat quality as related to available cover*

10 = Excellent – A reach exhibits EXCELLENT fish habitat when there is an even mix of cover components including large woody debris, large pools, root wads, overhanging vegetation, boulders and undercut banks. A reach with EXCELLENT fish habitat should also have a fair amount of shallow areas and small side channels at the stream margins that provide habitat for young-of-the-year and juvenile fish.

7 = Good – A reach exhibits GOOD fish habitat when the above cover components are present but may be somewhat lacking in quantity or quality in one or more of those components.

3 = Fair – A reach exhibits FAIR fish habitat when one or more of the above cover components is severely limited in quantity or quality or is completely absent from the reach.

0 = Poor – A reach exhibits POOR fish habitat when all or most of the above cover components are absent or are severely limited.

SCORE: Potential ___________________ Actual _____________________

Notes: Be sure to note instream cover components present within the surveyed reach as well as their general quantity and quality. Note the potential for future recruitment of large woody debris to the channel (i.e. are there trees within one tree length of the channel?). Also, note if the reach appears to provide potential spawning habitat (i.e. glide/run habitats with well sorted and clean gravels).

*** Some channel types may not require all cover components to be considered healthy. For example, E channels typically do not require abundant large woody debris or boulders as critical components of fish habitat, and healthy A and B channels do not necessarily require a significant proportion of undercut banks. It is best to think about what cover components would be expected under pristine conditions given the channel type and riparian vegetation present (THIS IS THE POTENTIAL).**

Environment Worksheet MT-1B
NAME OF STREAM: ________________________________ REACH ID: ___________________ DATE: ________________

SUPPLEMENTAL ATTRIBUTES

Note: These attributes are used to help characterize the condition of aquatic habitat and water quality associated with the riparian reach. As appropriate, complete a separate form for each reach. Check the most appropriate narrative criterion for the reach along with entering notes to explain the rationale for the value. A score is not calculated for this supplemental assessment. Please clarify the rationale for your rating, including comments regarding potential and document with photograph(s), if appropriate.

1) AQUATIC LIFE SUBSTRATE HABITATS

Excessive sediment deposited on the substrate often suffocates fish eggs and destroys macroinvertebrate habitat, especially if it occurs in fast moving/riffle dominated streams. For prairie streams the excessive sediment may also bury the aquatic vegetation. Excessive silt and sand often fills the interstices between the cobbles and gravel causing them to become embedded (cemented together or difficult to move).

Stream Bottom (For Fast moving/Riffle dominated streams)

___ Stony substrate of several sizes packed together, interstices obvious. Some silt may be present. Substrate is easily moved.

___ Stony substrate is interspersed with silt and sand. Cobbles are partially embedded and not easily moved. There are also usually slight depositions of sand and silt at the fringes of the stream channel and in the pools.

___ Bottom of silt, gravel and sand, cobbles are fully embedded and extremely difficult to move.

___ Uniform bottom of sand and silt loosely held together, stony substrate absent or buried.

Stream Bottom (For slow moving/pool dominated streams)

___ Mixture of substrate material with gravel or firm sand prevalent and/or vascular root mats and submerged vegetation abundant.

___ Mixture of gravel with soft sand and silt common; and/or some vascular root mats and submerged vegetation.

___ Mixture of soft sand, silt or clay; gravel is not common and little or no vascular root mats or submerged vegetation present.

___ All mud or clay, or channelized with sand bottom and no vascular root mats or submerged vegetation

Comments:

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2) FISH HABITATS

Fish and their fry need a variety of habitat types to flourish. This usually includes a mix of deep and shallow pools and security cover that are created by vegetation, woody debris, boulders, undercut banks, etc. The type of habitat that is important is dependant of the stream type. For example, woody debris and overhanging vegetation are often important for small Rosgen "A" and "B" streams that are in a forested environment while large deep pools and aquatic vegetation are important for Rosgen "C" channels in the prairie. Please note that short-term climatic effects such as high flows or drought should be considered when assessing fish habitat.

___ Even mix of deep, shallow, large and small pools (prairie streams would expect long deep pools); habitats created by woody debris, overhanging vegetation, boulders, root wads, undercut banks and/or abundant aquatic vegetation.

___ Shallow pools more prevalent than deep pools; limited habitats created by woody debris, overhanging vegetation, boulders, root wads, undercut banks and/or aquatic vegetation are limited.

___ Majority of pools are small and shallow or pools are absent; Habitats created by woody debris, overhanging vegetation, boulders, root wads, or undercut banks and/or aquatic vegetations are rare or nonexistent.

___ There is not enough water to support a fishery due to human-induced dewatering

___ Streams would not support fish under natural conditions due to insufficient flow.

Comments:

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3) TEMPERATURE INDICATORS

Elevated temperatures often have a negative impact on the fishery and aquatic life, especially for cold-water streams that are located within the mountains, intermountain valley and prairie foothills of western Montana. For small streams the lack of shade from riparian vegetation or other physical features such as undercut banks are often an important factor that causes elevated temperatures. While for all streams the storage of water by small dams or the widening of a stream channel and decrease in pool depth that exposes a larger volume of the stream's water to solar radiation will often cause the temperature to increase during the summer. Another practice

that can severely elevate the stream temperature is irrigation, either by chronic de-watering or through returning warm surface irrigation water to the stream. Also, intensive land uses within the watershed can decrease rainfall or snowmelt infiltration, change runoff patterns (i.e., streams often have a flashier hydrograph) and reduce the amount of groundwater (which tends to be cold) that is discharged into the stream during the late summer when the air temperatures are high.
___ The stream has adequate shading, stable geomorphology and sufficient flow or return flow to prevent the water temperature from becoming a stressor (Note: prairie streams and E channels may not have much potential for shading from vegetation and elevated temperatures from beaver ponds are considered to be natural stressors).
___ The shading, stream width, flow and presence or water storage (i.e., presence of water impoundments) have been ___ The shading, stream width, flow or water storage (i.e., presence of water impoundments) has been altered sufficiently enough where the temperature will likely become moderately elevated and aquatic life are impacted. Intensive land uses within the watershed may have an effect on the amount of groundwater discharging into the stream during the summer.
___ The shading, stream width, flow or water storage (i.e., presence of water impoundments) has been altered sufficiently enough where the temperature will likely become elevated to a level where aquatic life are severely impacted. Intensive land uses within the watershed may have a severe effect on the amount of groundwater discharging into the stream during the summer.
Comments:
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4) FLOW
The lack of flow or unnatural flow alterations often negatively impact aquatic life habitats for a variety of reasons including loss of habitat or increased salinity (i.e., low flow in prairies streams) or increased sediment. The effects from de-watering should be assessed during critical low flow periods or else you should inquire locally about this with fish biologists, anglers, landowners, etc. You should also consider and evaluate the effects from local land uses, inter-basin transfer (too much water) and hydrologic alterations such as dikes and dams which may prevent a stream's ability to access its historic flood plain or cause a stream reach to become de-watered, etc.
___ There is no noticeable alteration to the flow.
___ Change in flow is noticeable; however flow appears to be adequate for aquatic life.
___ Flow supports aquatic life, but habitat, especially riffles are drastically reduced or impacted and the pools are shallow; or there may not be a sufficient amount of flow during the spring runoff that accesses the floodplain (impacts of storage reservoirs). Or there are unnatural flows (volume and/or duration) that are likely to impact aquatic life. Intermittent prairie streams may have pools with high salinities caused by evaporation.
___ Water is present but not sufficient enough to support a diversity of aquatic life, especially fish. Pools dominate and are shallow and disconnected.

___ All water has been diverted from the stream channel or flows are so low that they would not support aquatic life.
Comments:
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5) NUTRIENT INDICATORS

Nitrogen and phosphorus are macronutrients that are usually associated with aquatic plant growth and abundance. Algal biomass, and in some cases vascular aquatic plants, are response variables to nutrient concentrations and directly affect the beneficial uses of a stream. A few detrimental effects of excessive algae include: reduced aesthetic and recreational opportunities; impairment of aquatic life caused by the depletion of dissolved oxygen; clogging of pumps for agricultural and industrial uses; or an unpleasant taste or odor that may impact the ability to use the water as a source of drinking water.

Algal biomass and in some cases vascular aquatic plants are response variables to nutrient concentrations and directly affect recreation use (and aesthetics), aquatic life and possibly other uses. Nitrogen and phosphorus concentrations usually limit the growth and abundance of algae. Microalgae (diatoms) are useful ecological indicators because they are found in abundance in most aquatic environments. A healthy stream has a sufficient amount of microalgae to cause the rocks to be slippery. These algae are often observed as a green or brown growth on the stream substrate (e.g., cobbles). Excessive microalgae growth is often an indicator of high nutrient levels. Large amounts of filamentous algae are usually good indicators of high nutrient levels. However, there are exceptions. For example, filamentous algae can be found in cold clear streams that are near ground water discharge areas. In these cases, the filamentous algae tend to be short and patchy, the density is usually low, and occurrences are not widespread. Phytoplankton is algae that is suspended in the water column and causes the water to appear to be turbid and green. It is usually found in unstable prairie streams where aquatic plants and benthic algae communities are not able to establish. Do not confuse aglal growth with that of vascular plants such as macrophytes. Healthy prairie streams and low gradient mountain and foothill streams often have well established macrophyte (submerged and emergent) communities that indicate stable conditions. The abundance of algae is often used as an indicator of nutrient enrichment. However, the assessor should be aware that toxics, light, temperature, de-watering, and scouring also affect algae growth. Please include comments regarding the current condition that stimulate or hinder the growth of algae, including weather, light, temperature, scouring, etc. Estimate the percent of the substrate that is covered with filamentous algae or aquatic plants____%.

___ A thin layer of algae is barely visible or rocks are slippery, patches of filamentous algae are short and occur occasionally.

___ Accumulation of algae layer is easily visible on cobbles and along the channel edge. Filamentous algae may be present but filaments are short and patchy and occurrences are not widespread.

___ There are thick micro-algae (diatom) layers on the cobble and/or filamentous algae are common. Prairie streams (pools) may appear to be green or have small-suspended particles (not clay or silt) due to phytoplankton growth or abundant rooted pondweeds (macrophytes) are present.
___ Algae mats cover the bottom (hyper enriched conditions) or plants not apparent and rocks not slippery (toxic conditions; e.g., from mining drainage).
Comments:

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OBSERVATIONS

1) DESCRIBE ANY POSSIBLE FISH BARRIERS OR ENTRAINMENT OF FISH INTO WATER DIVERSIONS. Culverts, water diversions, dams and other structures can often have a serious impact on fish populations by either preventing access to an upper or lower stream reach or by literally removing the fish from the stream.

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2) DESCRIBE ANY OBSERVATIONS OF SURFACE OILS, TURBIDITY, SALINIZATION, PRECIPITANTS OR WATER ODOR.

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3) DESCRIBE THE MACROINVERTEBRATE COMMUNITY. For flowing waters are there black fly larva on cobbles that would indicate organic enrichment? Are macroinvertebrates rare or absent or does there appear to be a diverse macroinvertebrate community?

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4) FULLY DESCRIBE ALL LAND USE ACTIVITIES THAT MAY IMPACT WATER QUALITY OR HABITAT that are adjacent to the stream such as concentrated livestock operations, wastewater discharges, mines, row crops, etc. Review aerial photography and talk to the landowners to determine historic land uses and current management approaches.

5) IF YOU HAVE A METER, RECORD THE PH, TEMPERATURE, SPECIFIC CONDUCTIVITY AND DISSOLVED OXYGEN. Include the time of day and estimated or measure discharge for the time period in which these measurements were taken.

6) IS THERE EVIDENCE OF ICE SCOUR OR RECENT FLOODING? If so, please describe the extent and impacts (such as scoured stream banks with exposed soil) that ice scour or flooding may have on stream bank or channel stability.

7) LEVEL OF CERTAINTY. Please describe the level of certainty of the assessment based on the degree of accessibility to the stream reach. Rank the level of certainty (1-4) according to the following narratives:
Level 1 No access. The stream reach was not walked at any location. Only aerial interpretations were made.
Level 2 Limited on stream access. The stream reach was accessed at 1-3 locations and observations from an adjacent road were minimal.

Level 3 Multiple points along the stream reach were accessed and/or a large percentage of the stream was viewed from an adjacent road (in combination with several access points).
Level 4 The entire stream reach was accessed.
The level of certainty for the assessment:

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NRCS, MT
September 2004