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Abstract: Sampling results for the Yellowstone River, Shields River, and Dailey Lake for 2012 and 2013.

Fisheries Investigations in the Yellowstone and Shields River Basins, Park County, Montana

Annual Report for 2012 and 2013

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Abstract

The Mill Creek Section on the Yellowstone River was sampled in 2012, and abundance estimates for rainbow *Oncorhynchus mykiss* and brown trout *Salmo trutta* were down slightly from 2009. The Yellowstone cutthroat trout *Oncorhynchus clarki bouvieri* estimate was higher than 2009. In the Shields River, the Zimmerman and Convict Grade sections were sampled in both 2012 and 2013. In the Convict Grade Section, the 2012 brown trout abundance estimate was down slightly from 2011, and the 2013 abundance estimate was higher than 2012. Low sample numbers of rainbow trout prohibited calculation of an abundance estimate in 2012, but one was calculated in 2013. Low numbers of Yellowstone cutthroat trout prohibited the calculation of abundance estimates in 2012 and 2013. Abundance of brown trout in the Zimmerman Section was not calculated in 2012 due to low numbers of fish, and the 2013 estimate was higher than 2011. The abundance estimate for mountain whitefish in the Zimmerman Section increased in both 2012 and 2013. Low numbers of Yellowstone cutthroat and eastern brook trout in the Zimmerman Section prohibited the calculation of abundance estimates in 2012 and 2013. Results from the long-term gill netting series in Dailey Lake show that catch-per-unit-effort (CPUE) for rainbow trout and walleye *Stizostedion vitreum* increased while yellow perch *Perca flavescens* and Yellowstone cutthroat trout decreased. This is the second year that Yellowstone cutthroat trout have been captured in nets after being stocked annually starting in 2008. Average lengths of rainbow trout and walleye decreased from 2011 to 2012. Average lengths of Yellowstone cutthroat trout increased and yellow perch remained the same for this time period. A night electrofishing effort was made in 2012 with limited success in further describing fish populations in the lake. No sampling of Dailey Lake occurred in 2013.

Introduction

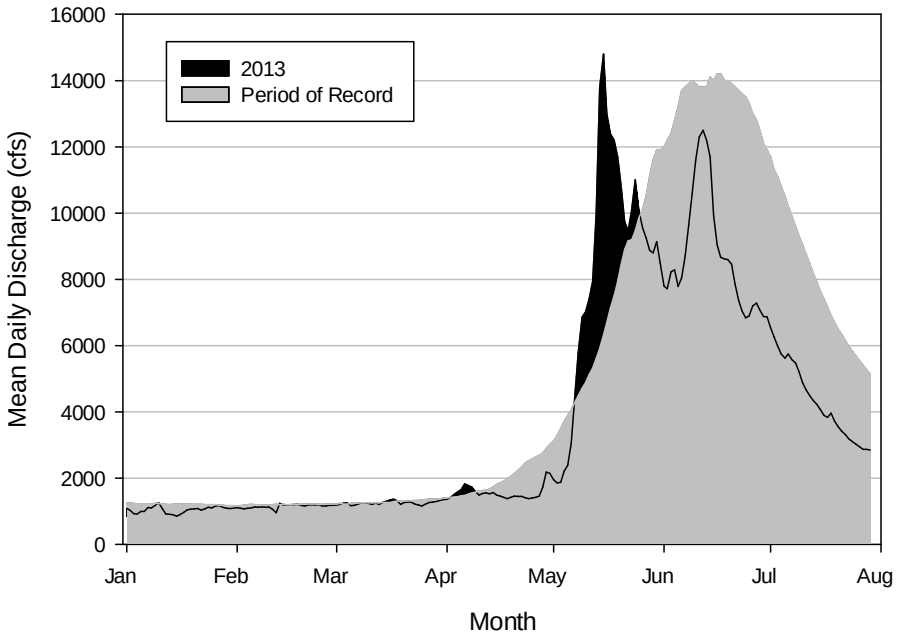
Electrofishing Procedures

Mark-recapture methodology was used to estimate trout populations in the Yellowstone and Shields Rivers. Marking and recapture runs consisted of electrofishing the entire section or reach of river, with multiple fish-working stops to minimize stress of sampled fish. During the marking run all fish were marked with a fin clip, which can be detected during subsequent sampling events. The fish were then released back into the section and allowed to redistribute themselves for 7 days. After this redistribution period the recapture run was completed. Fish were examined and those that had the first fin clip are noted as recaptured.

Yellowstone River Procedures

In 2013, no sections were sampled in the Yellowstone River due to the near record low flows prior to runoff and the rapid increase in flows as runoff began (Figure 1).

In spring 2012, trout were only sampled in the Mill Creek Section of the Yellowstone River (Table 1 and Figure 2), which is a long-term monitoring section.



- Figure 1: Mean daily discharge for the Yellowstone River at the USGS 06192500 gage, near Livingston, for 2013 and the period of record (5/1/1897-12/31/11).

Electrofishing of the Yellowstone River was completed through the use of two jet boats mounted with boom electrofishing equipment. One boat was an 18-foot aluminum Alumacraft™ outboard jet boat with a Mercury™ 90 jet, equipped with a Coffelt™ VVP-15 and a 5,000-watt Honda™ EG5000CL

generator. The second boat was a 20-foot Wooldridge™ outboard jet boat with an Evenrude™ 225 jet, equipped with a Coffelt™ VVP-15 and a Honda™ EM7500 generator. The anodes on both boats were stainless steel droppers suspended from twin booms at the bow, and the hull served as the cathode.

A mark-recapture effort was made on the Mill Creek Section. Fish were netted and held in live cars. After anesthetizing, the fish were identified to species, measured to the nearest 0.1 inch, and weighed to the nearest 0.01 pound. Trout were marked with a fin clip and returned to the river. Seven days after the last marking run, the recapture effort was made.

Captured Yellowstone cutthroat, twelve inches and greater in total length, were tagged with a yellow, numbered, Floy™ tag to allow for large-scale monitoring of movement and growth of individual fish.

Population abundance was estimated using FA+ (MFWP 2004). The partial log-likelihood model was used for the estimates. For the partial log-likelihood model, fish were separated into one-inch length groups for analysis. Population estimates for brown and rainbow trout ≥ 7 inches and Yellowstone cutthroat trout ≥ 10 inches were calculated in the Mill Creek Section.

- Table 1: Survey section where trout abundance and composition was sampled in the Yellowstone River in 2012.

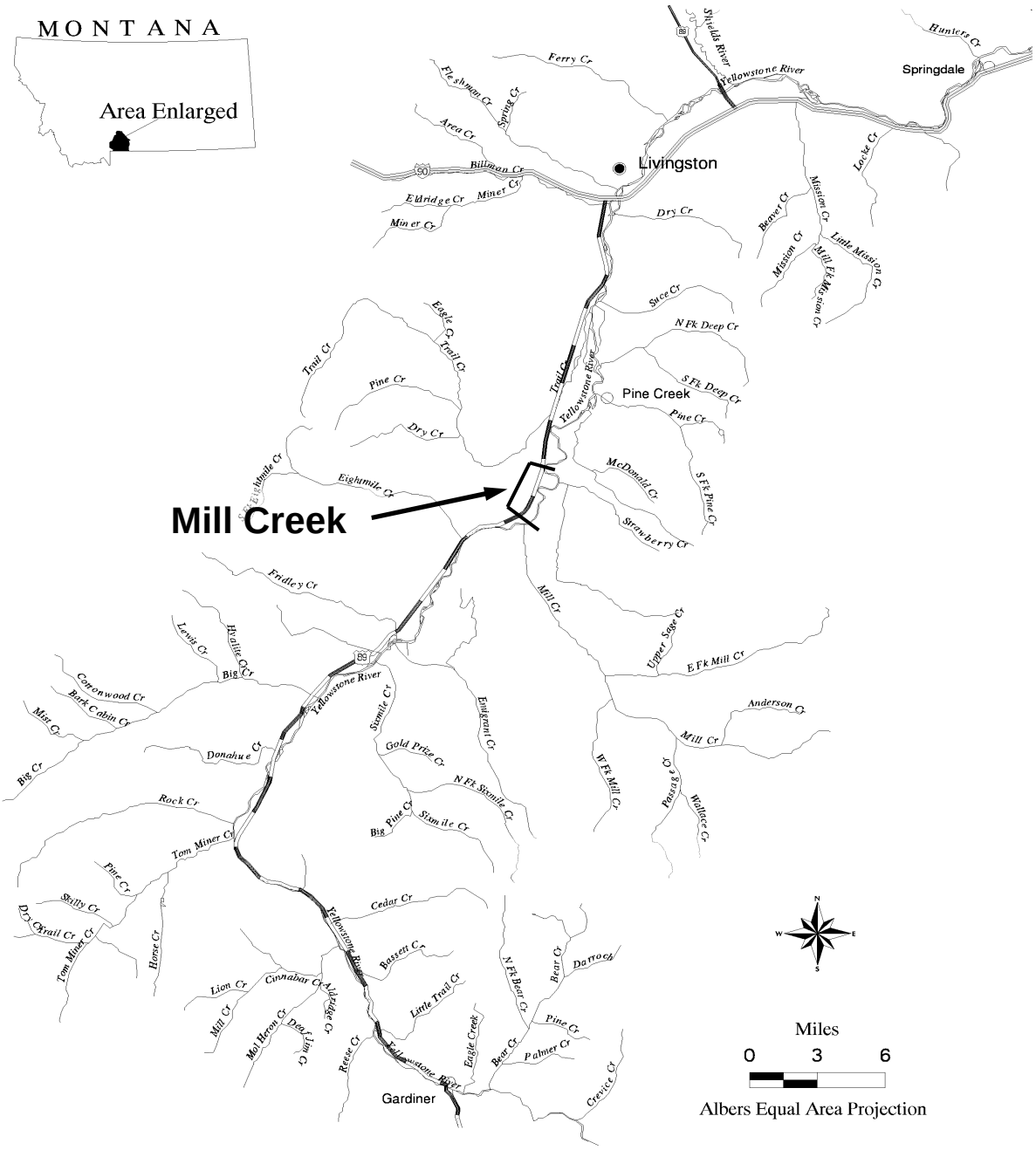
Section Name	Survey Date	Length (ft)	Approximate Location		
Mill Creek	04/16/12	24,816	Upper Boundary	North	45.64994
				West	110.56211
			Lower Boundary	North	45.69826
				West	110.51517

- Coordinates in decimal degrees are NAD83 datum.

Mill Creek Section

Survey runs were made on the Mill Creek Section on April 16, 17, 18, and 23, 2012. The section was split into five subsections. On April 16, the right and left bank of the first two subsections were sampled. Both banks of third and fourth subsections were sampled on April 17 and the fifth subsection was sampled on April 18. On April 23, another marking run was completed on both banks of the entire section. Only one boat was use April 16-18 and two boats were used on April 23. All trout were marked with a left pelvic fin clip.

The recapture effort for the entire section was completed on April 30 with the use of two boats, one on each bank.



• Figure 2: Map of the Upper Yellowstone River drainage displaying the location of the 2012 sampling section.

Yellowstone River Results

Yellowstone River Trout Abundances

Electrofishing data were used to calculate trout abundance estimates and monitor population trends. Results, by species, are presented below (Table 2).

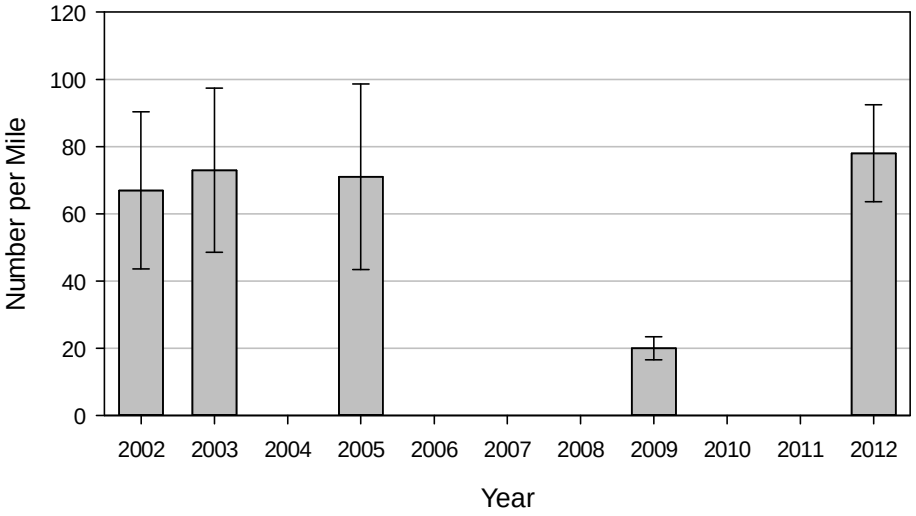
- Table 2: Population abundance results for the Mill Creek Section of the Yellowstone River by species in 2012. Est represents the number of brown and rainbow trout (≥7 inches) per mile and Yellowstone cutthroat trout (≥10 inches) per mile.

Section (mark date)				Overall model			Pooled model	
Fish Species	**Est**	**SD**	**DF**	**Chi-square**	**P**	**DF**	**Chi-square**	**P**
Brown Trout	255	16.3	11	12.52	0.33	7	8.64	0.28
Rainbow Trout	391	19.6	7	5.86	0.56	7	5.86	0.56
Yellowstone Cutthroat Trout	78	7.2	3	4.15	0.25	2	1.96	0.38

Yellowstone Cutthroat Trout

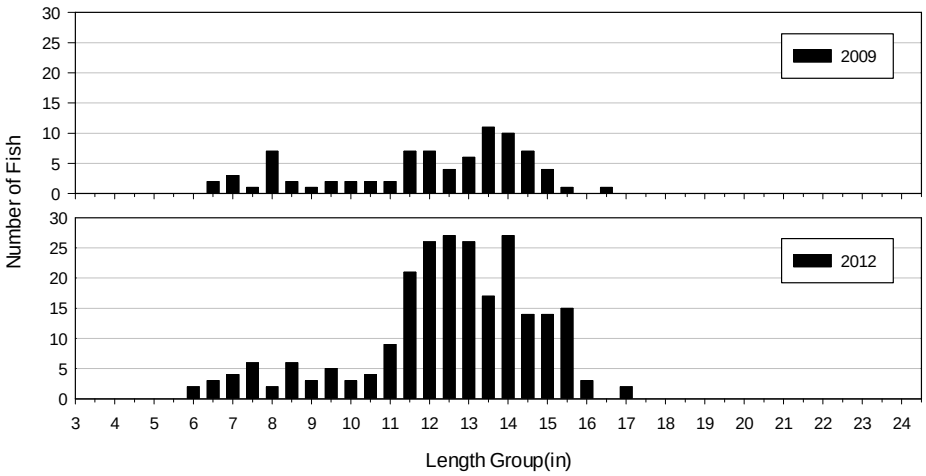
Mill Creek Section

The population estimate for Yellowstone cutthroat trout in the Mill Creek Section was 78 fish/mile (≥ 10in), in 2012. This is up significantly from the 2009 estimate of 20 fish/mile (≥ 10in), but remains similar to the 2002, 2003, and 2005 estimates (Figure 3). Yellowstone cutthroat trout that showed morphological signs of hybridization were not included in the abundance estimates.



- Figure 3: Abundance estimates for Yellowstone cutthroat trout (≥ 10in) in the Mill Creek Section of the Yellowstone River from 2002-2012. Error bars represent +/- 2 SD. The section was not sampled in 2004, 2006, 2008, and 2010. No abundance estimates were made in 2007 and 2011.

Comparison of length-frequency distributions from 2009 and 2012 indicate almost no changes in the overall size range. In 2012, there was an increase in the number of fish in the 10.5 to 17.0 inch range indicating increased survival and recruitment of fish in this size range (Figure 4).

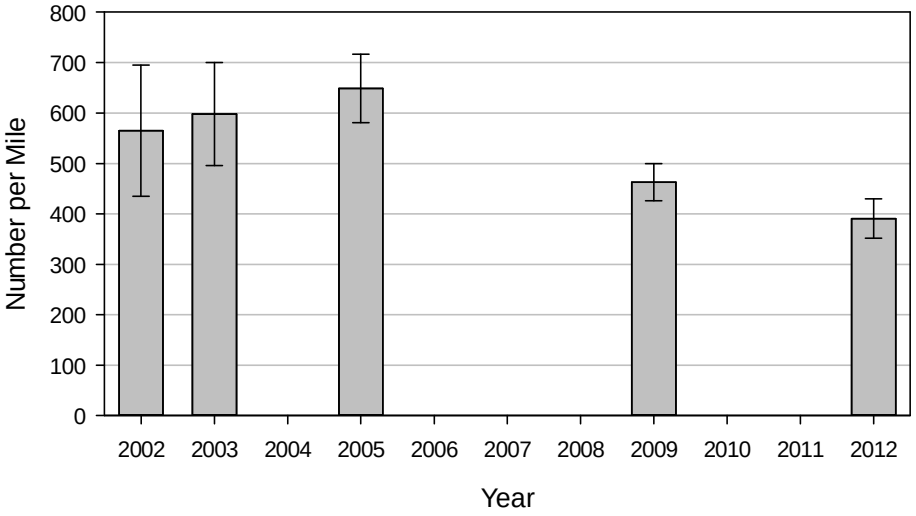


- Figure 4: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Mill Creek Section of the Yellowstone River during 2009 and 2012.

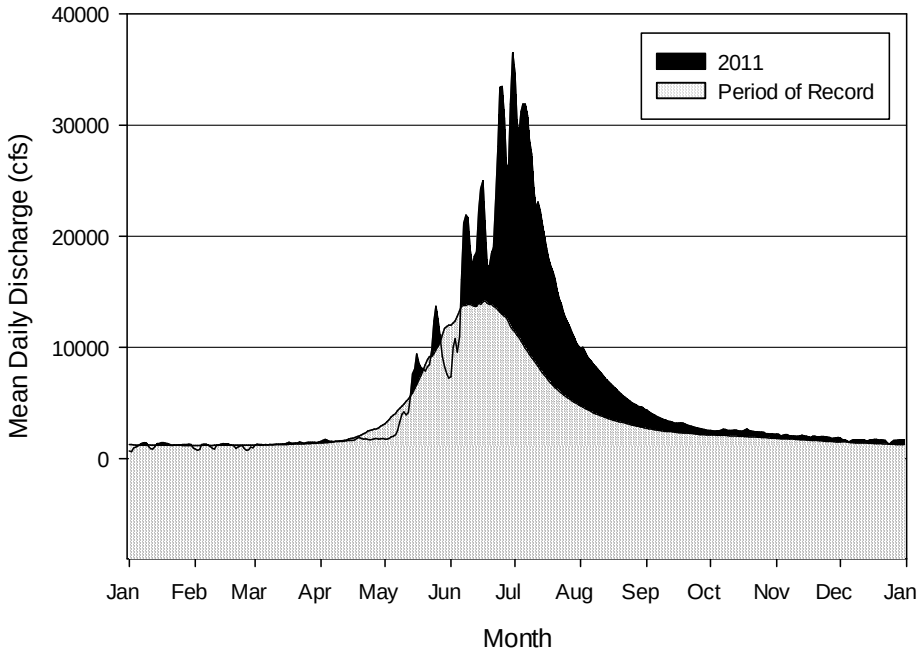
Rainbow Trout

Mill Creek Section

In the Mill Creek Section, the abundance estimate for rainbow trout was 391 fish/mile (≥ 7in), down from 463 fish/mile (≥ 7in) in 2009 (Figure 5). The 2012 estimate is lower than estimates for previous years, but only significantly lower than the 2003 and 2005 estimates. Some of the decrease observed from 2011 to 2012 could be the result of the 2011 spring runoff having a negative impact on survival and recruitment of rainbow trout (Figure 6).

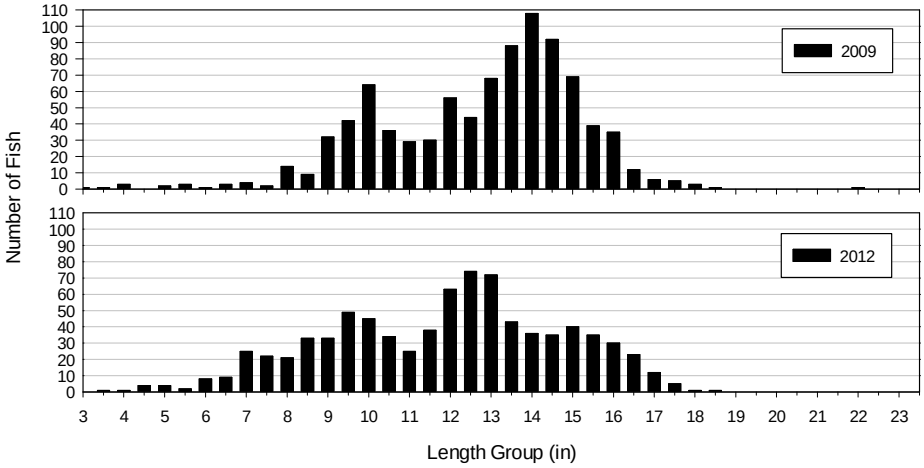


- Figure 5: Abundance estimates for rainbow trout (≥ 7in) in the Mill Creek Section of the Yellowstone River from 2002-2012. Error bars represent +/- 2 SD. The section was not sampled in 2004, 2006, 2008, and 2010. No abundance estimates were made in 2007 and 2011.



- Figure 6: Mean daily discharge for the Yellowstone River at the USGS 06192500 gage, near Livingston, for 2011 and the period of record (5/1/1897-12/31/10).

The length-frequency distributions for rainbow trout in the Mill Creek Section in 2009 and 2012 are presented below. In both years fish ranged from 3.0 to 18.5 inches in total length. In 2012, there was a decrease in the number of fish in the 13.5 to 16.5 inch range and an increase in numbers of fish in the 4.0 to 9.5 inch range and the 11.5 to 13.0 inch range (Figure 7).

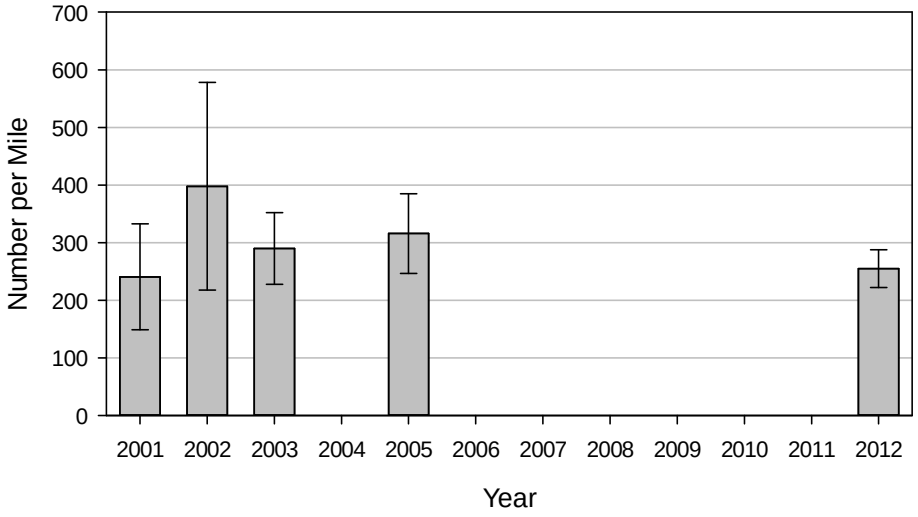


- Figure 7: Length-frequency distributions for rainbow trout sampled in the Mill Creek Section of the Yellowstone River during 2009 and 2012.

Brown Trout

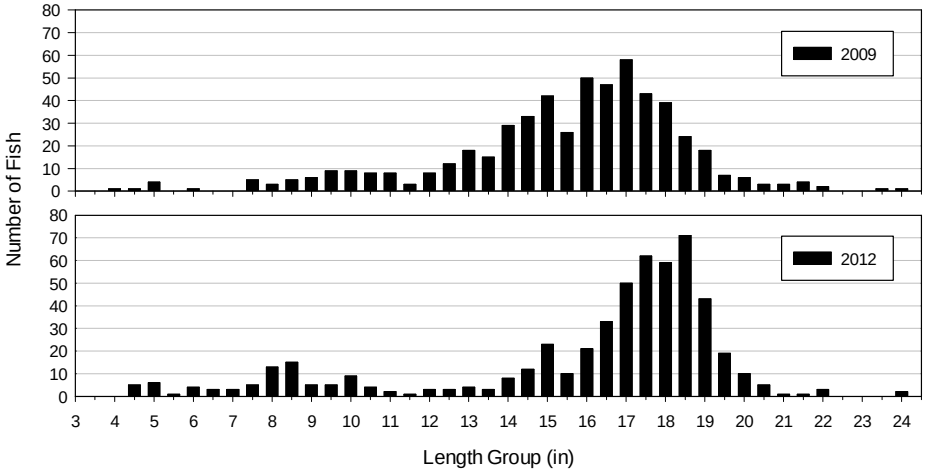
Mill Creek Section

In 2012, the abundance estimate for brown trout in the Mill Creek Section was 255 fish/mile (≥ 7in), down from 316 fish/mile (≥ 7in) in 2009 (Figure 8). The 2012 estimate is not significantly different than the prior estimates presented and indicates that the brown trout population in the Mill Creek Section is stable.



- Figure 8: Abundance estimates for brown trout (≥ 7in) in the Mill Creek Section of the Yellowstone River from 2002-2012. Error bars represent +/- 2 SD. The section was not sampled in 2004, 2006, 2008, and 2010. No abundance estimates were made in 2007, 2009, and 2011.

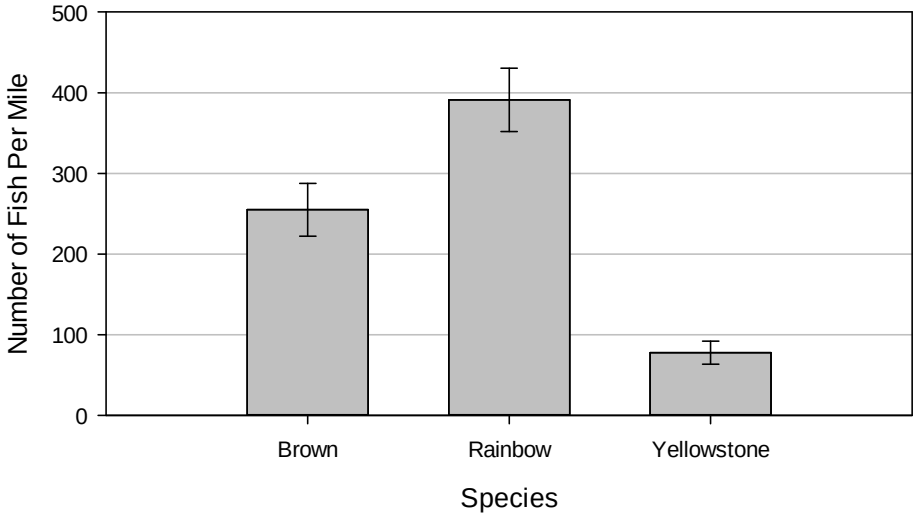
The 2012 length-frequency distribution for brown trout in the Mill Creek Section showed a decrease in the frequency of fish in the 10.5 to 17.0 inch range and an increase in the 17.5 to 20.5 inch range (Figure 9). This suggests limited recruitment and survival of smaller fish from 2009 to 2012 as well as an increase in survival and recruitment of larger fish.



- Figure 9: Length-frequency distributions for brown trout sampled in the Mill Creek Section of the Yellowstone River in 2009 and 2012.

Summary

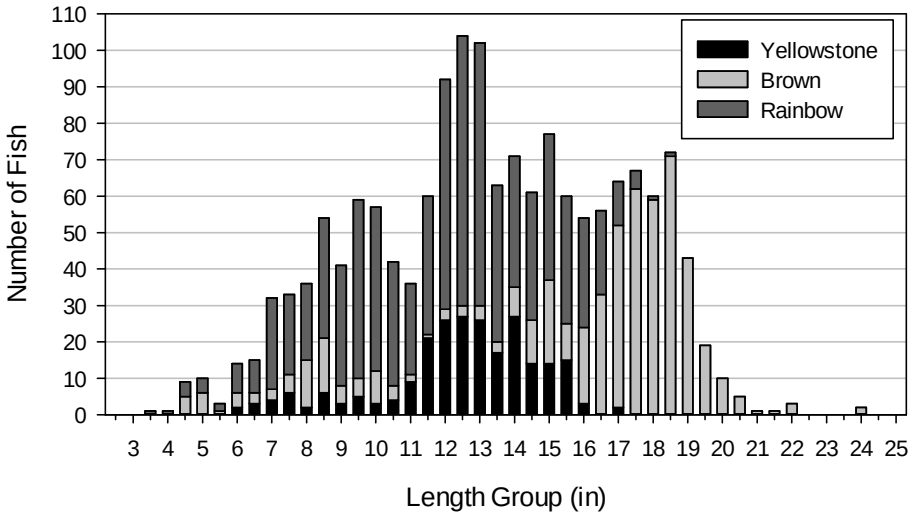
There are obvious differences when the 2012 abundance estimates for brown, rainbow, and Yellowstone cutthroat trout in the Mill Creek Section are compared. All three of the estimates are significantly different from each other (Figure 10). Rainbow trout had the highest abundance followed by brown and Yellowstone cutthroat trout, respectively. It should be noted that the Yellowstone cutthroat trout estimate is only for fish ≥ 10in, while the estimates for rainbow and brown trout are for fish ≥ 7in.



- Figure 10: Abundance estimates for brown and rainbow trout (≥ 7in) and Yellowstone cutthroat trout (≥10in) in the Mill Creek Section of the Yellowstone River for 2012. Error bars represent +/- 2 SD.

The 2012 length-frequencies for all three trout species in the Mill Creek Section are combined below (Figure 11). Rainbow trout make up the majority of the fish in the 3.0 to 16.0 inch length range. Both rainbow trout and Yellowstone cutthroat trout make up almost all of the fish in the 11.0 to 13.0 inch length range with very few brown trout in the sample. Brown trout make up the

majority of the fish in the16.5 to 18.5 inch length range and are the only species in the 19.0 to 24 inch length range for the Mill Creek Section.



- Figure 11: Length-frequency distribution for rainbow trout, brown trout, and Yellowstone cutthroat trout sampled in the Mill Creek Section of the Yellowstone River in 2012.

Shields River Procedures

In spring 2012 and 2013, the Convict Grade and Zimmerman Sections of the Shields River were sampled (Table 3 and Figure 12).

A plastic drift boat mounted with mobile electrofishing gear was used to sample the Convict Grade Section of the Shields River. The drift boat had a Coffelt™ VVP-15 and a 5,000-watt Honda™ EG5000CL generator. The anode was a single hand-held (mobile) electrode connected to the power source by 30 feet of cable, and an aluminum band around the bottom of the drift boat served as the cathode.

A Coleman Crawdad™ boat mounted with mobile electrofishing gear was used to sample the Zimmerman Section. The gear included a 3,500-watt Honda™ EG3500X generator and a Coffelt™ VVP-15. The cathode consisted of two braided steel cables that were hung over each side of the boat and the anode was a single hand-held (mobile) electrode connected to the power source by 30 feet of cable.

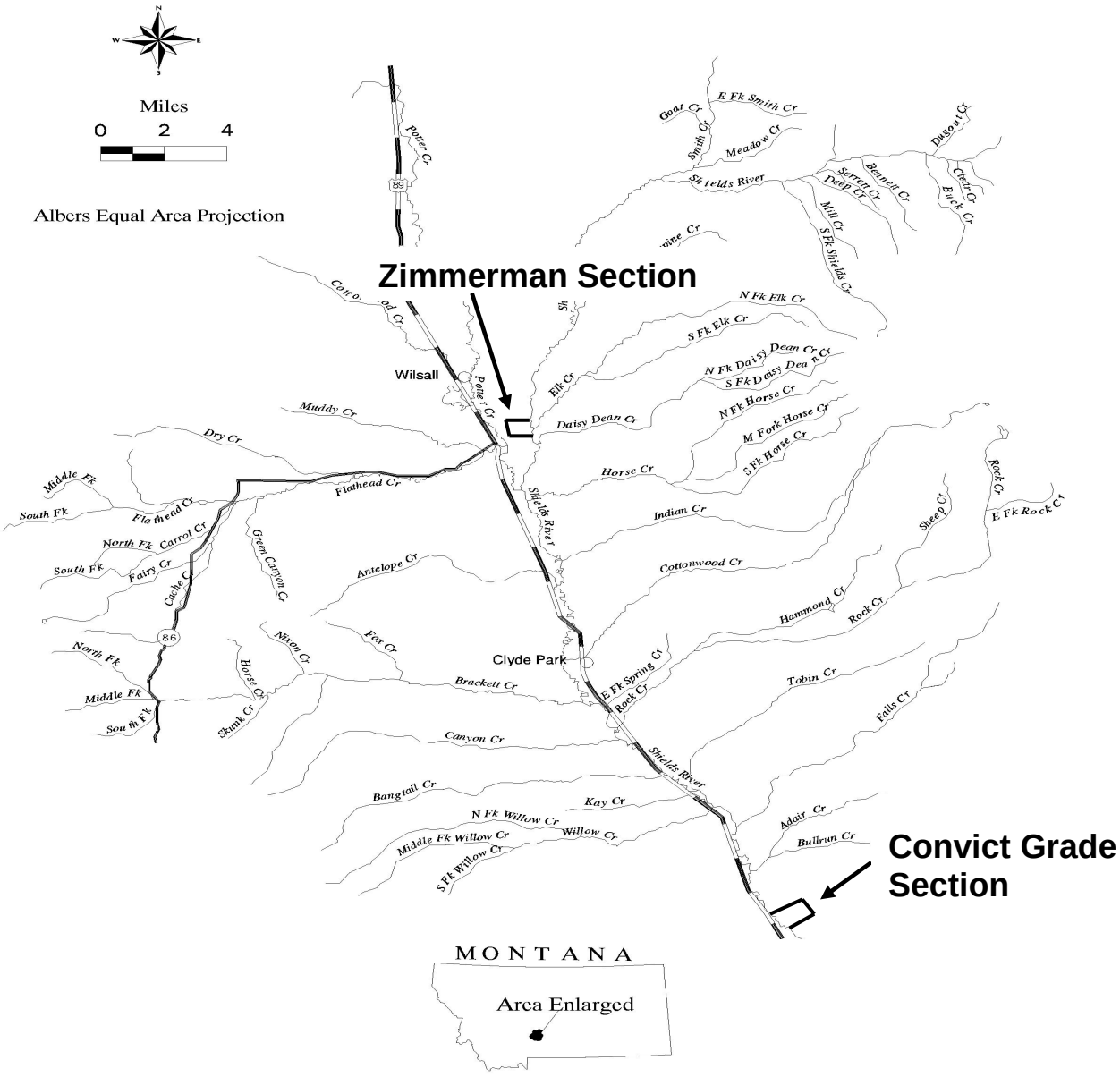
In both cases, sampled fish were held in live cars, identified to species, measured to the nearest 0.1 inch, and weighed to the nearest 0.01 pound. Trout were marked with fin clips and returned to the stream. Recapture sampling efforts in both the Convict Grade and Zimmerman Section occurred 7 days after the marking effort.

In both sections genetic samples were collected from Yellowstone cutthroat trout for later analysis. The sample consisted of a small pelvic fin clip that was stored in 100% denatured ethanol. Captured Yellowstone cutthroat, twelve inches and longer in total length, were tagged with a red, numbered, Floy™ tag to allow for large-scale monitoring of movement and growth of individual fish. On May 17, 2013, 4 Yellowstone cutthroat trout and 6 brook trout were implanted with PIT™ tags as an additional method of looking at movement of individual fish.

Population abundance was estimated using the Chapman Modified Peterson method (Chapman 1951) for both sections. Population estimates were calculated for brown trout and rainbow trout ≥ 7 inches in the Convict Grade Section. Population estimates for brown trout ≥ 7 inches and mountain whitefish ≥ 10 inches were calculated for the Zimmerman Section.

- Table 3: Survey sections where trout and mountain whitefish abundance was estimated in the Shields River in 2012 and 2013.

Section Name	Survey Date	Length (ft)	Approximate Location		
Convict	03/20/12	6,758	Upper	North	45.74036
	03/29/13		Boundary	West	110.48224
			Lower	North	45.72618
			Boundary	West	110.46231
Zimmerman	04/22/12	4,224	Upper	North	46.02599
	05/08/13		Boundary	West	110.64086
			Lower	North	46.01728
			Boundary	West	110.64012



• Figure 12: Map of the Shields River drainage displaying the 2012 and 2013 sampling locations.

Convict Grade Section

On March 20 and 21, 2012 and April 29 and 30, 2013, marking runs were completed on the Convict Grade Section. Captured trout were marked with a left pelvic fin clip.

The recapture runs were conducted in the section on March 28, 2012 and May 6, 2013. In 2012, all captured trout were marked with an anal fin clip. The secondary clip was used in order to avoid counting fish more than once during the recapture run. Limited numbers of fish with an anal clip were recaptured in 2012 and the secondary anal clip was deemed unnecessary in 2013.

Zimmerman Section

The marking runs for this section were completed on March 22, 2012 and May 8, 2013. Captured trout were marked with a left pelvic fin clip.

On March 29, 2012, and May 17, 2013 the recapture runs were completed on the Zimmerman section. A secondary clip, anal fin, was used in order to avoid counting fish more than once during the recapture run. Limited recapture of fish with an anal clip occurred in 2012 and the secondary anal clip was deemed unnecessary in 2013.

On May 17, 2013, 4 Yellowstone cutthroat trout and 6 brook trout were implanted with PIT™ tags as an additional method of looking at movement of individual fish.

Shields River Results

Shields River Abundances

Electrofishing data were used to calculate trout abundance estimates and monitor population trends. Results, by species, are presented below (Table 4).

- Table 4: Population abundance estimate results for the Convict Grade Section of the Shields River by species in 2012 and 2013. Est represents the number of trout (≥7 inches) per mile for Convict Grade. N represents the number of trout (≥7 inches) and mountain whitefish (≥10 inches) per 1,000 ft. for Zimmerman.

Section (Sample Date)	Species	Est	SD
Convict Grade (4/20/12)	Brown Trout	205	36
Convict Grade (4/29/13)	Brown Trout	376	37.7
	Rainbow Trout	165	24.7
Zimmerman (4/22/12)	Mountain Whitefish	86	12.6
Zimmerman (5/8/13)	Mountain Whitefish	98	11.4
	Brown Trout	65	11.4

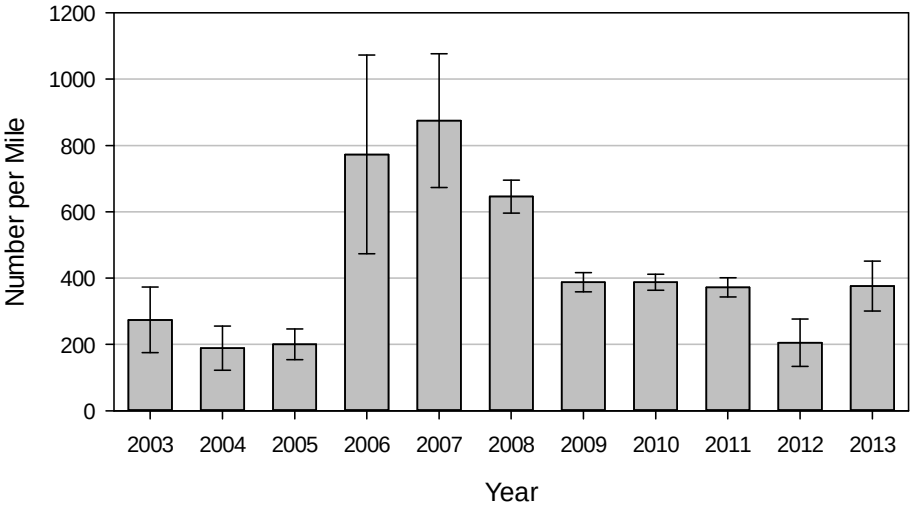
Brown Trout

Convict Grade Section

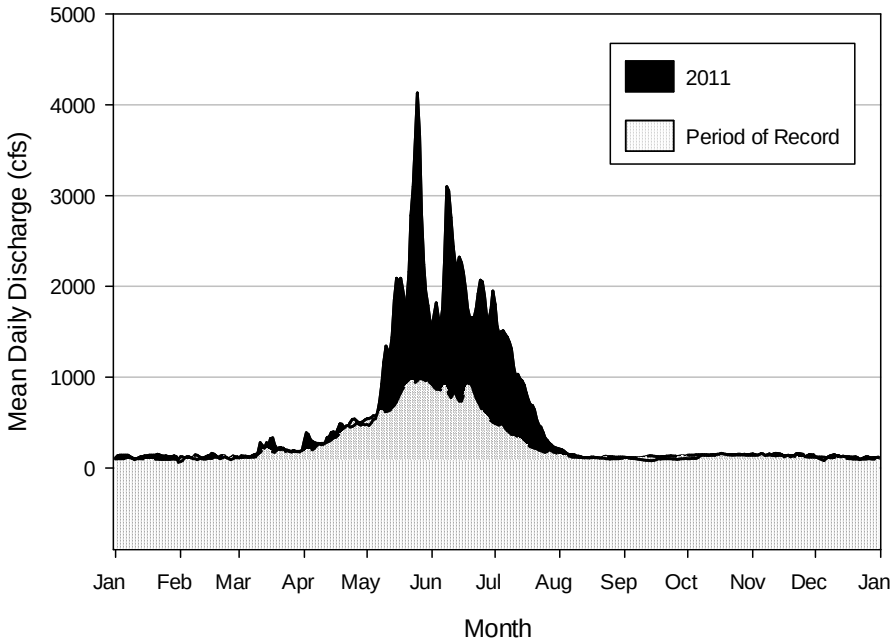
The 2012 abundance estimate for brown trout in the Convict Grade Section was 205 fish/mile (≥ 7 in) and is the lowest point on a downward trend from a high of 875 fish/mile (≥ 7 in) in 2007 (Figure 13). This estimate was significantly lower than the 2011 estimate of 372 fish/mile (≥ 7 in), yet remained

similar to those from 2003 through 2005. The large spring runoff from 2011 likely contributed to the decrease in abundance from 2011 to 2012 (Figure 14).

The abundance estimate for brown trout in 2013 increased to 376 fish/mile (≥ 7 in). It was significantly higher than the 2012 estimate and was similar to estimates in 2009 through 2011 (Figure 13).



- Figure 13: Abundance estimates for brown trout (≥ 7 in) in the Convict Grade Section of the Shields River from 2003-2013. Error bars represent +/- 2 SD.

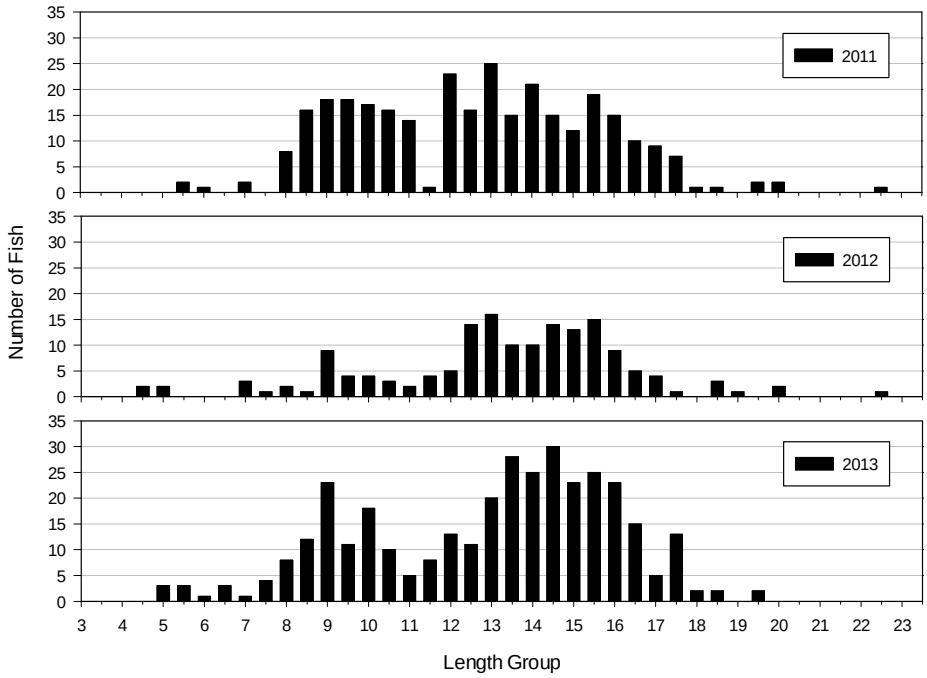


- Figure 14: Mean daily discharge for the Shields River at the USGS 06195600 gage for 2011 and the period of record (10/1/1978-12/31/10).

The length-frequency distribution for brown trout in the Convict Grade Section shows a decrease in all length categories from 2011 to 2012 (Figure 15). Fish in the 8 to 11 inch range showed the largest

decrease between years. These changes likely reflect the influence of the high water year in 2011 (Figure 14).

The length-frequency distribution for brown trout in this section for 2013 shows an increase in all length categories when compared to 2011 and 2012 (Figure 15). The largest increases were in the 11.5 to 17.5 inch range. Although brown trout longer than 20 inches were sampled in 2011 and 2012, none were sampled in 2013.

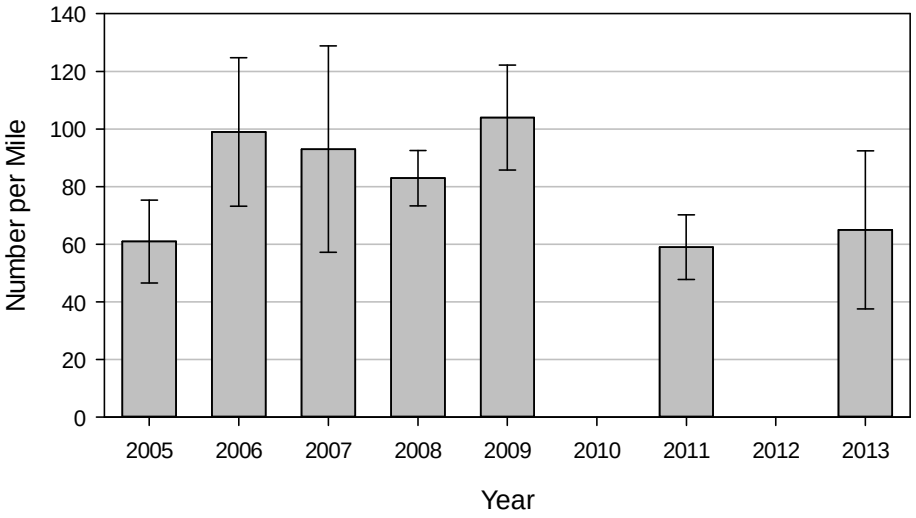


- Figure 15: Length-frequency distributions for brown trout sampled in the Convict Grade Section of the Shields River in 2011, 2012, and 2013.

Zimmerman Section

In 2012, a total of 36 brown trout were marked in the Zimmerman Section and only 1 was recaptured. As a result no population estimate was produced. There appears to have been some movement of brown trout out of the section as only 13 were captured during the recapture run. There was no obvious cause for this movement such as a significant increase in flow or a dramatic weather change.

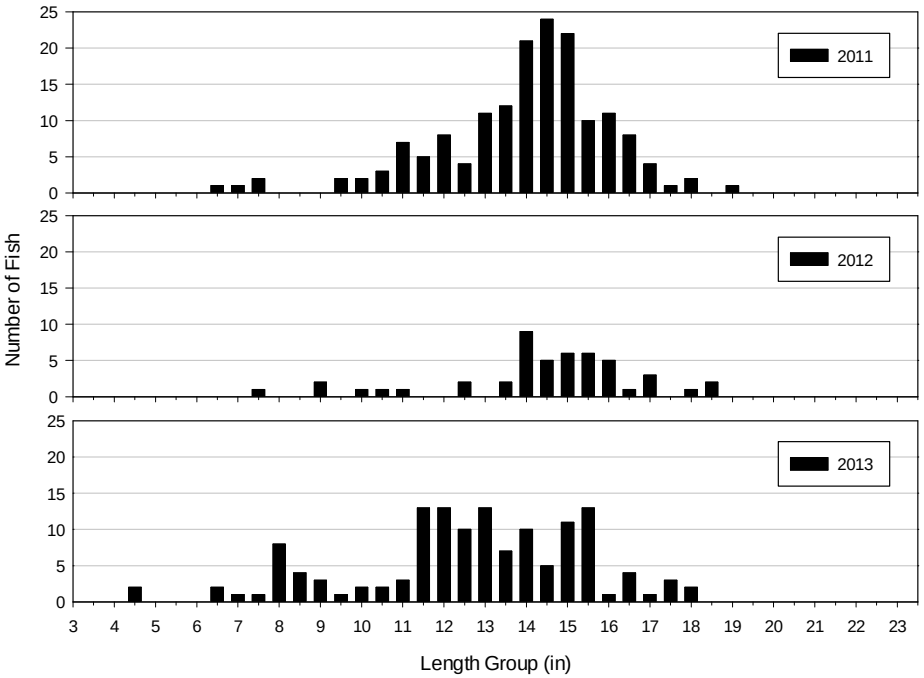
In 2013, the population estimate for brown trout in this section was 65 fish/mile (≥ 7 in), up slightly from 59 fish/mile (≥ 7 in) in 2011(Figure 16).



- Figure 16: Abundance estimates for brown trout (≥ 7 in) in the Zimmerman Section of the Shields River from 2005-2013. Error bars represent +/- 2 SD.

The length-frequency distribution for brown trout in the Zimmerman Section shows an obvious decrease in the frequency of fish in almost all length groups from 2011 to 2012 (Figure 17). This reflects the reduced number of fish captured in the section and the inability to produce a population estimate in 2012.

In 2013, the frequencies of fish increased above the 2012 levels, but remained lower that the 2011 levels for fish in the 14.0 to 15.0 inch range.



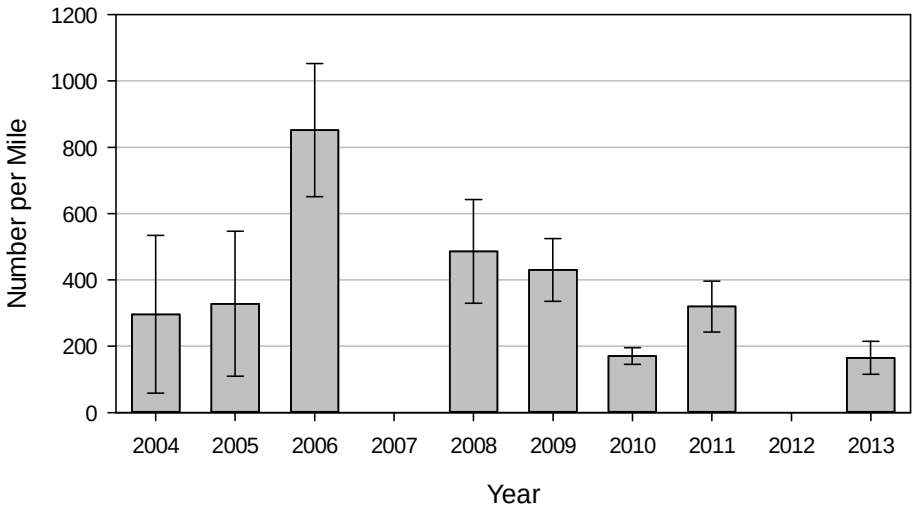
- Figure 17: Length-frequency distributions for brown trout sampled in the Zimmerman Section of the Shields River in 2011, 2012 and 2013.

Rainbow Trout

Convict Grade Section

In the Convict Grade Section, an abundance estimate for rainbow trout was not made in 2012 due to the lack of sufficient marked and recaptured fish in this section. Large movement of spawning rainbow trout into and out of this section have been documented in the past and is likely a contributing factor for the lack of marked and recaptured fish.

An abundance estimate of 165 fish/mile (≥ 7 in) was calculated for rainbow trout in 2013 and was the lowest estimate since 2004 (Figure 18). As seen in the graph abundance estimates fluctuate and are influenced year to year by rainbow trout spawning timing and movement.

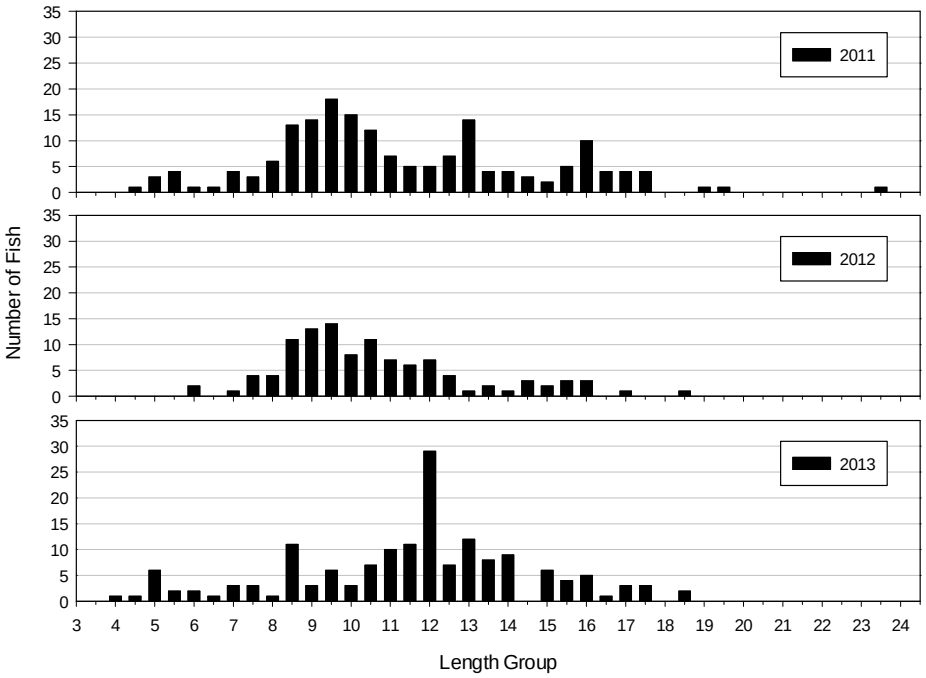


- Figure 18: Abundance estimates for rainbow trout (≥ 7 in) in the Convict Grade Section of the Shields River from 2004-2013. Error bars represent +/- 2 SD. No estimates were made in 2007 and 2012 due to the lack of sufficient data.

The length-frequency distributions for rainbow trout, in the Convict Grade Section, in all three years indicate similar ranges of fish lengths (Figure 19).

The 2012 length-frequency distribution shows a decrease in the frequency of rainbow trout across all length groups when compared to 2011. As seen in 2011, there continued to be a higher frequency of fish in the 8.0 to 12.0 range. This suggests that this population continued to have good recruitment and survival of smaller fish.

In 2013, there was a decrease in the frequency of fish in the 7.0 to 10.5 inch range and an increase in the 11.0 to 15.5 inch range, suggesting high survival of year classes from the previous year. It should be noted that spawning timing and movement influence the abundance of rainbow trout in this section.



- Figure 19: Length-frequency distributions for rainbow trout sampled in Convict Grade Section of the Shields River in 2011, 2012, and 2013.

Zimmerman Section

The first documentation of rainbow trout in the Zimmerman Section occurred in 2013. Two rainbow trout were captured in the section and were 7.3 and 8.1 in. in total length. Hybrid crosses between rainbow trout and Yellowstone cutthroat trout have been captured in the section in the past.

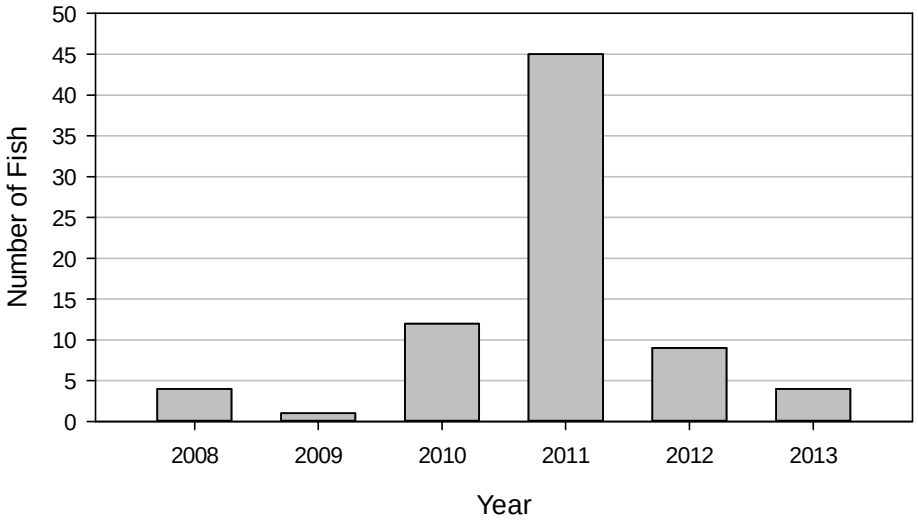
Yellowstone Cutthroat Trout

Convict Grade Section

There were not enough fish marked and recaptured to produce a population estimate for Yellowstone cutthroat trout in this section in either 2012 or 2013.

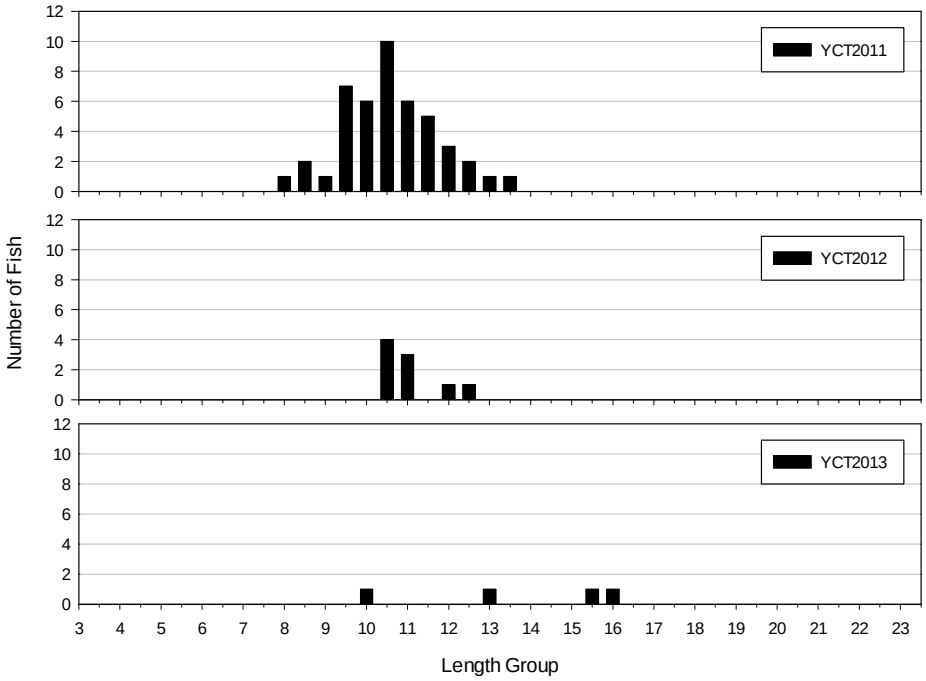
Captures of Yellowstone cutthroat trout in this section have ranged from 1 to 45 fish from 2008-2013 (Figure 20). In 2012, a total of 9 Yellowstone cutthroat trout were captured in the Convict Grade Section. This is the down from the high of 45 in 2011. The number of Yellowstone cutthroat trout captured continued to decline in 2013 to a total of 4 fish.

Cutthroat trout with morphological indications of hybridization with rainbow trout were not included in this analysis.



- Figure 20: Number of Yellowstone cutthroat trout captured in the Convict Grade Section of the Shields River for 2008-2013.

The 2011 and 2012 length-frequencies for Yellowstone cutthroat trout are presented below (Figure 21). The decreased distribution and frequency reflects the large decrease in number of Yellowstone cutthroat trout captured in the Convict Grade Section in 2012 and 2013.



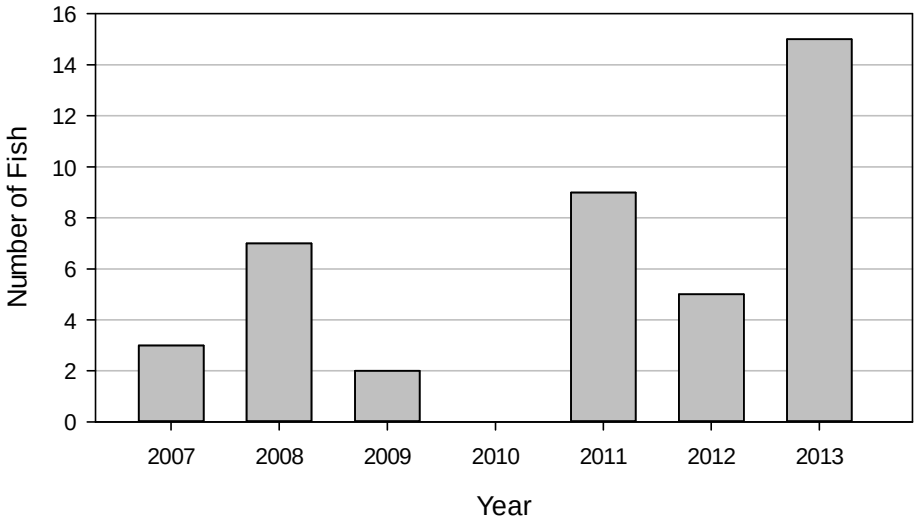
- Figure 21: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Convict Grade Section of the Shields River in 2011, 2012 and 2013.

Zimmerman Section

In 2012, a total of five Yellowstone cutthroat trout were captured in the Zimmerman Section. This is down from nine in 2011 (Figure 22).

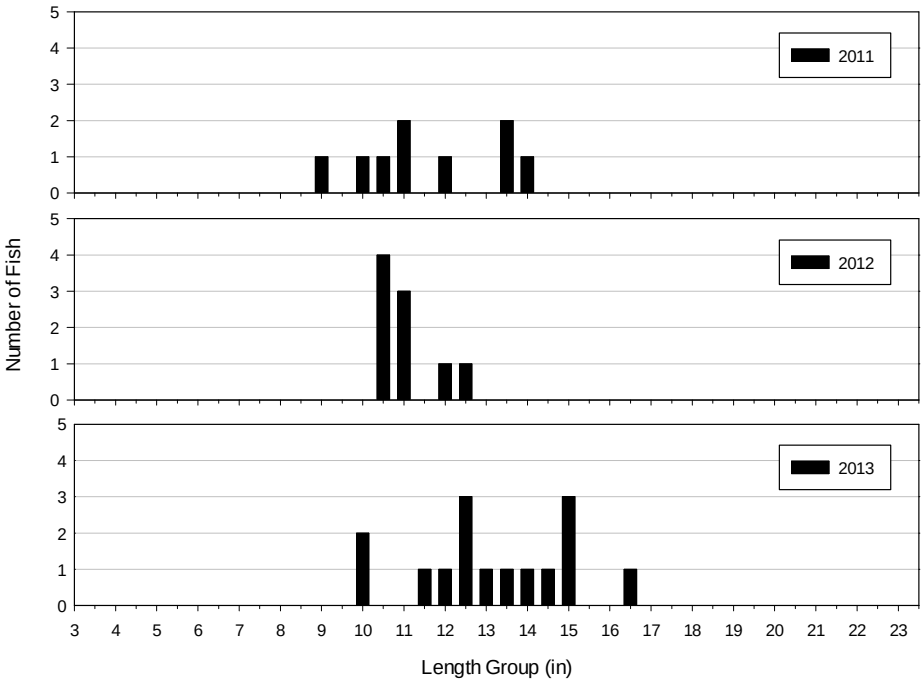
The number of Yellowstone cutthroat trout that were captured in this section increased to 15 in 2013. This is the highest number of Yellowstone cutthroat trout captured in this section since 2007.

Cutthroat trout with morphological indications of hybridization with rainbow trout were not included in the analysis for either year.



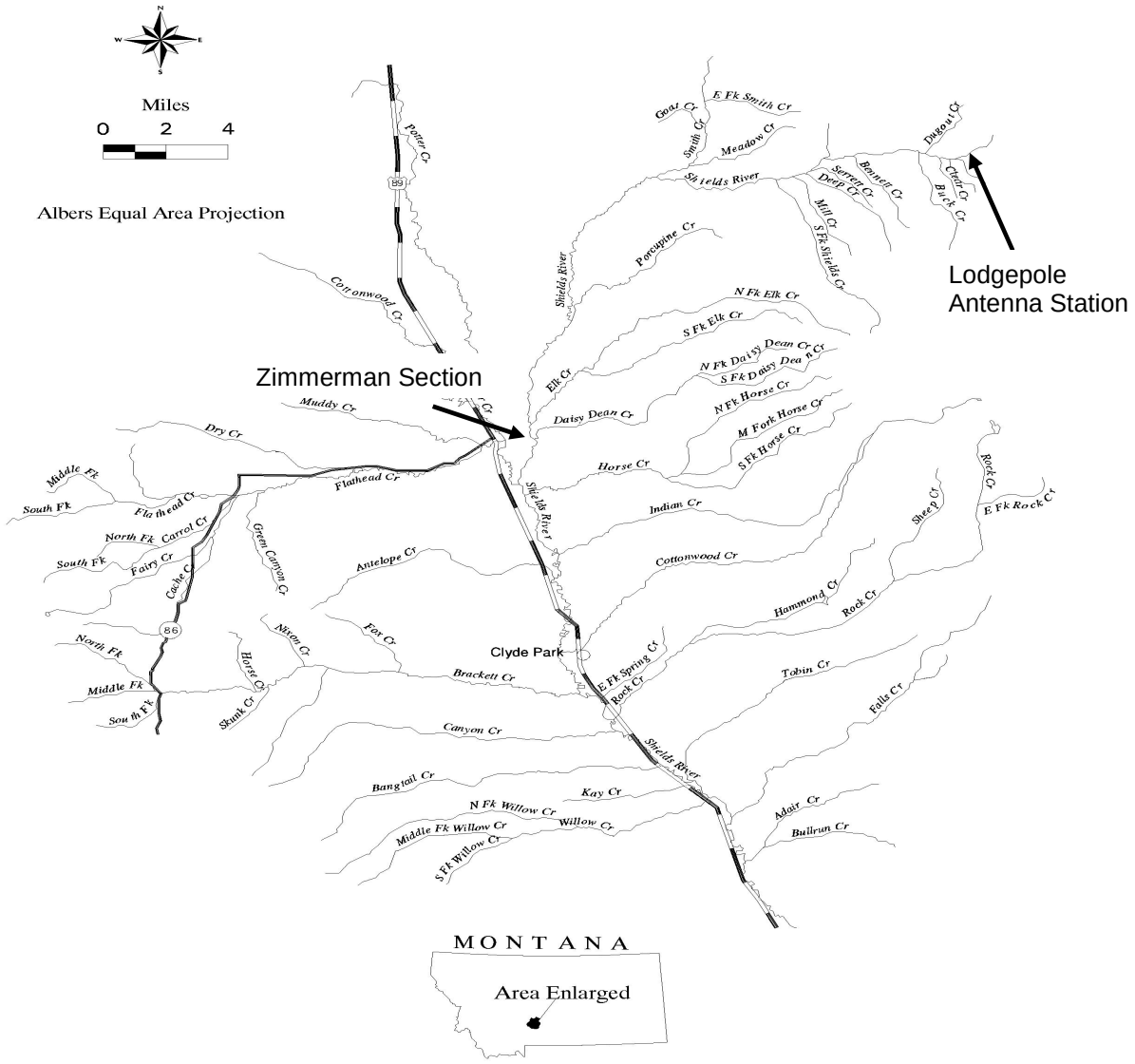
- Figure 22: Total numbers of Yellowstone cutthroat trout captured in the Zimmerman Section of the Shields River 2007-2013. No sampling occurred in 2010.

The length-frequency distributions for Yellowstone cutthroat in this section are presented below (Figure 23). The changes from year to year reflect the changes in the number of fish captured each year in the Zimmerman Section.



- Figure 23: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Zimmerman Section of the Shields River in 2011, 2012 and 2013.

Of the 4 Yellowstone cutthroat trout that were implanted with a PIT tag in the Zimmerman Section, on May 17, 2013, only one was detected at an antenna station near the mouth of Lodgepole Creek (Figure 24). The Lodgepole antenna station was located approximately 24.5 miles upstream of the Zimmerman Section. The fish was 12.4 in. long, weighed 0.72 lbs and was detected on June 15 and 22, 2013 at the antenna station.

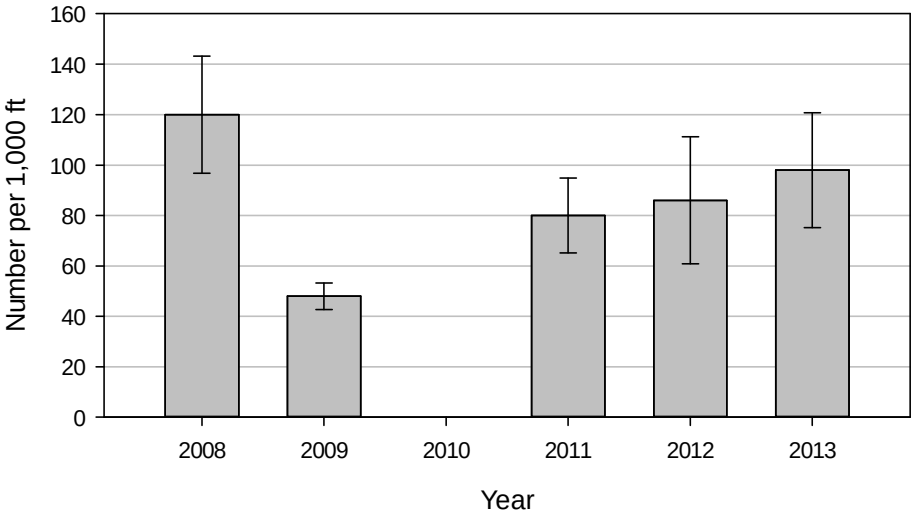


• Figure 24: Location of Zimmerman Section and Lodgepole antenna station.

Mountain Whitefish

Zimmerman Section

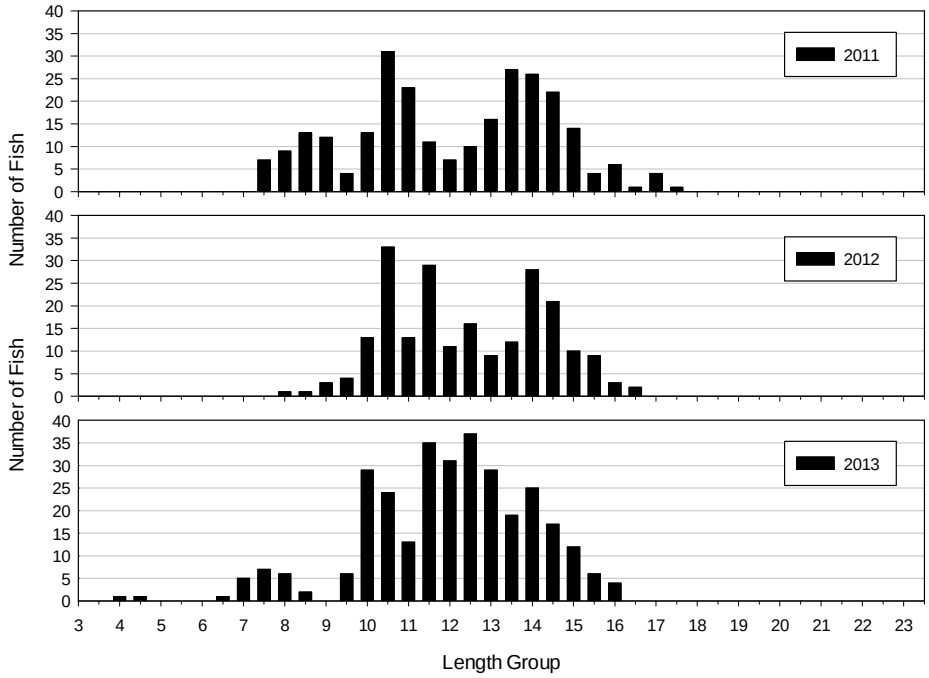
Abundance estimates for mountain whitefish in the Zimmerman Section have continued to increase since 2009 (Figure 25). The 2012 abundance estimate for mountain whitefish in the Zimmerman Section was 86 fish/1,000 feet (≥ 10in) up from 80 fish/1,000 feet (≥ 10in) in 2011. In 2013, the abundance estimate increased to 98 fish/1,000 feet (≥ 10in). Both estimates are significantly higher than the 2009 estimate of 48 fish/1,000 feet (≥ 10in), but not significantly different than the 2008 and 2011 estimates or each other.



- Figure 25: Abundance estimates for mountain whitefish (≥ 10in) in the Zimmerman Section of the Shields River from 2008-2013. Error bars represent +/- 2 SD. The section was not sampled in 2010.

The length-frequency distributions of mountain whitefish for 2011 and 2012, in the Zimmerman Section, were similar (Figure 26). Only a slight decrease in the size range and frequencies of a few length groups, particularly fish in the 7.0 to 9.0 inch range, occurred in 2012.

In 2013, an increase in frequency of most length groups occurred. Fish in the 4.0-7.0 inch range were not sampled in the previous years.



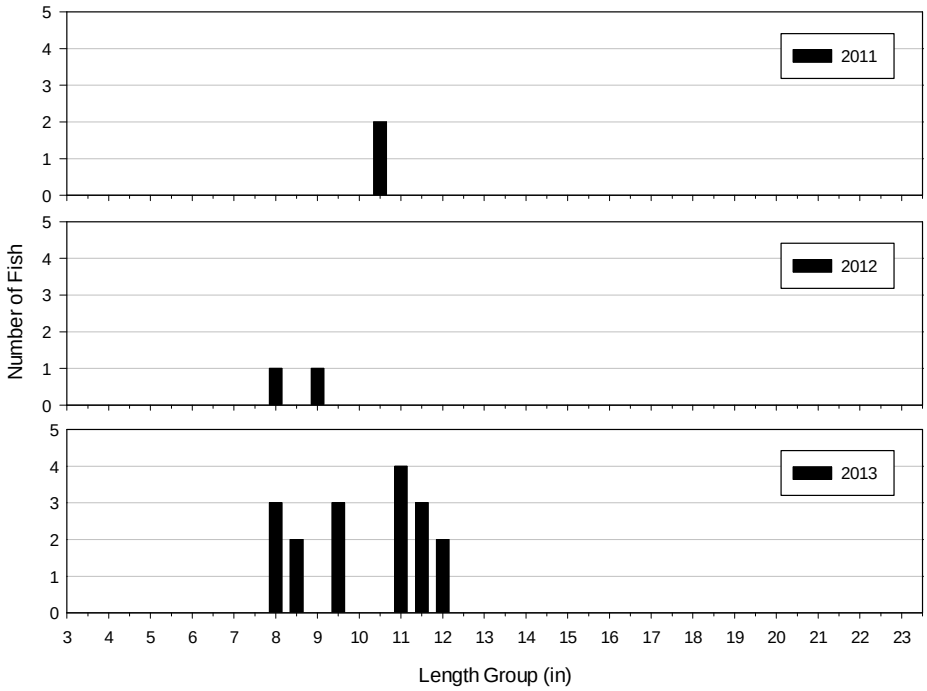
- Figure 26: Length-frequency distributions for mountain whitefish sampled in the Zimmerman Section of the Shields River in 2011, 2012 and 2013.

Brook Trout

Zimmerman Section

Brook trout were not historically present in the Zimmerman Section and they currently remain at a low level but appear to be increasing. It is unknown if these are resident or migratory fish. Continued monitoring will determine the ability of brook trout to expand and establish a population in this section.

In 2011, two brook trout were captured in the Zimmerman Section and were 10.0 and 10.2 inches in total length (Figure 27). Similar to 2011, only two brook trout captured in 2012 and these fish were 8.0 and 9.3 inches in total length. In 2013, the number of brook trout captured increased to 17 fish that ranged from 8.0-12.2 inches in total length.

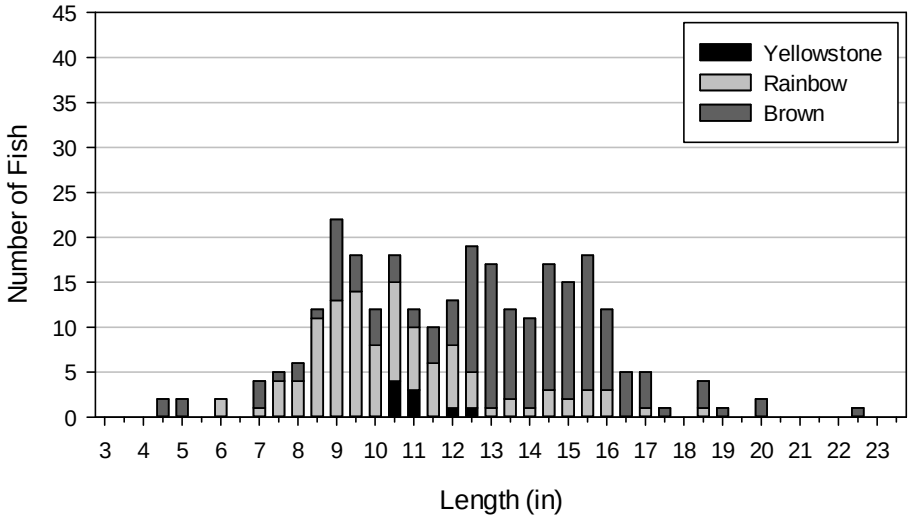


- Figure 27: Length-frequency distribution for all brook trout sampled in the Zimmerman Section of the Shields River in 2011, 2012 and 2013.

Summary

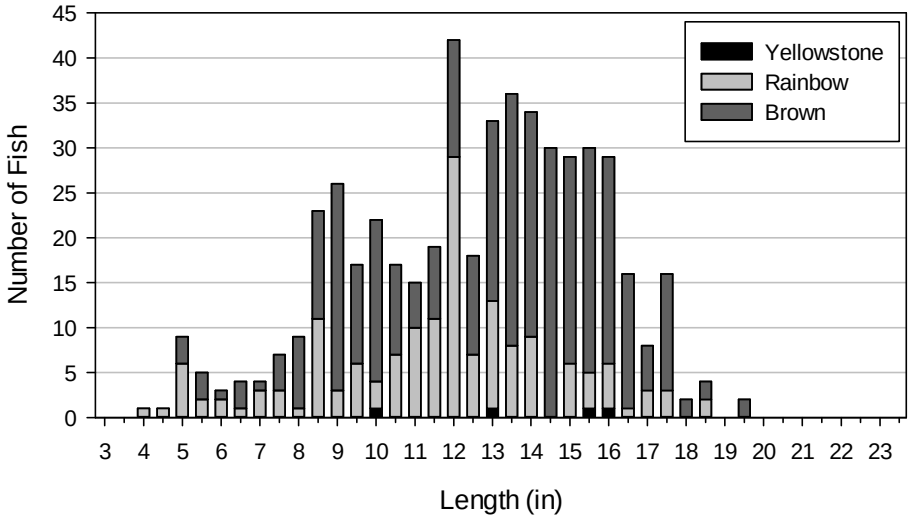
Convict Grade

When the length-frequencies for all trout in 2012, in the Convict Grade Section, are combined rainbow trout make up the majority of the fish in the 7.5 to 12.0 inch length groups (Figure 28). Brown trout make up the majority of the fish in the 12.5 to 22.5 inch length groups and Yellowstone cutthroat trout are only a small portion of fish in the 10.5 to 12.5 inch range.



- Figure 28: Length-frequency distribution for rainbow trout, brown trout and Yellowstone cutthroat trout sampled in the Convict Grade Section of the Shields River in 2012.

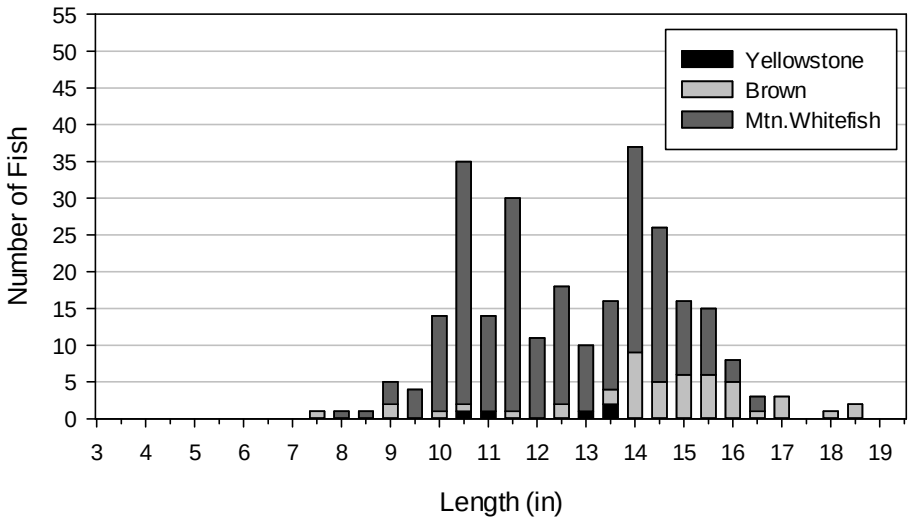
In 2013, brown trout made up the majority of fish in the 7.5 to 19.5 inch range when length frequencies for all trout were combined (Figure 29). This is the opposite of 2012 and reflects the variable nature of sampling rainbow trout in the Convict Grade Section in the spring. Rainbow trout sampled in this section may have a fluvial life history originating from the Yellowstone River. Yellowstone cutthroat trout continued to make up the smallest portion of fish in the sample.



- Figure 29: Length-frequency distribution for rainbow trout, brown trout and Yellowstone cutthroat trout sampled in the Convict Grade Section of the Shields River in 2013.

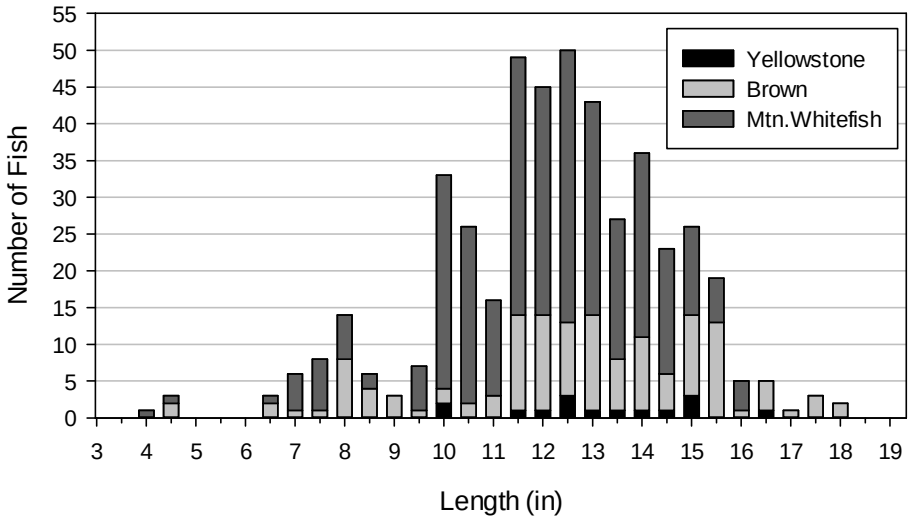
Zimmerman

In the Zimmerman Section, mountain whitefish made up the majority of the fish in the 8.0 to 15.5 inch length groups when all species length-frequencies are combined for 2012 (Figure 30). Brown trout entirely made up the 17.0 to 18.5 inch length groups and Yellowstone cutthroat only contribute slightly to the 10.5 to 13.5 inch length groups.



- Figure 30: Length-frequency distribution for Yellowstone cutthroat trout, brown trout and mountain whitefish sampled in the Zimmerman Section of the Shields River in 2012.

The 2013 results of the combined length-frequencies for the Zimmerman Section were similar to 2012 (Figure 31). Mountain whitefish made up the majority of fish in the 7.0 to 14.5 inch range and brown trout were the only fish in the 17.0 to 18.0 inch range. More Yellowstone cutthroat trout were present that 2012, yet continued to contribute little to the overall fish frequencies.



- Figure 31: Length frequency distribution for Yellowstone cutthroat trout, brown trout and mountain whitefish sampled in the Zimmerman Section of the Shields River in 2013.

Dailey Lake Fish Stocking

Dailey Lake has been stocked annually with rainbow trout, Yellowstone cutthroat trout, and walleye in order to maintain a fishery for these species.

Dailey Lake was stocked with 10,500 rainbow trout and 4,900 Yellowstone cutthroat trout in 2012. The stocking records for 2013 were not available at the time of this report, but the lake was stocked with approximately 10,000 rainbow trout and 5,000 Yellowstone cutthroat trout. These fish were from the Bluewater Springs Trout, Giant Springs Trout, and Yellowstone River Trout hatcheries. The number of rainbow trout that were stocked in the lake was reduced from 20,000 to 10,000 as part of an annual stocking plan change implemented in 2012. The intent is to increase the survival of trout by reducing the competition within the species. This change will be monitored and changed as needed.

In 2012, Dailey Lake was not stocked with walleye. This was also part of a stocking plan change that will have walleye stocked every other year in the lake and will reduce the number of walleye stocked from 10,000 to 5,000. The intent is to increase the survival of walleye by reducing competition within and among the fish species. This change will be monitored to determine success and will be changed as necessary. Approximately 5,000 walleye from the Miles City Fish Hatchery were stocked in 2013.

Walleye

Stocking data for walleye in 2011 were not available at the time of the 2011 annual report and are presented in the table below (Table 5Table 6). As indicated above, walleye were not stocked in 2012 as part of the new stocking plan.

- Table 5: Walleye stocking information from 2008-2011.

Year	Date	Strain	Length (in)	Number
2008	July 1	Fort Peck	1.5	5,000
	Sept. 19	Fort Peck	3.4	3,650
			Total	8,650
2009	July 1	Fort Peck	1.6	5,000
	Sept. 22	Fort Peck	2.9	5,500
			Total	10,500
2010	July 1	Fort Peck	1.4	5,000
	Sept. 14	Fort Peck	3.8	5,000
			Total	10,000
2011	June 29	Fort Peck	1.6	5,112
	Sept. 13	Fort Peck	5.0	5,000
			Total	10,112

Rainbow Trout and Yellowstone Cutthroat Trout

A total of 5,000 Arlee rainbow trout young-of-the-year (YOY) from Giant Springs Trout Hatchery were stocked on April 25, 2012 (Table 6). The Arlee rainbow trout averaged 4.3 inches in length. On June 13, 2012, 5,500 Eagle Lake strain YOY rainbow from Bluewater Springs Trout Hatchery

were stocked, and the fish had an average length of 3.21 inches. The Eagle Lake rainbow trout were given an adipose clip prior to stocking to allow for future identification and determination of survival in the lake. Exact numbers of rainbow trout plants and average fish lengths for 2013 were not available at the time of this report.

On April 23, 2012, Dailey Lake was stocked with 4,900 Yellowstone cutthroat trout YOY from the Yellowstone River Hatchery. These fish had an average length of 6.7 inches. Exact numbers of Yellowstone cutthroat trout plant and average fish length for 2013 were not available at the time of this report.

- Table 6: Trout stocking information from 2008-2012.

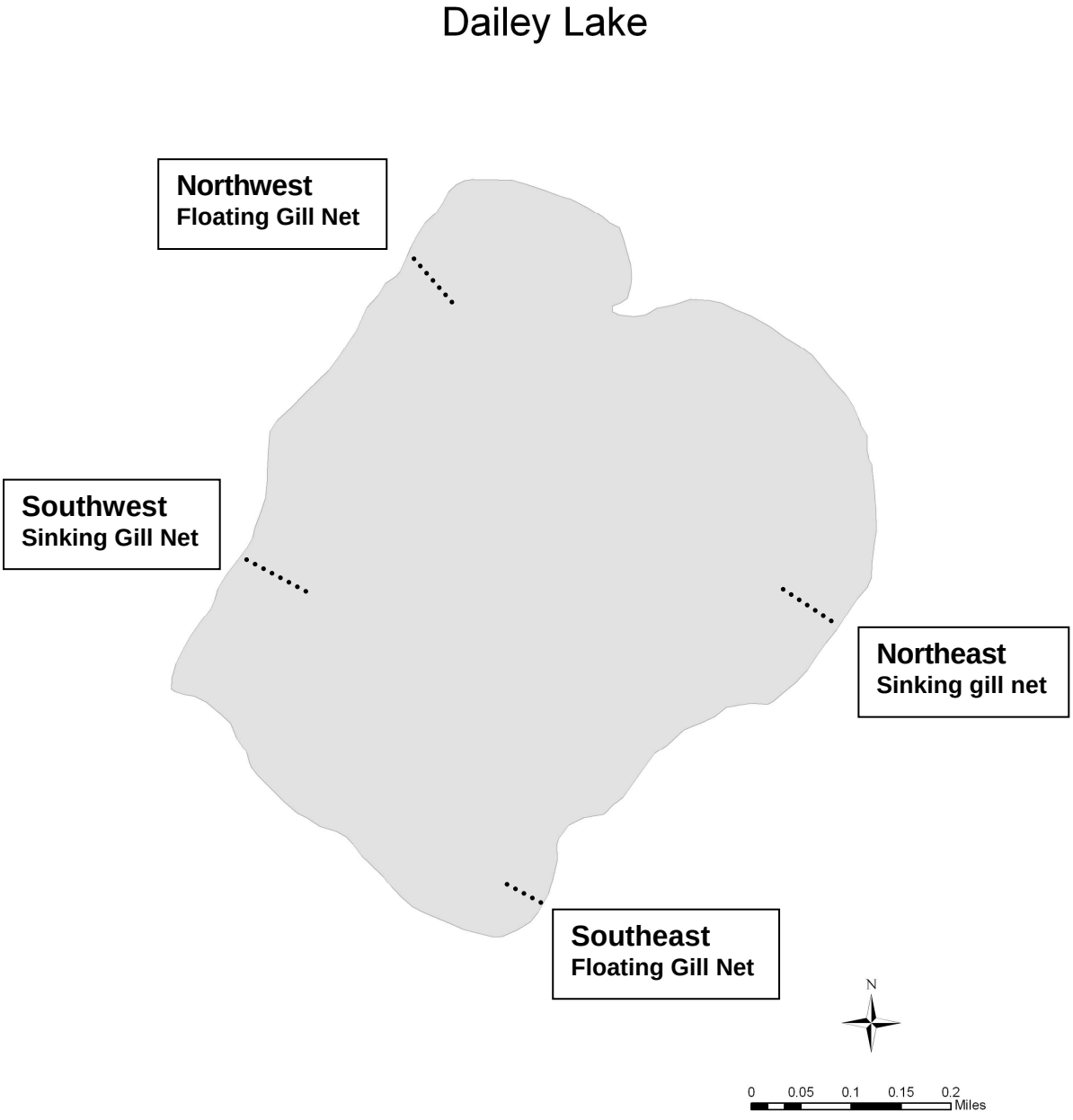
Year	Date	Strain	Length (in)	Number
2008	Apr. 29	Arlee	3.4	10,044
	Sept. 8	Yellowstone	4.4	5,000
	May 14	Eagle Lake	3.1	10,000
			Total	25,044
2009	Apr. 17	Arlee	4.0	10,000
	Sept. 23	Yellowstone	4.0	5,000
	May 18	Eagle lake	3.0	10,037
			Total	25,037
2010	Apr. 20	Arlee	3.5	10,000
	Apr. 16	Yellowstone	7.25	1,500
	May 5	Yellowstone	7.0	3,300
	May 17	Eagle lake	2.95	10,004
			Total	24,804
2011	Apr. 20	Arlee	3.8	9,000
	Apr. 25	Yellowstone	7.3	2,700
	May 3	Yellowstone	7.5	2,300
	May 16	Eagle lake	2.7	10,039
			Total	24,039
2012	Apr. 25	Arlee	4.3	5,000
	Apr. 23	Yellowstone	6.7	4,900
	June 13	Eagle lake	3.21	5,500
			Total	15,400

Dailey Lake Procedures

Gill Netting

Two floating and two sinking experimental (125 feet long and 6.0 feet deep with 1.0, 1.5, 2.0, 2.5 and 3.0 inch-bar-mesh) gill nets were used to sample Dailey Lake in 2012. The lake was not sampled in 2013 due to timing conflicts. The long-term series of gill nets were set the evening of May 14, 2012. This set consists of four gill nets located in the four corners of the lake (Figure 32).

The nets were pulled on the morning of May 15, 2012. Lengths were recorded for all fish to the nearest 0.1 inch and weights to the nearest 0.01 pound. All live fish were released back into the lake.



- Figure 32: Map of Dailey Lake showing locations of gill nets in 2012.

Night Electrofishing

On March 25, 2012, a night electrofishing effort was completed on Dailey Lake. A 20-foot Wooldridge™ boat equipped with electrofishing gear including a Coffelt™ VVP-10 and a 7,500 watt Honda™ generator was used to sample the entire shoreline of the lake after dark. Fish were identified to species, measured to the nearest 0.1 inch, and weighed to the nearest 0.01 pound. All fish were released back to the lake.

Dailey Lake Results

Gill Netting

Catch-Per-Unit-Effort

Rainbow Trout

Catch-per-unit effort (CPUE) for rainbow trout in all nets, in 2012, increased to 5.8 fish/net night, up from 3.75 fish/net night in 2011. This is still below the CPUE for 2007, 2008 and 2009 (Figure 33). The CPUE for rainbow trout in floating nets in 2011 was 4.5 fish/net night and increased to 7.0 fish/net night in 2012 (Figure 34). CPUE in sinking nets increased slightly from 3.0 fish/net night in 2011 to 4.3 fish/net night in 2012 (Figure 35).

Yellow Perch

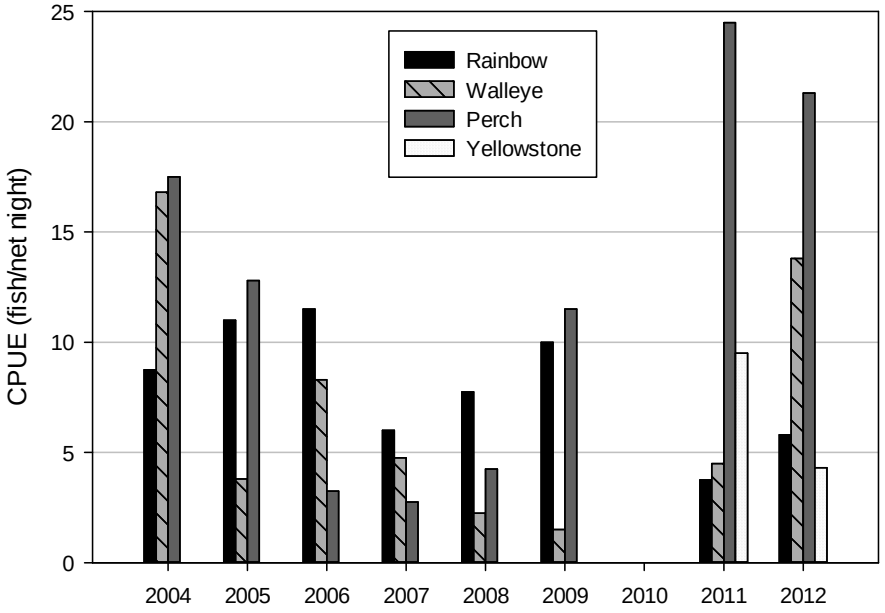
In 2012, the CPUE for yellow perch in all nets was 21.3 fish/net night compared to 24.5 fish/net night in 2011 (Figure 33). In 2011, CPUE for yellow perch in the floating nets was 38.0 fish/net night and decreased to 24.0 fish/net night in 2012 (Figure 34). The CPUE for sinking gill nets was 18.5 fish/net night in 2012, an increase from 11.0 fish/net night in 2011 (Figure 35).

Walleye

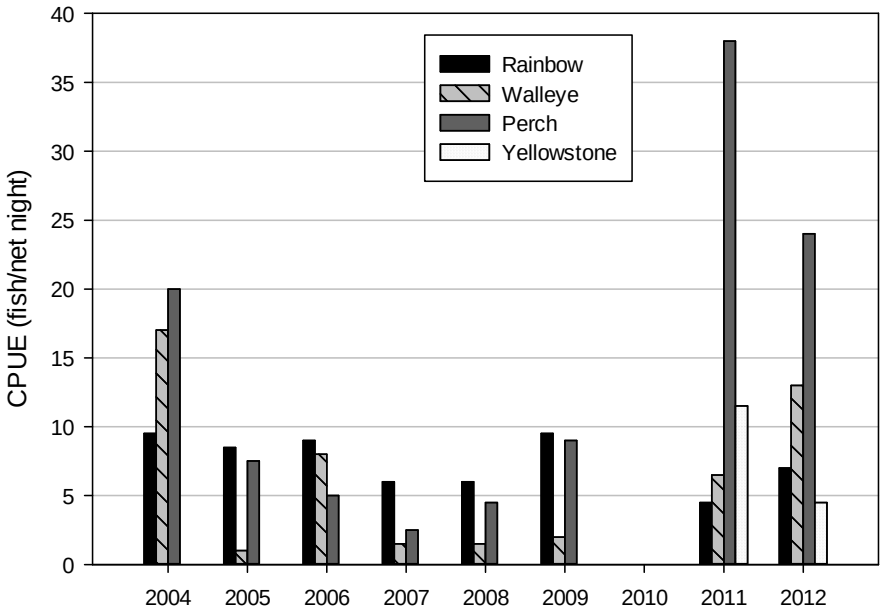
CPUE for walleye in all nets continued to increase from a low of 1.5 fish/net night in 2009 to 13.8 fish/net night in 2012 (Figure 33). In 2012, CPUE for floating nets was 13.0 fish/net night, up from 6.5 fish/net night in 2011(Figure 34). The CPUE of 14.5 fish/net night was up from 2.5 fish/net night for the sinking nets in 2011 (Figure 35).

Yellowstone Cutthroat Trout

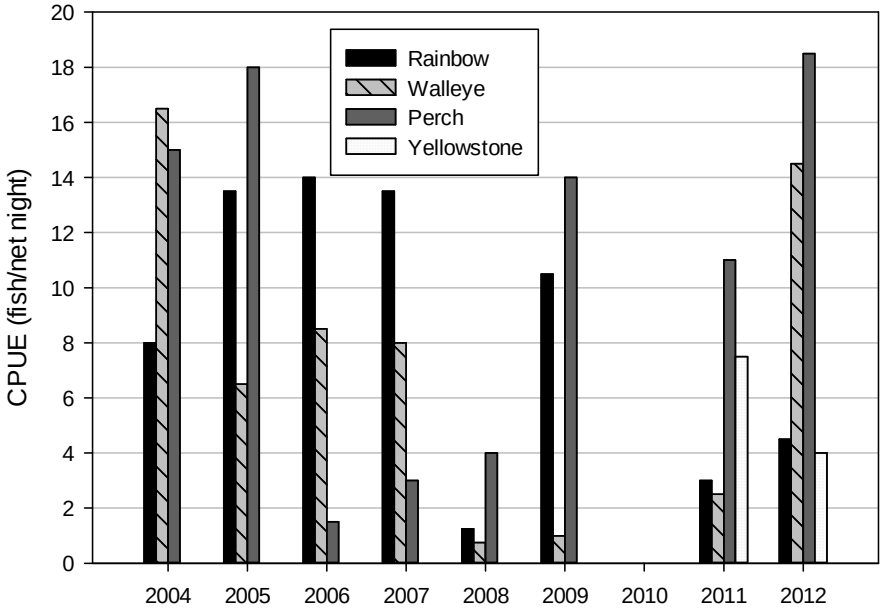
The CPUE for Yellowstone cutthroat in all nets was 4.3 fish/net night in 2012 compared to 9.5 fish/net night in 2011 (Figure 33). In 2012, CPUE for floating nets decreased from 11.50 fish/net night to 4.5 fish/net night (Figure 34). The CPUE for the sinking nets in 2011 was 7.50 fish/net night and decrease to 4.0 fish/net night in 2012 (Figure 35). Yellowstone cutthroat have been stocked in the lake since 2008. The 2012 sample is only the second time Yellowstone cutthroat have been sampled in gill nets.



- Figure 33: Catch-per-unit-effort for rainbow trout, walleye, yellow perch, and Yellowstone cutthroat trout in all gill nets for 2004-2012. No gill net sampling was completed in 2010.



- Figure 34: Catch-per-unit-effort for rainbow trout, walleye, yellow perch, and Yellowstone trout in floating gill nets for 2004-2012. No gill net sampling was completed in 2010.



- Figure 35: Catch-per-unit-effort for rainbow trout, walleye, yellow perch, and Yellowstone cutthroat trout in sinking gill nets for 2004-2012. No gill net sampling was completed in 2010.

Average Length

Rainbow trout

The average length of rainbow trout captured continued to decrease from the 2009 high of 19.7 inches to 17.6 inches in 2012 (Figure 36). This remains higher than the average lengths for 2006-2008. Rainbow trout captured in 2012 ranged from 12.4 to 26.2 inches in total length.

Yellow Perch

In 2012, the average length of yellow perch remained the same as 2011 at 8.9 inches and remains below the high of 10.0 inches in 2009 (Figure 36). Captured yellow perch ranged from 7.0 to 12.3 inches in total length.

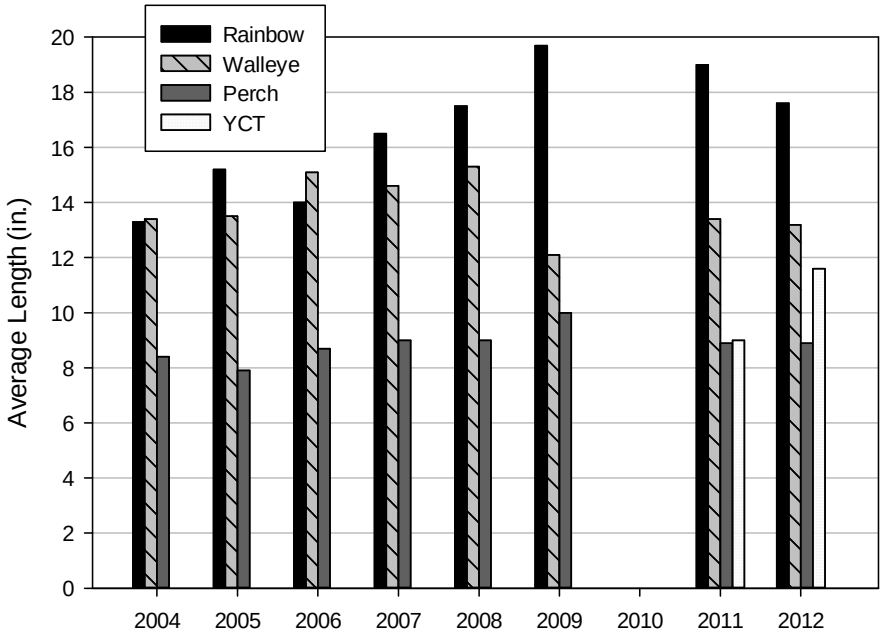
Walleye

The average length of walleye in 2012 was 13.2 inches. This is down slightly from 13.4 inches in 2011 and remains below the high of 15.3 inches in 2008 (Figure 36). Captured walleye ranged from 9.4 to 20.7 inches in total length.

Yellowstone Cutthroat Trout

The average length of Yellowstone cutthroat trout in 2011 was 9.0 inches in total length. In 2012, this increased to 11.6 inches (Figure 36). Captured Yellowstone cutthroat trout ranged from 6.9 to 19.9 inches in total length.

Yellowstone cutthroat trout have been stocked in Dailey Lake since 2008. Yellowstone cutthroat trout have only been sampled in gill nets in 2011 and 2012.

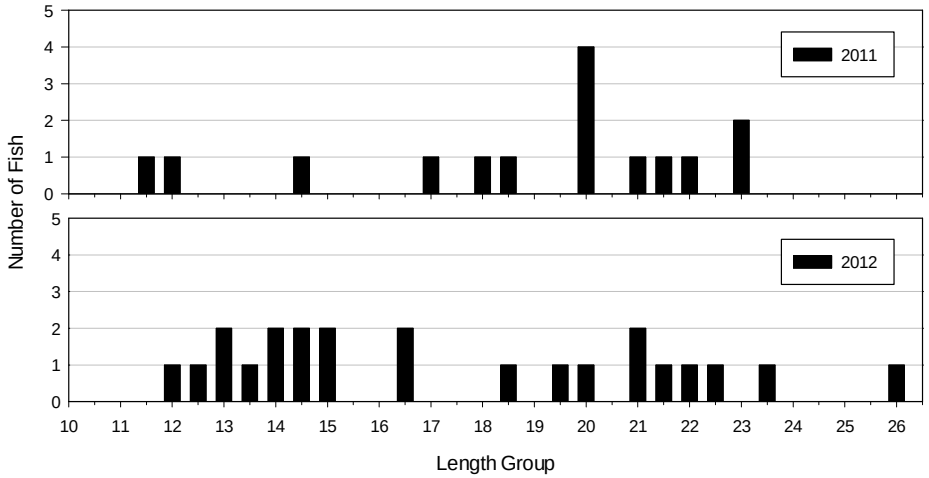


- Figure 36: Average lengths of rainbow trout, walleye, yellow perch and Yellowstone cutthroat trout captured in gill nets in Dailey Lake for 2004-2012. Nets were not set in 2010.

Length-Frequency

Rainbow Trout

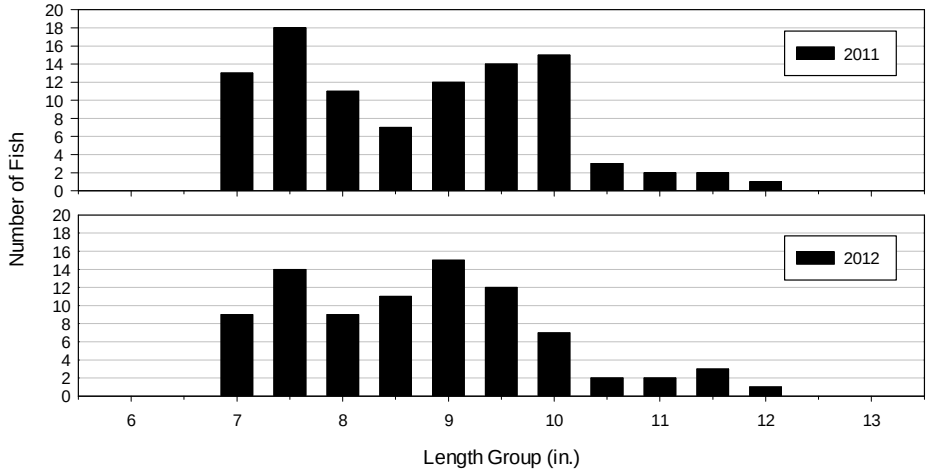
In 2012 and 2011, the length-frequency distribution of rainbow trout in Dailey Lake was spread across a similar range of lengths (Figure 37). Rainbow trout less than 11.0 inches were not sampled in either year and the largest fish sampled increased from 23.0 in 2011 to 26.2 inches in total length in 2012. The continued lack of smaller fish and lower numbers of fish sampled appears to be a result of sampling efficiency. This has been the case since 2008 and sampling continues to show a large range of rainbow trout each year with no indication of continued decline.



• Figure 37: Length-frequency distribution for Dailey Lake rainbow trout in 2011 and 2012.

Yellow Perch

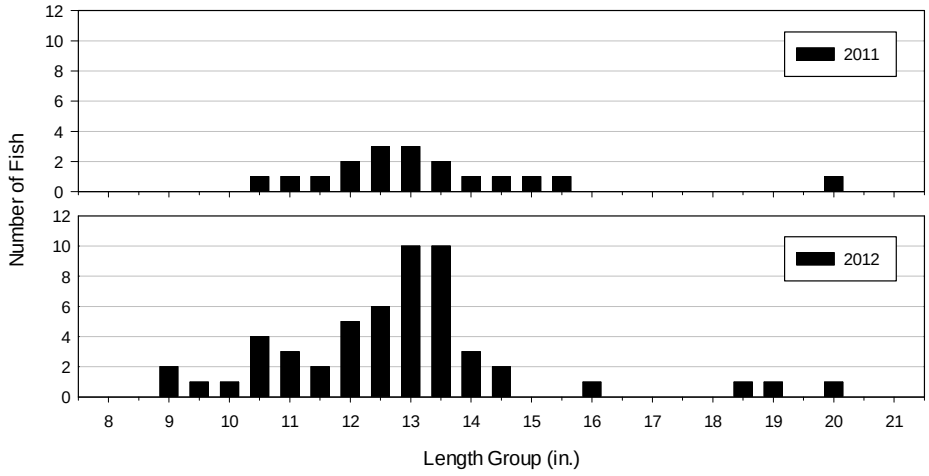
The length-frequency distribution for yellow perch in 2012 continues to be skewed toward fish between 7.0 and 10.0 inches in total length and overall numbers in the sample are similar to those from 2011 (Figure 38). Smaller fish were absent from both samples. The lack of smaller fish is likely an issue of recruitment to the sampling gear.



• Figure 38: Length-frequency distribution for Dailey Lake yellow perch in 2011 and 2012.

Walleye

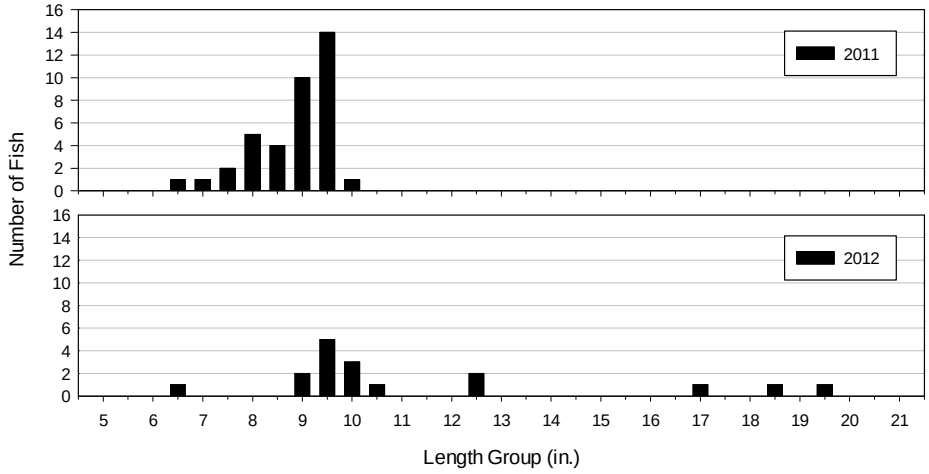
The length-frequency distribution of walleye in 2012 shows an increased distribution compared to 2011 with both smaller and larger fish in the sample (Figure 39). Numbers of fish in the 10.5 to 14.5 inch range also increased for 2011 to 2012.



• Figure 39: Length-frequency distribution of Dailey Lake walleye in 2011 and 2012.

Yellowstone Cutthroat Trout

In 2012, the length-frequency distribution of Yellowstone cutthroat trout shows a wider range of lengths of fish captured than 2011 (Figure 40). The number of fish in the 7.0 to 9.5 inch range decreased from 2011 to 2012. Yellowstone cutthroat have been stocked in the lake since 2008. These are the first two years that Yellowstone cutthroat have been sampled in gill nets. Continued monitoring is needed to clearly understand stocking survival and capture efficiency.



• Figure 40: Length-frequency distribution of Dailey Lake Yellowstone cutthroat trout in 2011 and 2012.

Night Electrofishing

A conductivity of 1220 µs/cm prevented effective capture of fish and many fish were observed avoiding the electrical field. Rainbow trout, Yellowstone cutthroat trout, walleye, yellow perch and white suckers were all captured using electrofishing equipment. That information is presented in the table below (Table 7).

- Table 7: 2012 Dailey Lake night electrofishing results by species and 0.5 inch size classes for 2012.

Species	Size Class (inches)	# Sampled
Rainbow Trout	4.0-4.49	1
	4.5-4.99	1
	20.0-20.49	1
	22.5-22.99	1
	23.0-23.49	1
	Total	5
Yellowstone Cutthroat Trout	6.0-6.49	1
	6.5-6.99	7
	7.0-7.49	8
	7.5-7.99	5
	8.0-8.49	3
	8.5-8.99	1
	Total	25
Walleye	9.5-9.99	1
	13.0-13.49	1
	13.5-13.99	1
	17.5-17.99	1
	Total	4
Yellow Perch	4.0-4.49	1
	7.0-7.49	3
	7.5-7.99	3
	8.0-8.49	2
	8.5-8.99	4
	9.0-9.49	5
	9.5-9.99	2
	Total	20
White Sucker	15.5-15.99	1
	16.0-16.49	1
	16.5-16.99	1
	Total	3

Literature Cited

Chapman, D. G. 1951. Some properties of the hypergeometric distribution with applications to zoological censuses. University of California Publications in Statistics 1:131-160.