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

Annual Report for 2014

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Abstract

The Sheep Mountain, Mill Creek, and Corwin Springs Sections on the Yellowstone River were sampled in 2014, and trout abundance estimates were calculated for the Mill Creek Section. Rainbow *Oncorhynchus mykiss*, brown trout *Salmo trutta*, and Yellowstone cutthroat trout *Oncorhynchus clarki bouvieri* estimates were all higher during 2014 estimates than 2012. Lack of sufficient recapture data in the Sheep Mountain Section and no recapture data, as a result of river conditions, in the Corwin Springs Section prohibited the calculation of population estimates. The Zimmerman, Upper Chadbourne, and Convict Grade sections in the Shields River were sampled in 2014. In the Zimmerman Section, the brown trout abundance estimate was up slightly from 2013 and the abundance estimate for mountain whitefish *Prosopium williamsoni was* down from 2013. Low numbers of Yellowstone cutthroat and eastern brook trout in the Zimmerman Section prohibited the calculation of abundance estimates 2014. River conditions prohibited the completion of recapture efforts in the Convict Grade and Upper Chadbourne Sections. Results from the long-term gill netting series in Dailey Lake show that catch-per-unit-effort (CPUE) for rainbow trout, walleye *Stizostedion vitreum*, yellow perch *Perca flavescens* and Yellowstone cutthroat trout all decreased. This is the third year that Yellowstone cutthroat trout have been captured in nets after being stocked annually starting in 2008. Average lengths of rainbow trout, walleye, and yellow perch increased from 2012 to 2014. Average lengths of Yellowstone cutthroat trout decreased during the same time frame.

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 fin clip were noted as recaptured.

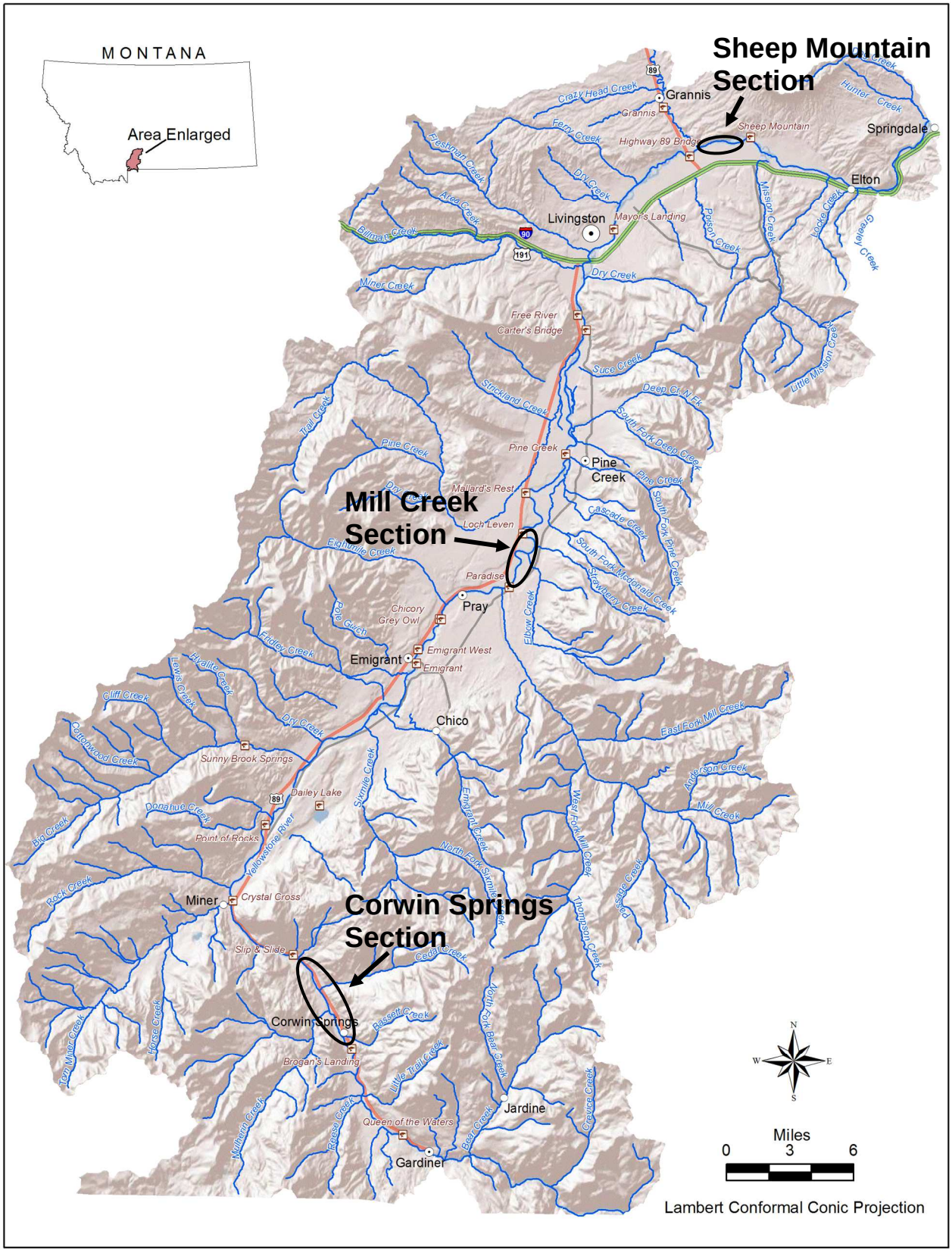
Yellowstone River Procedures

In spring 2014, trout were sampled in the Mill Creek and Corwin Springs Sections of the Yellowstone River (Table 1 and Figure 1), both of which are long-term monitoring sections. A new section, Sheep Mountain, was also completed in the Yellowstone River in 2014.

- Table 1: Survey section where trout sampling occurred in the Yellowstone River in 2014.

Section Name	Survey Date	Length (ft)	Approximate Location		
Sheep Mountain	04/09/14	9,504	Upper Boundary	North	45.72716
				West	110.42089
			Lower Boundary	North	45.72385
				West	110.45505
Mill Creek	04/22/14	24,816	Upper Boundary	North	45.64994
				West	110.56211
			Lower Boundary	North	45.69826
				West	110.51517
Corwin Springs	04/29/14	23,232	Upper Boundary	North	45.16214
				West	110.8350
			Lower Boundary	North	45.10993
				West	110.79077

- Coordinates in decimal degrees are NAD83 datum.



• Figure 1: Map of the upper Yellowstone River displaying 2014 sampling locations.

Electrofishing of the Yellowstone River was completed through the use of one or 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 and Sheep Mountain sections. The mark-recapture effort on the Corwin Springs Section was not completed as a result of river conditions. 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 the Chapman Modified Peterson method (Chapman 1951). Population estimates for brown and rainbow trout ≥ 7 inches and Yellowstone cutthroat trout ≥ 10 inches were calculated in the Mill Creek Section. Limited recapture data prevented the calculation of trout population estimates in the Sheep Mountain Section.

Sheep Mountain Section

Marking runs were made on the Sheep Mountain Section on April 09 and 10, 2014. The section was split into three subsections. The right and left bank of all three subsections were sampled on both days with one boat. All trout were marked with a right pelvic fin clip.

The recapture effort for the section was completed on April 15 with the use of one boat.

Mill Creek Section

On the Mill Creek Section, marking runs were made on April 21, 22, and 23, 2014. The section was split into five subsections. On April 21, the right and left bank of the first two subsections were sampled. Both banks of third subsection were sampled on April 22 and the fourth and fifth subsections were sampled on April 23. All trout were marked with a left pelvic fin clip.

The recapture effort for the section was completed on April 28 and 29 with the use of two boats, one on each bank. The first three subsections were sampled on April 28 and the last two were sampled on April 29.

Corwin Springs Section

The Corwin Springs Section was sampled on April 29 and 30, 2014. The section was split into four subsections. On April 29, the right and left bank of the first two subsections were sampled with one boat on each side. Both banks of third and fourth subsection were sampled on April 30. All trout were marked with a left pelvic fin clip.

The recapture effort for the section was not completed due to high water and turbidity as a result of spring runoff.

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).

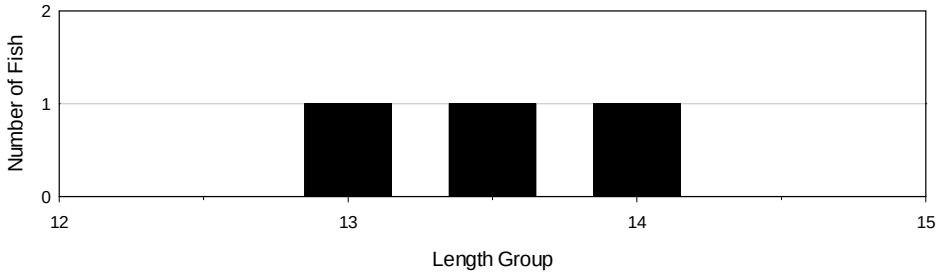
- Table 2: Population abundance results for the Mill Creek Section of the Yellowstone River by species in 2014. N/mile represents the estimated number of brown and rainbow trout (≥7 inches) per mile and Yellowstone cutthroat trout (≥10 inches) per mile. SD=standard deviation.

Section	Fish Species	N/mile	SD
Mill Creek	Brown Trout	371	40.8
	Rainbow Trout	522	33.6
	Yellowstone Cutthroat Trout	109	19.3

Yellowstone Cutthroat Trout

Sheep Mountain Section

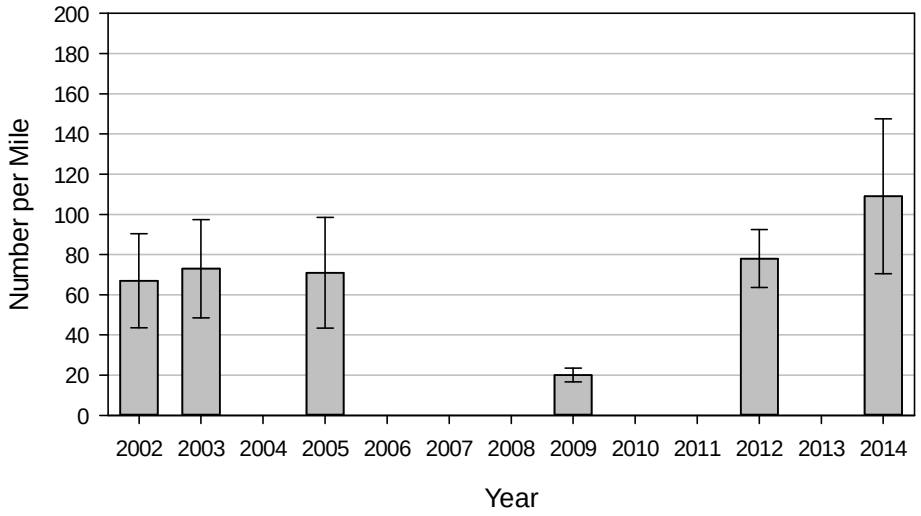
Only three YCT were sampled in the Sheep Mountain Section in 2014. The fish were 13.1, 13.5, and 14.3 inches in total length (Figure 2).



- Figure 2: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Sheep Mountain Section of the Yellowstone River during 2014.

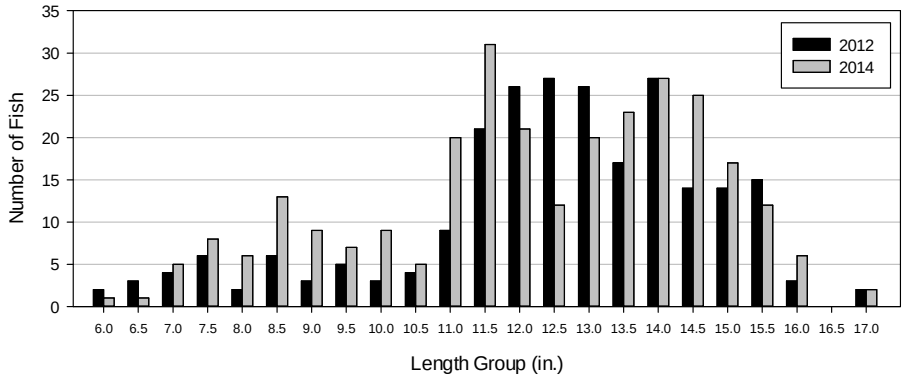
Mill Creek Section

The population estimate for Yellowstone cutthroat trout in the Mill Creek Section increased from 78 fish/mile (≥ 10in) in 2012 to 109 fish/mile (≥ 10in) in 2014. This was also higher than 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 2002-2014. Error bars represent +/- 2 SD. The section was not sampled in 2004, 2006, 2008, 2010, and 2013. No abundance estimates were made in 2007 and 2011.

Comparison of length-frequency distributions from 2012 and 2014 indicates no changes in the overall length groups that fish were captured in (Figure 4). In 2014, there was an increase in the number of fish in most length groups indicating increased survival and recruitment of fish. Decreases in numbers from 2012 to 2014 were seen in the 6.0 to 6.5 and 12.0 to 13.0 inch length groups.

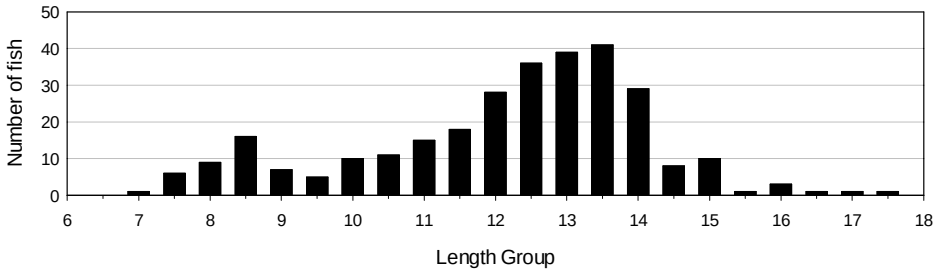


- Figure 4: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Mill Creek Section of the Yellowstone River during 2012 and 2014.

Corwin Springs Section

In 2014, river conditions prevented the completion of an YCT population estimate in the Corwin Springs Section; therefore trends in length frequency were examined for sample fish.

Length-frequency data indicates a range of fish in the 7.0 to17.5 inch length groups with the highest frequencies of YCT in the 12.0 to 14.0 inch length groups (Figure 5).

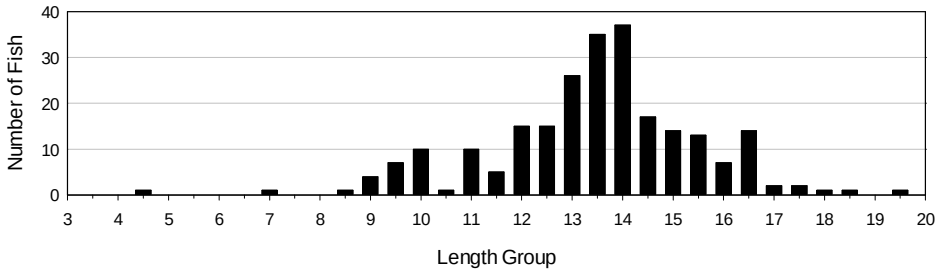


- Figure 5: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Corwin Springs Section of the Yellowstone River during 2014.

Rainbow Trout

Sheep Mountain Section

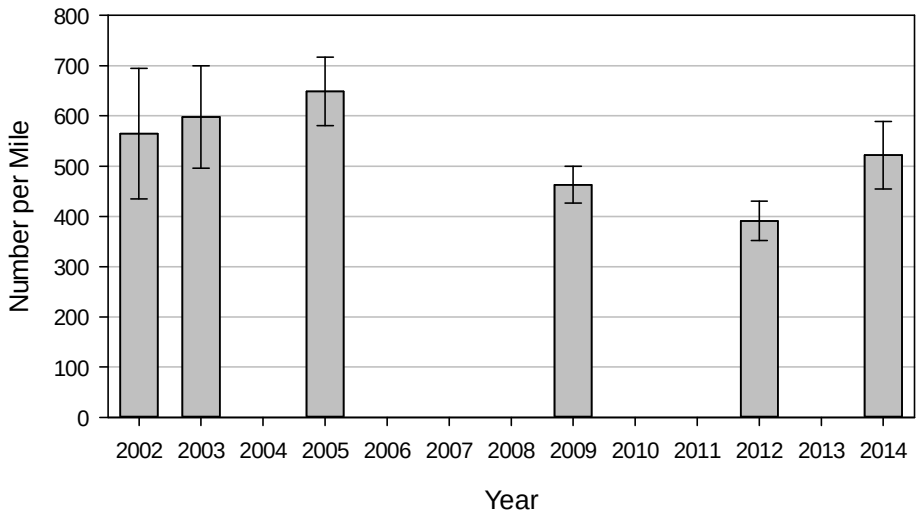
Limited recapture data prevented the calculation of a rainbow trout population estimate for the Sheep Mountain Section in 2014. Length-frequencies of fish that were captured during the sampling effort ranged from the 4.5 to 19.5 inch length groups with the highest frequencies being in the 13.0 to 14.0 inch length groups (Figure 6).



- Figure 6: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Mill Creek Section of the Yellowstone River during 2012 and 2014.

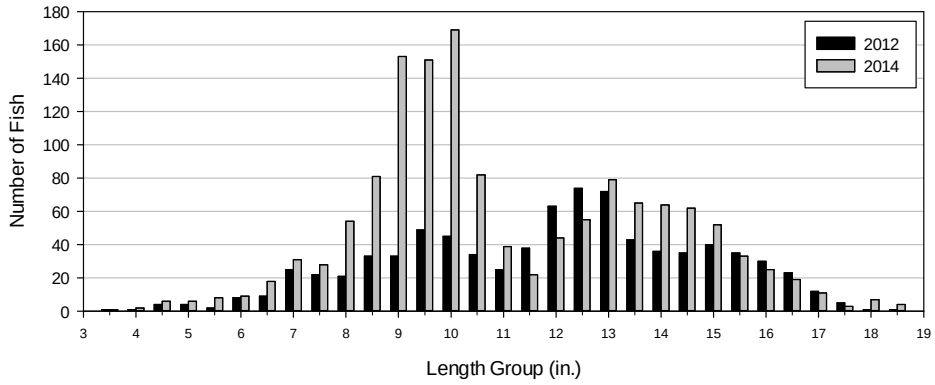
Mill Creek Section

In the Mill Creek Section, the 2014 abundance estimate for rainbow trout was 522 fish/mile (≥ 7in), up from 391 fish/mile (≥ 7in) in 2012 (Figure 7). The 2014 estimate remained lower than estimates for 2002, 2003, and 2005.



- Figure 7: Abundance estimates for rainbow trout (≥ 7in) in the Mill Creek Section of the Yellowstone River from 2002-2014. Error bars represent +/- 2 SD. The section was not sampled in 2004, 2006, 2008, 2010, and 2013. No abundance estimates were made in 2007 and 2011.

The length-frequency distributions for rainbow trout in the Mill Creek Section in 2012 and 2014 are presented below. In both years fish were captured in the 3.5 to 18.5 inch length groups (Figure 8). In 2014, there were large increases in the number of fish in the 8.0 to 11.0 inch length groups indicating increased recruitment and survival of these fish (likely the 2013 cohort). There was a decrease in numbers of fish in the 11.5 to 12.5 inch length groups.

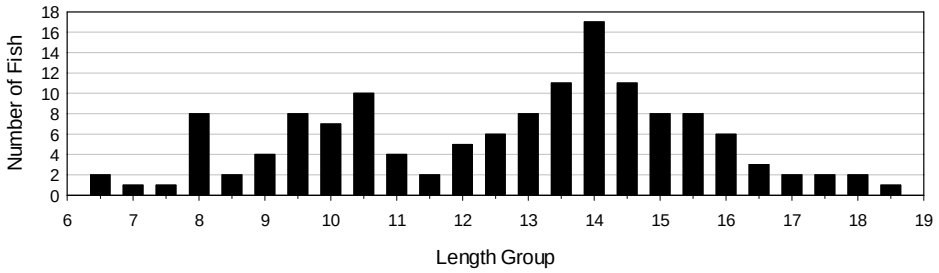


- Figure 8: Length-frequency distributions for rainbow trout sampled in the Mill Creek Section of the Yellowstone River during 2012 and 2014.

Corwin Springs Section

In 2014, river conditions prevented the completion of a rainbow trout population estimate in the Corwin Springs Section; therefore trends in length frequency were examined for sample fish.

Length-frequency data indicates fish were captured in the 6.5 to 18.5 inch length groups with the highest frequencies of rainbow trout in the 13.5 to 14.5 inch length groups (Figure 9).

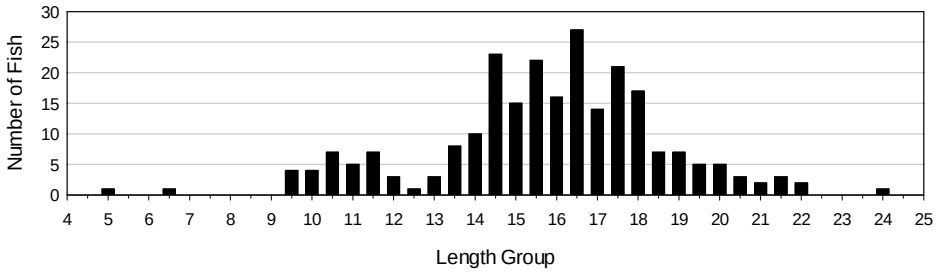


- Figure 9: Length-frequency distributions for rainbow trout sampled in the Corwin Springs Section of the Yellowstone River during 2014.

Brown Trout

Sheep Mountain Section

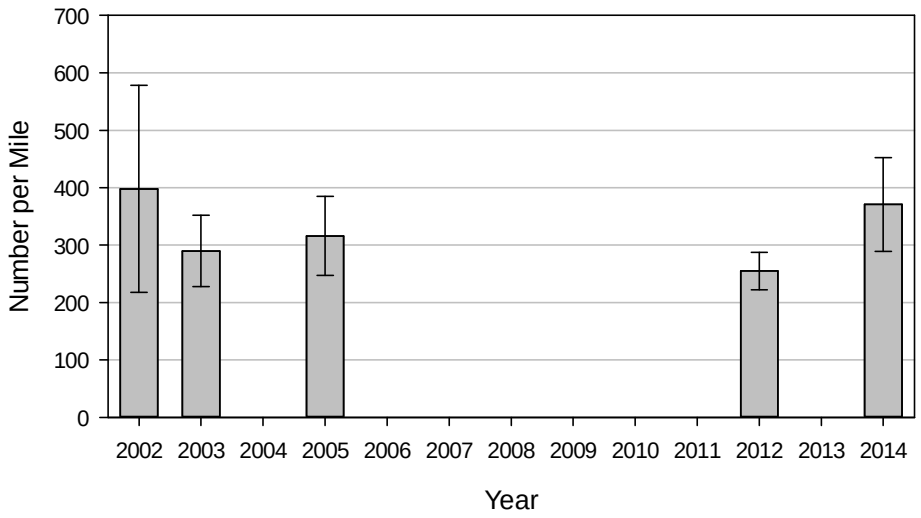
Limited recapture data prevented the calculation of a brown trout population estimate for the Sheep Mountain Section in 2014. Length-frequencies of fish that were captured during the sampling effort ranged from the 5.0 to 24.0 inch length groups with the highest frequencies being in the 14.5 to 18.0 inch length groups (Figure 10**Error! Reference source not found.**).



- Figure 10: Length-frequency distributions for brown trout sampled in the Mill Creek Section of the Yellowstone River during 2014.

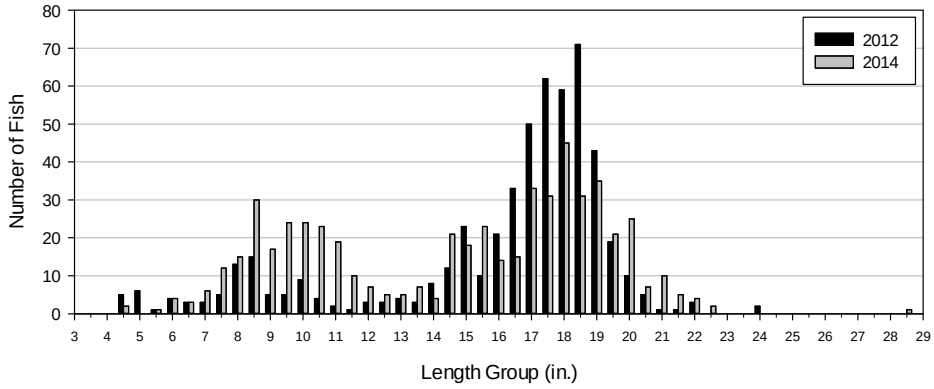
Mill Creek Section

In 2014, the abundance estimate for brown trout in the Mill Creek Section was 371 fish/mile (≥ 7in), down from 255 fish/mile (≥ 7in) in 2012 (Figure 11). The 2014 estimate remained lower than the 2002 estimate and was higher than the 2003 and 2005 estimates.



- Figure 11: Abundance estimates for brown trout (≥ 7in) in the Mill Creek Section of the Yellowstone River from 2002-2014. Error bars represent +/- 2 SD. The section was not sampled in 2004, 2006, 2008, 2010, and 2013. No abundance estimates were made in 2007, 2009, and 2011.

The 2014 length-frequency distribution for brown trout in the Mill Creek Section showed an increase in the frequency of fish in the 7.0 to 13.5 inch length groups and a decrease in the 15.0 to 19.0 inch groups (Figure 12). This suggests an increase in recruitment and survival of smaller fish from 2012 to 2014 as well as a decrease in survival and recruitment of some of the larger fish.



- Figure 12: Length-frequency distributions for brown trout sampled in the Mill Creek Section of the Yellowstone River in 2012 and 2014.

Corwin Springs Section

River conditions in 2014 prevented the completion of a brown trout population estimate in the Corwin Springs Section; therefore trends in length frequency were examined for sample fish.

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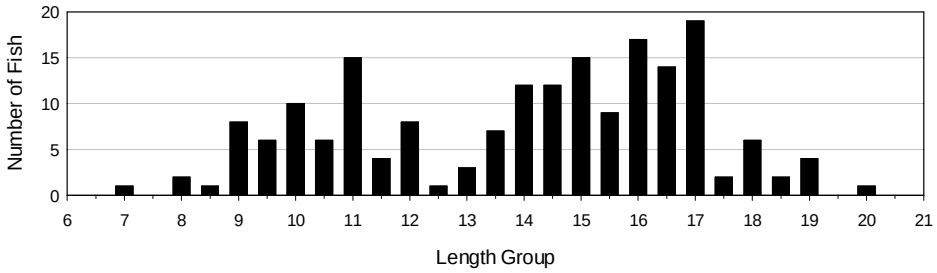
Length-frequency data indicates a range from the 7.0 to 20.0 inch length groups with the highest frequencies of brown trout in the 10.0 to 11.0 and 14.0 to 17.0 inch length groups (Figure 13).

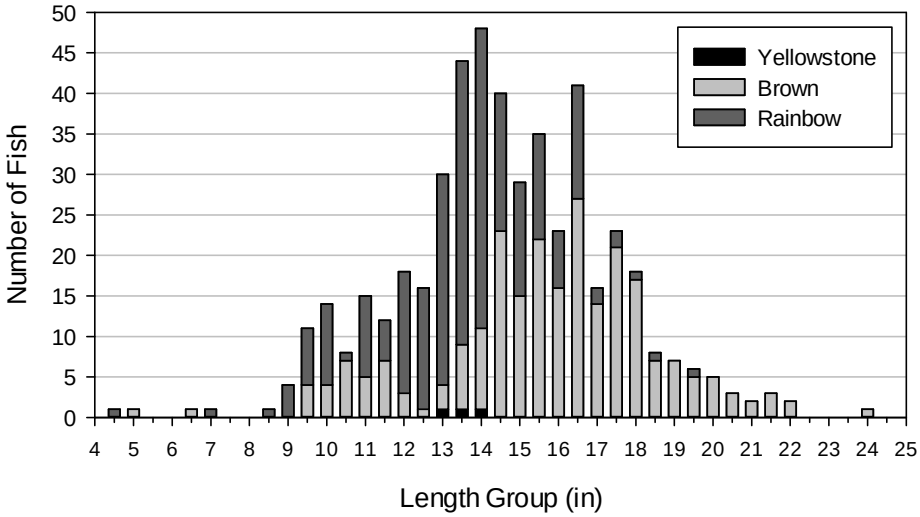


- Figure 13: Length-frequency distributions for brown trout sampled in the Mill Creek Section of the Yellowstone River during 2014.

Summary

Sheep Mountain Section

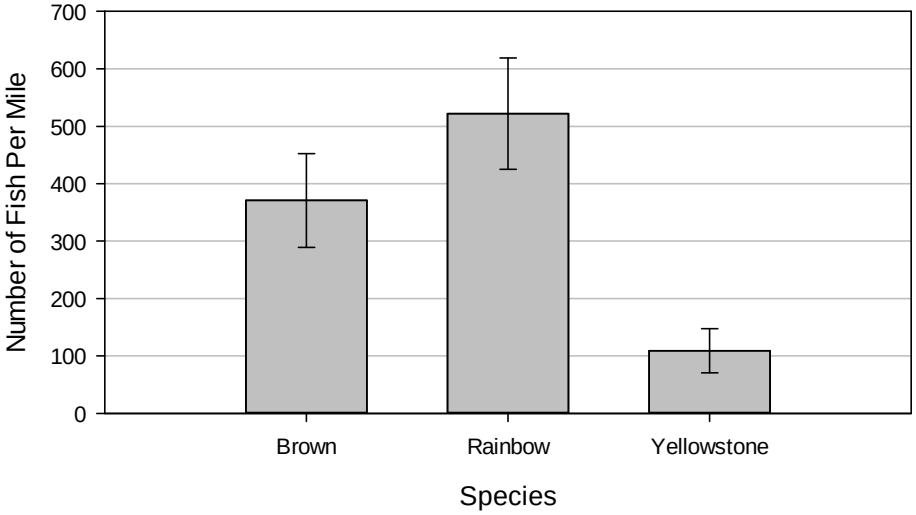
Length-frequencies of all three trout species in the Sheep Mountain Section in 2014 were compared. Rainbow trout made up most of the fish in the 8.5 to 10.0 and 12.0 to 14.0 inch length groups (Figure 14). Brown trout made up most of the fish in the 14.5 to 24.0 inch length groups. Yellowstone cutthroat were represented by one fish in each of the 13.0, 13.5, and 14.0 inch length groups.



* Figure 14: Length-frequency distribution for rainbow trout, brown trout, and Yellowstone cutthroat trout sampled in the Sheep Mountain Section of the Yellowstone River in 2014.

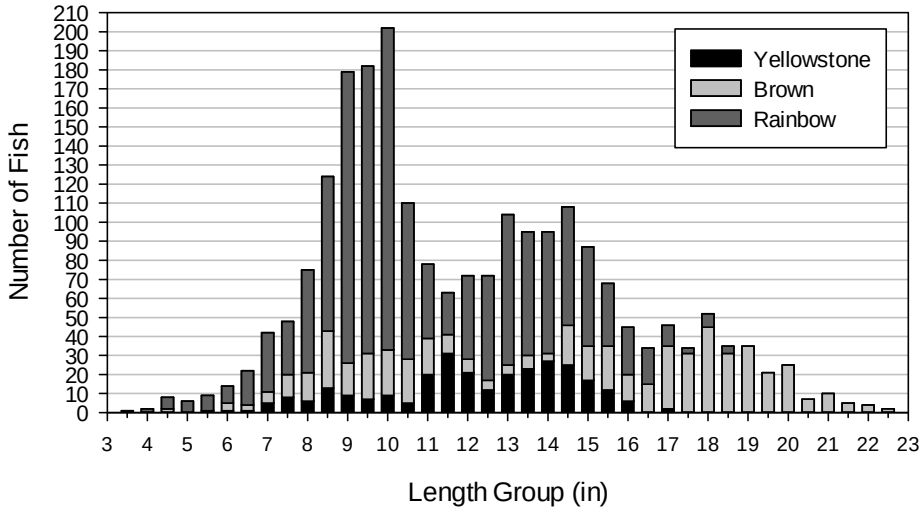
Mill Creek Section

There are obvious differences when the 2014 abundance estimates for brown, rainbow, and Yellowstone cutthroat trout in the Mill Creek Section are compared. The rainbow and brown trout estimates are significantly different from the Yellowstone cutthroat trout (Figure 15). 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 and this accounts for some of the difference noted.



- Figure 15: Abundance estimates for brown and rainbow trout (≥ 7in) and Yellowstone cutthroat trout (≥10in) in the Mill Creek Section of the Yellowstone River for 2014. Error bars represent +/- 2 SD.

The 2014 length-frequencies for all three trout species in the Mill Creek Section are combined below (Figure 16). Rainbow trout made up the majority of the fish in the 3.5 to 16.0 inch length groups. Both rainbow trout and Yellowstone cutthroat trout made up almost all of the fish in the 11.0 to 15.0 inch length groups with few brown trout in the sample. Brown trout made up the majority of the fish in the 15.0 to 28.5 inch length groups and were the only species in the 19.0 to 24 inch length groups for the Mill Creek Section.

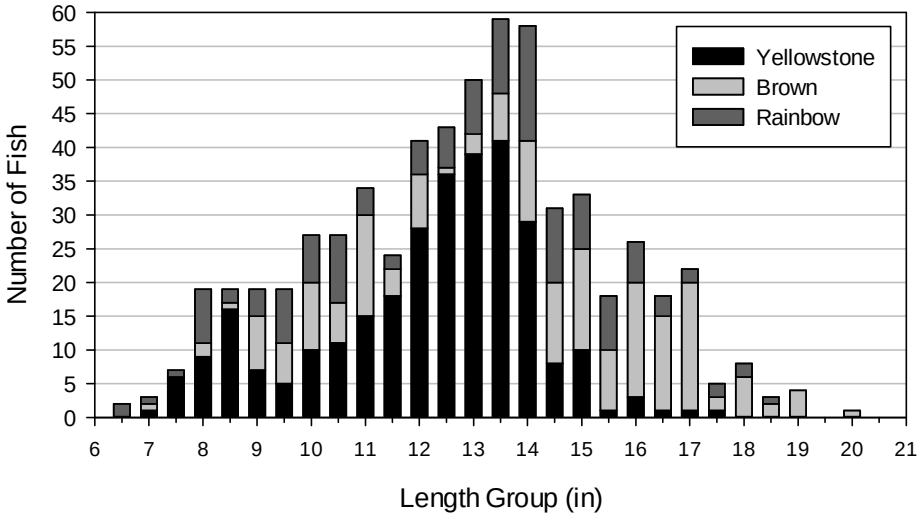


- Figure 16: Length-frequency distribution for rainbow trout, brown trout, and Yellowstone cutthroat trout sampled in the Mill Creek Section of the Yellowstone River in 2014.

Corwin Springs Section

When length-frequencies for all three trout species in the Corwin Springs Section were compared for 2014 Yellowstone cutthroat trout made up the majority of the fish in the 7.5 to 8.5 and 10.5 to 14.0 inch length groups (Figure 17). Brown trout made up the majority of the fish in the 14.5 to

20.0 inch length groups and rainbow trout only made up the majority of the fish in the 8.0 and 9.5 inch length groups.



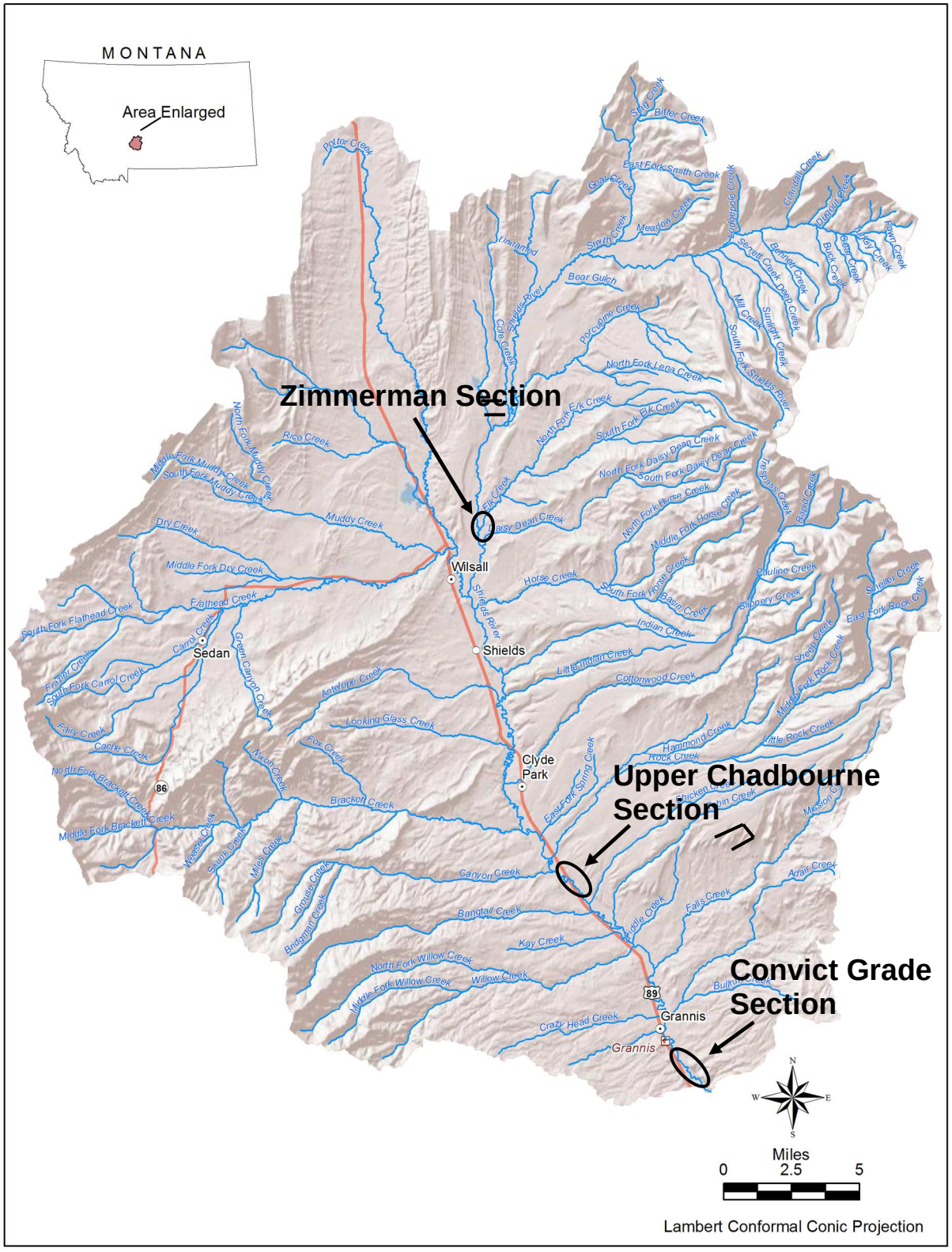
- Figure 17: Length-frequency distribution for rainbow trout, brown trout, and Yellowstone cutthroat trout sampled in the Corwin Springs Section of the Yellowstone River in 2014.

Shields River Procedures

In spring 2014, the Convict Grade, Upper Chadbourne, and Zimmerman Sections of the Shields River were sampled (Table 3 and Figure 18).

- Table 3: Survey sections where trout and mountain whitefish sampling occurred in the Shields River in 2014.

Section Name	Survey Data	Length (ft)	Approximate Location		
Convict Grade	04/01/14	6,758	Upper Boundary	North West	45.74036 110.48224
			Lower Boundary	North West	45.72618 110.46231
Upper Chadbourne	04/02/14	3,208	Upper Boundary	North West	45.83520 110.57040
			Lower Boundary	North West	45.82979 110.55937
Zimmerman	04/08/14	4,224	Upper Boundary	North West	46.02599 110.64086
			Lower Boundary	North West	46.01728 110.64012



• Figure 18: Map of the Shields River drainage displaying the 2014 sampling locations.

A plastic drift boat mounted with mobile electrofishing gear was used to sample the Convict Grade and Upper Chadbourne Sections 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 all three sections, 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 a fin clip and returned to the stream. River conditions prevented a recapture effort in the Convict Grade and Upper Chadbourne Sections.

In the Zimmerman Section, 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. In the Convict Grade and Upper Chadbourne Sections, captured rainbow trout, twelve inches and longer in total length, were tagged with a red, numbered, Floy™ tag to allow for evaluation of Chadbourne Diversion as a passage barrier as well as large-scale monitoring of movement and growth of individual fish.

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

Convict Grade Section

On April 1, 2014 a marking run was completed on the Convict Grade Section. Captured trout were marked with a left pelvic fin clip.

River conditions prevented the completion of a recapture run. As a result a population estimate could not be completed for this section.

Upper Chadbourne Section

The Upper Chadbourne Section was sampled on April 2 and 3, 2014. Rainbow trout that were captured in this section were tagged with an individual numbered Floy™ tag and were transported and released below the Chadbourne Diversion to assess the effectiveness of the diversion as barrier to fish passage as well as reduce the threat of hybridization with Yellowstone cutthroat trout. River conditions prevented the completion of a recapture run and the completion of a population estimate for trout, other than rainbow trout, in this section.

Zimmerman Section

The marking run for this section was completed on April 8, 2014. Captured trout were marked with a left pelvic fin clip.

On April 14, 2014 the recapture run was completed on the Zimmerman Section.

Shields River Results

Shields River Abundances

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

- Table 4: Population abundance estimate results for the Zimmerman Section of the Shields River by species in 2014. Est represents the number of trout (≥7 inches) and mountain whitefish (≥10 inches) per 1,000 ft.

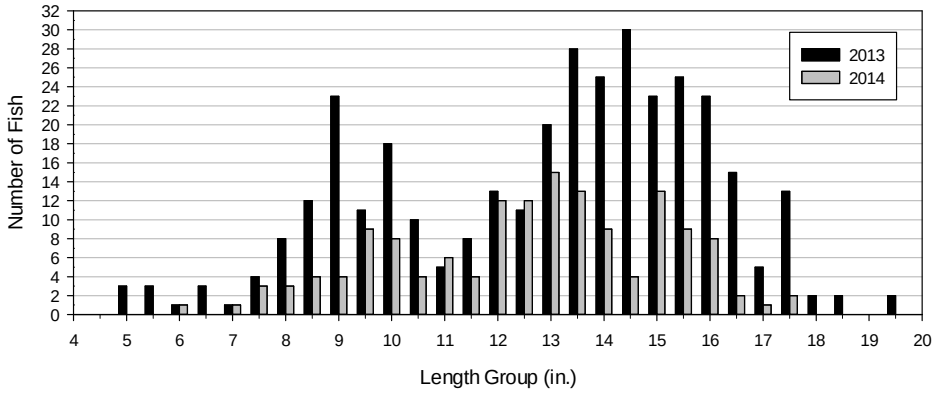
Section (Sample Date)	Species	Est	SD
Zimmerman (5/8/13)	Brown Trout	67	14.6
	Mountain Whitefish	82	12.0

Brown Trout

Convict Grade Section

River conditions prevented the completion of a population estimate for brown trout in the Convict Grade Section in 2014.

The length-frequency distribution for brown trout in the Convict Grade Section shows a decrease in frequencies in all length groups, except the 6.0 and 7.0 inch length groups, from 2013 to 2014 (Figure 19). These decreases are more likely the result of decreased sampling effort in 2014 than to actual changes in the fish population. Future sampling will determine if the decreases were the result of sampling effort or an actual decline in the fish population.

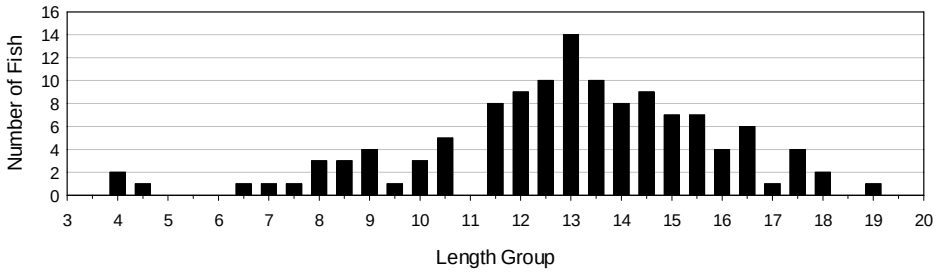


- Figure 19: Length-frequency distributions for brown trout sampled in the Convict Grade Section of the Shields River in 2013 and 2014.

Upper Chadbourne Section

A population estimate was not completed in the Upper Chadbourne Section in 2014 as a result of river conditions.

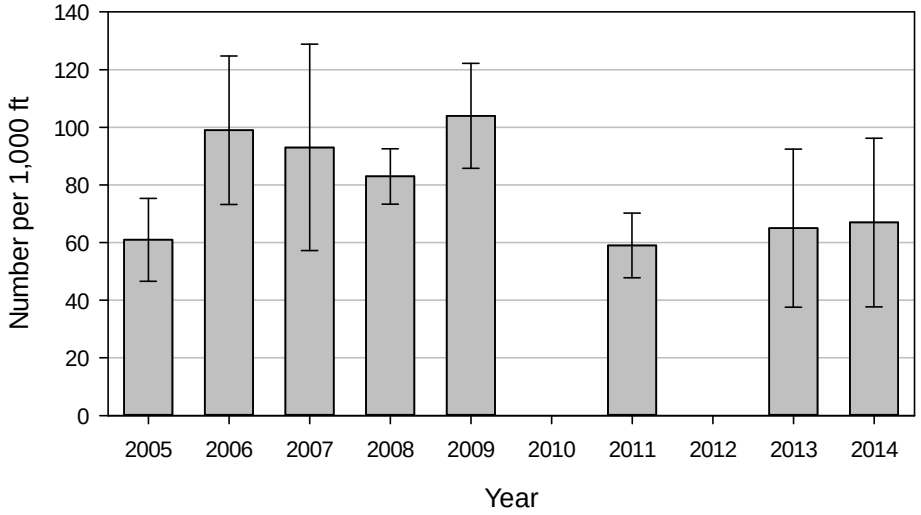
The length-frequency distribution of brown trout in the Upper Chadbourne Section indicates a range of fish in length groups from 4.0 to 19.0 inches in 2014 (Figure 20). The highest frequency of fish was in the 13.0 inch length group.



- Figure 20: Length-frequency distributions for brown trout sampled in the Upper Chadbourne Section of the Shields River in 2014.

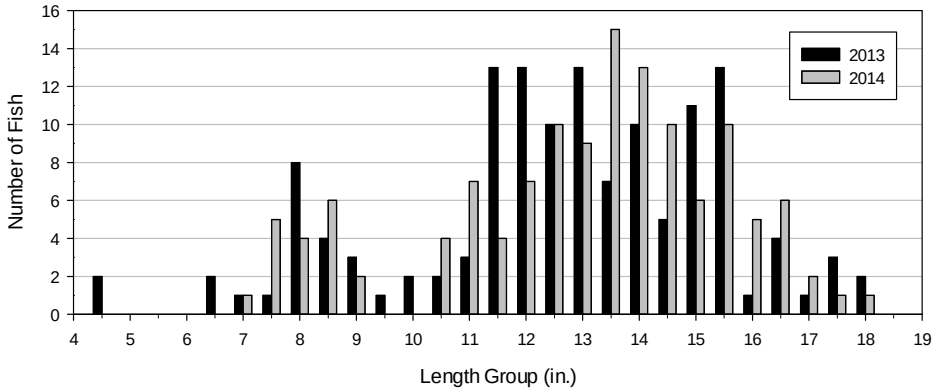
Zimmerman Section

In 2014, the population estimate for brown trout in the Zimmerman Section was 67 fish/mile (≥ 7 in), up slightly from 65 fish/mile (≥ 7 in) in 2013 (Figure 21). This still remains below the estimates of 2006 through 2009 but is consistent with 2005, 2011, and 2013 estimates.



- Figure 21: Abundance estimates for brown trout (≥ 7 in) in the Zimmerman Section of the Shields River from 2005-2014. Error bars represent +/- 2 SD. No sampling occurred in 2010 and no estimate was made in 2012.

The length-frequency distributions for brown trout in the Zimmerman Section shows limited changes from 2013 to 2014 (Figure 22). In 2014, the changes included increases and decreases among length groups for the 4.5 to 18.0 inch length groups.



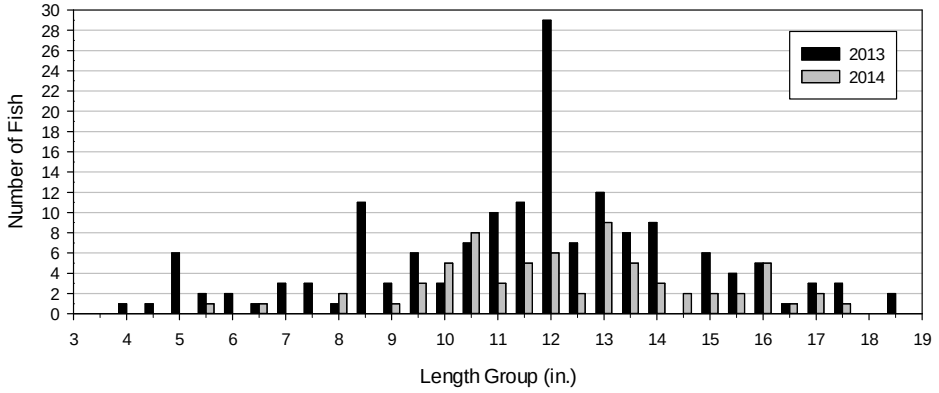
- Figure 22: Length-frequency distributions for brown trout sampled in the Zimmerman Section of the Shields River in 2013 and 2014.

Rainbow Trout

Convict Grade Section

In the Convict Grade Section, an abundance estimate for rainbow trout was not made in 2014 due to river conditions preventing the completion of a recapture effort.

The length-frequency distributions for rainbow trout in the Convict Grade Section indicate similar ranges of fish length groups for both years with 2013 having a few smaller and larger fish than 2014 (Figure 23). Frequencies of fish were lower in 2014 than 2013 and were likely the result of the limited sampling effort in 2014. The highest frequencies were in the 12.0 inch and 13.0 inch length groups in 2013 and 2014, respectively.

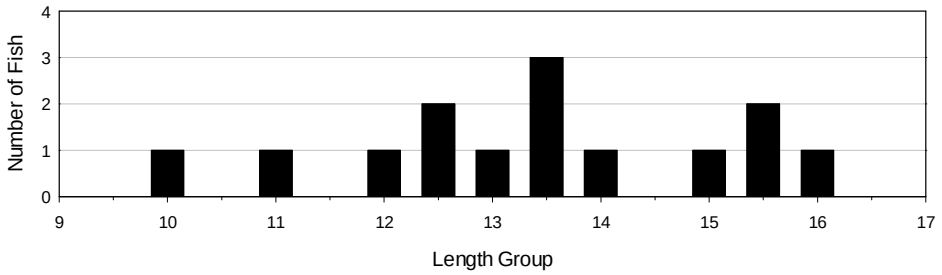


- Figure 23: Length-frequency distributions for rainbow trout sampled in Convict Grade Section of the Shields River in 2013 and 2014.

Upper Chadbourne Section

In 2014, a total of14 rainbow trout were captured in the Upper Chadbourne Section. All of the captured rainbow trout were tagged with an individual Floy™ tag and released below Chadbourne Diversion to reduce the threat of hybridization with Yellowstone cutthroat trout and to evaluate the effectiveness of the diversion as a fish passage barrier. As a result, no population estimate for rainbow trout was made for this section.

The rainbow trout length-frequency data for the Upper Chadbourne Section in 2014 had a range of length groups from 10.0 to 16.0 inches (Figure 24). In 2014, the highest frequencies were in the 13.5, 12.5, and 15.5 inch length groups.



- Figure 24: Length-frequency distributions for rainbow trout sampled in the Upper Chadbourne Section of the Shields River in 2014.

Zimmerman Section

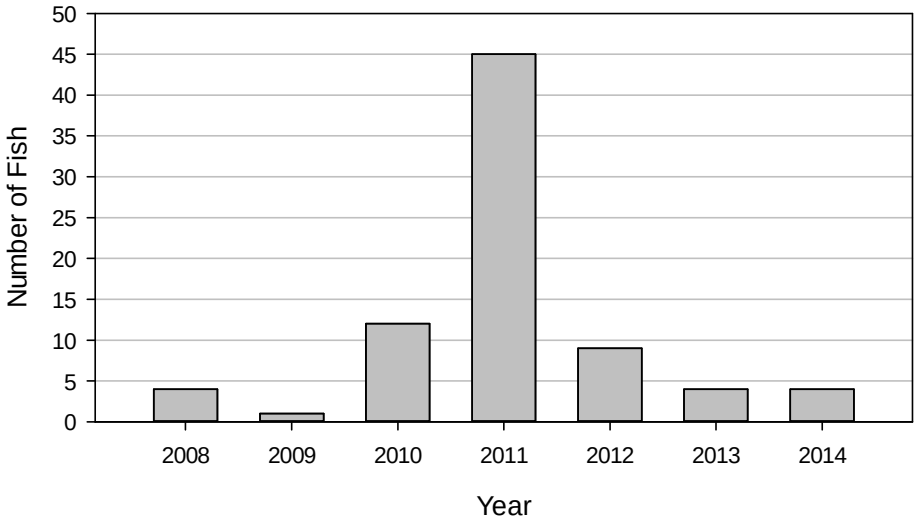
The first documentation of rainbow trout in the Zimmerman Section occurred in 2013. Two rainbow trout were captured in the section and were 7.3 and 8.1 inches in total length. No rainbow trout were captured in the section in 2014. One hybrid fish that was 7.5 inches in total length was captured in 2014. Hybrid crosses between rainbow trout and Yellowstone cutthroat trout have been captured in the section in the past.

Yellowstone Cutthroat Trout

Convict Grade Section

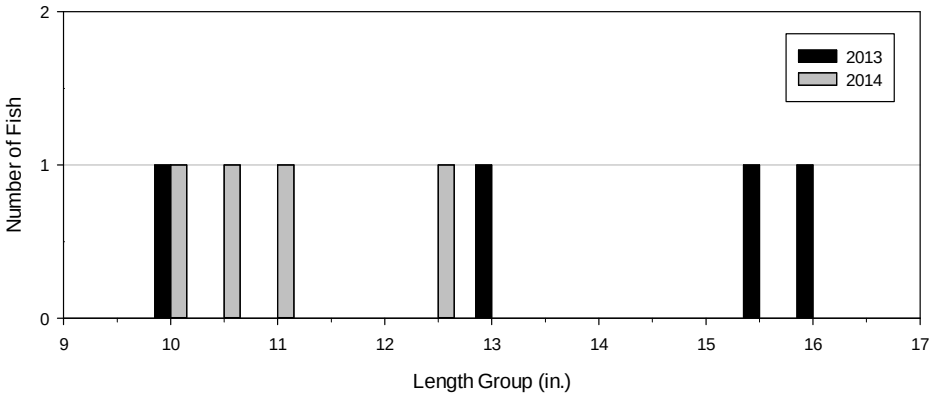
A population estimate for Yellowstone cutthroat trout could not be generated for the Convict Grade Section as a result of river conditions that did not allow for a recapture effort. Captures of Yellowstone cutthroat trout in this section have ranged from 1 to 45 fish from 2008-2014 (Figure 25). In 2014, a total of four Yellowstone cutthroat trout were captured in the Convict Grade Section. This remains below the high of 45 in 2011.

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



- Figure 25: Number of Yellowstone cutthroat trout captured in the Convict Grade Section of the Shields River for 2008-2014.

The 2013 and 2014 length-frequencies for Yellowstone cutthroat trout in the Zimmerman Section are presented below (Figure 26). Fish in the 13.0 to 16.0 inch length groups were not present in the 2014 sample.

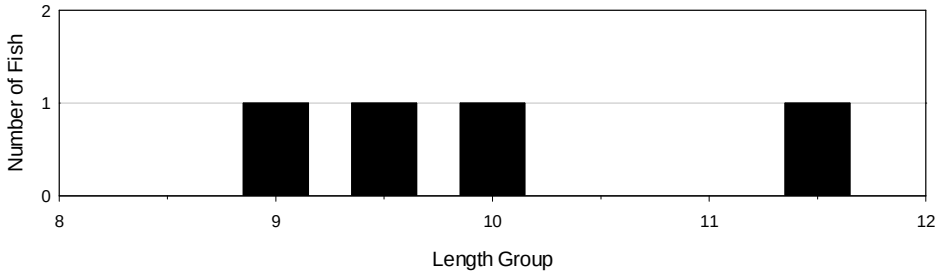


- Figure 26: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Convict Grade Section of the Shields River in 2013 and 2014.

Upper Chadbourne Section

River conditions prohibited a recapture effort on the Upper Chadbourne Section and no population estimate was done for Yellowstone cutthroat trout.

The length-frequency distribution for Yellowstone cutthroat trout captured in the Upper Chadbourne Section in 2014 is presented below (Figure 27).

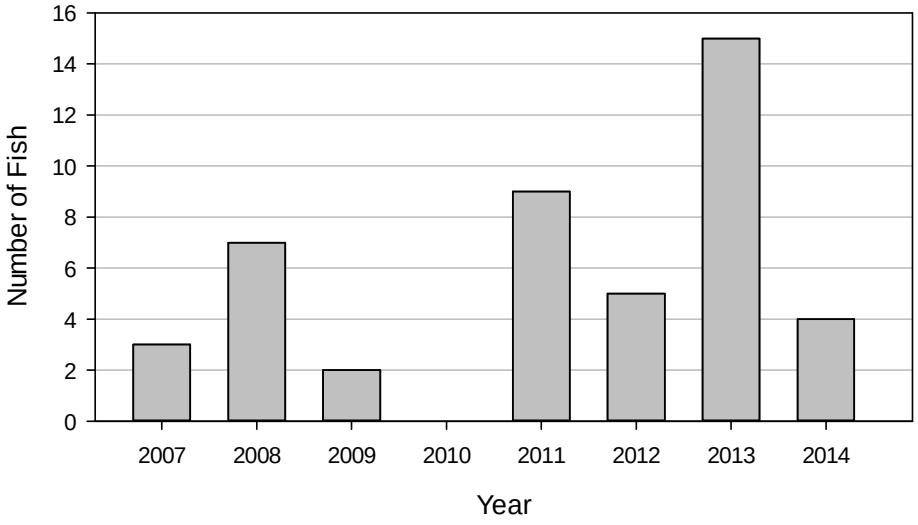


- Figure 27: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Upper Chadbourne Section of the Shields River in 2014.

Zimmerman Section

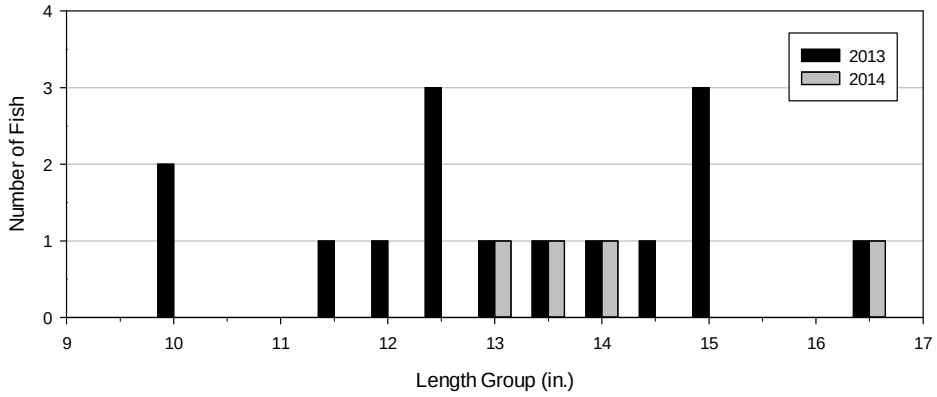
In 2014, a total of four Yellowstone cutthroat trout were captured in the Zimmerman Section. This is down from 15 in 2014 (Figure 28). Numbers of Yellowstone cutthroat trout captured in the Zimmerman section remain variable from year to year.

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



- Figure 28: Total numbers of Yellowstone cutthroat trout captured in the Zimmerman Section of the Shields River 2007-2014. No sampling occurred in 2010.

The length-frequency distributions for Yellowstone cutthroat in the Zimmerman Section indicate obvious changes in the range of length groups with fish between 2013 and 2014 (Figure 29).

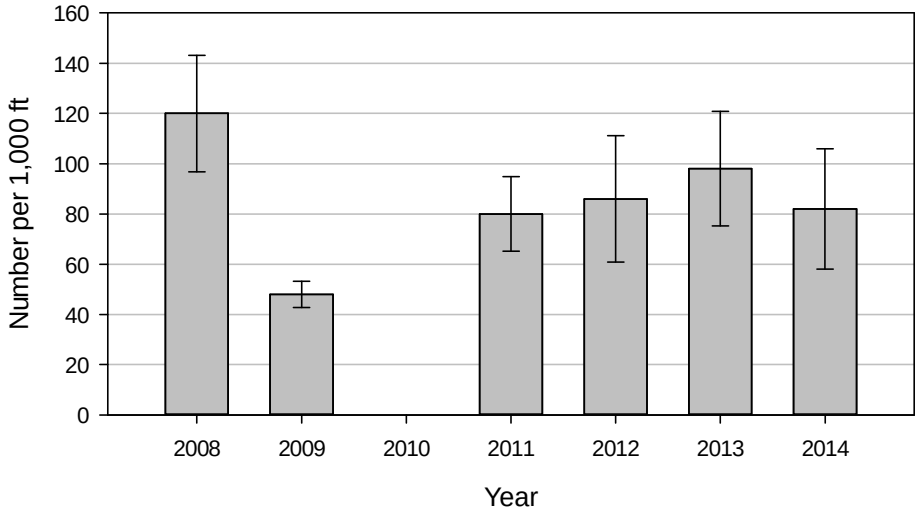


- Figure 29: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Zimmerman Section of the Shields River in 2011, 2012 and 2013.

Mountain Whitefish

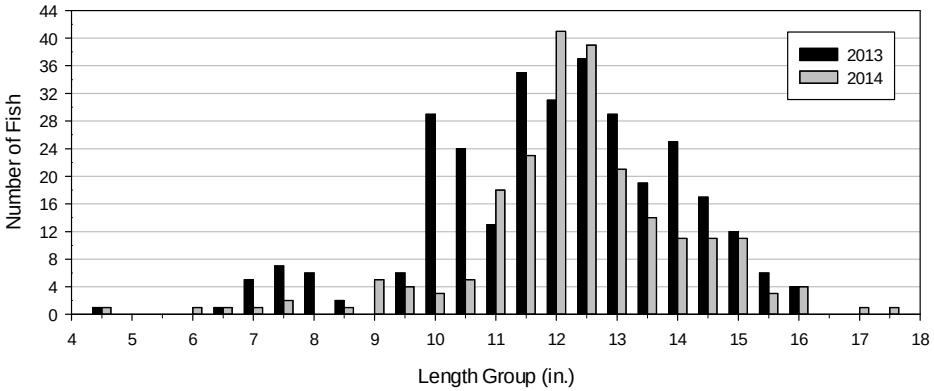
Zimmerman Section

Abundance estimates for mountain whitefish in the Zimmerman Section increased from 2009 through 2013 and decreased in 2014 (Figure 30). The 2014 abundance estimate for mountain whitefish in the Zimmerman Section was 82 fish/1,000 feet (≥ 10in) down from 98 fish/1,000 feet (≥ 10in) in 2013.



- Figure 30: 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 2013 and 2014, in the Zimmerman Section, were similar (Figure 31). Decreases in the frequencies of a few length groups, particularly fish in the 7.0 to 10.5 and 13.0 to 15.5 inch length groups, occurred in 2014.

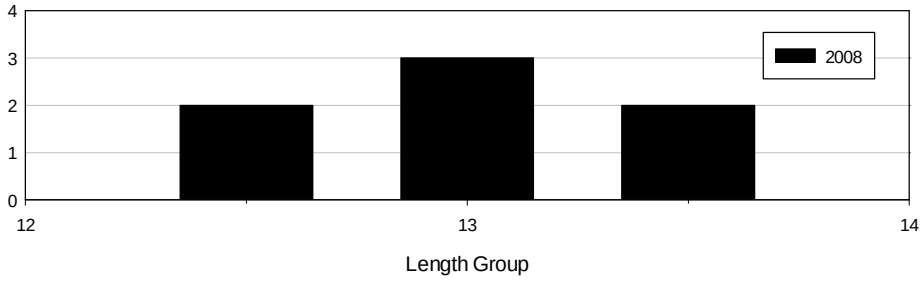


- Figure 31: Length-frequency distributions for mountain whitefish sampled in the Zimmerman Section of the Shields River in 2013 and 2014.

Brook Trout

Upper Chadbourne Section

Brook trout were not captured in the Upper Chadbourne section in 2014. In 2008, the last time the section was sampled, a total of seven brook trout were captured in the section and the length-frequency distribution is presented below (Figure 32).

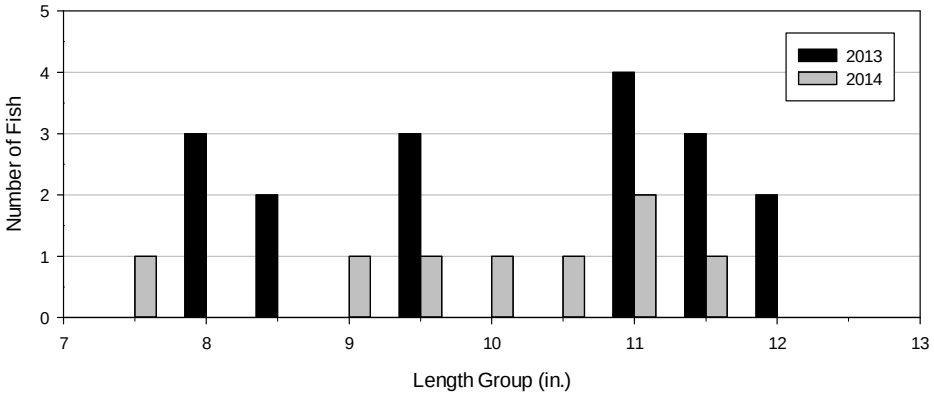


- Figure 32: Length-frequency distribution for brook trout sampled in the Upper Chadbourne Section of the Shields River in 2008.

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 2014, eight brook trout were captured in the Zimmerman Section and ranged from 7.8 to 13.3 inches in total length (Figure 33). This is down from the 17 fish captured in 2013.

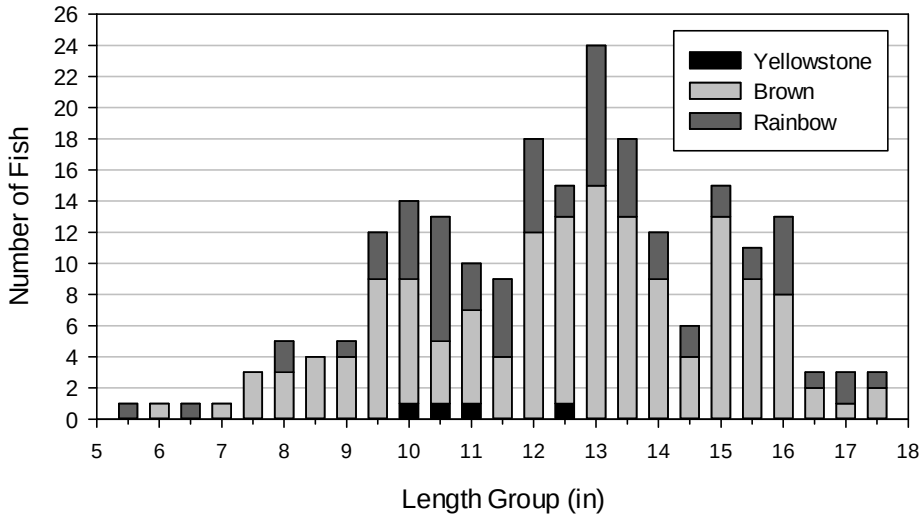


- Figure 33: Length-frequency distributions for all brook trout sampled in the Zimmerman Section of the Shields River in 2013 and 2014.

Summary

Convict Grade Section

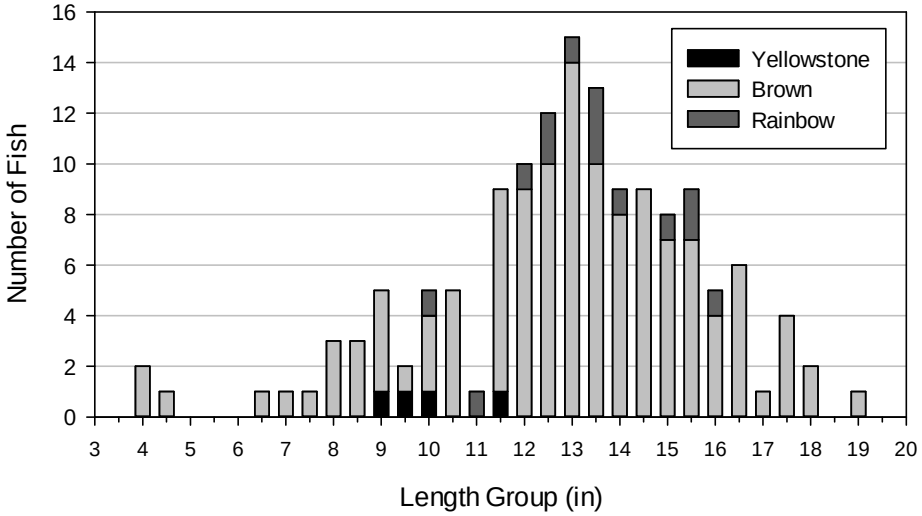
When the length-frequencies for all trout in 2014, in the Convict Grade Section, are combined brown trout make up the majority of the fish in the 7.0 to 16.5 inch length groups (Figure 34). Rainbow trout made up the second largest proportion of fish in the same range of length groups. Yellowstone cutthroat trout only made up a total of three fish in the 10.0 to 12.5 inch length group range.



- Figure 34: Length-frequency distribution for Yellowstone cutthroat, brown and rainbow trout sampled in the Convict Grade Section of the Shields River in 2014.

Upper Chadbourne Section

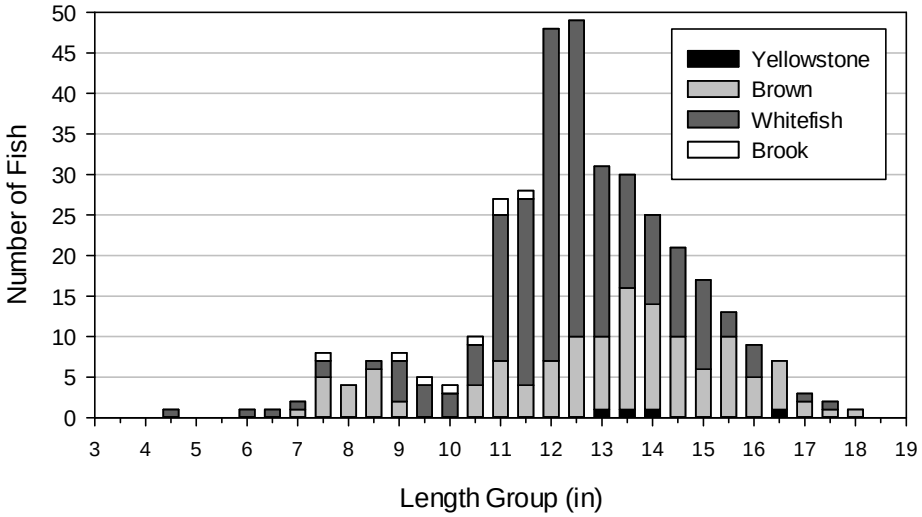
In 2014, brown trout made up the majority of the trout in all length groups with the exception of the 11.0 inch length group, which was made up of only rainbow trout, when all of the length frequencies were combined (Figure 35). Rainbow trout made up a small portion the fish in the 10.0 and 12.0 to 16.0 inch length groups. Yellowstone cutthroat consisted of only one fish in the 10.0 to 11.0 and 12.5 inch length groups.



- Figure 35: Length-frequency distribution for Yellowstone cutthroat, brown and rainbow trout sampled in the Upper Chadbourne Section of the Shields River in 2014.

Zimmerman Section

In the Zimmerman Section, mountain whitefish made up the majority of the fish in the 9.0 to 15.0 inch length groups when all species length-frequencies were combined for 2014 (Figure 36). Brown trout made up the majority of the fish in the 7.5 to 8.5 inch length groups and Yellowstone cutthroat only contributed on fish to the 13.0 to 14.0 and 16.5 inch length groups. Brook trout made up a small portion of the fish in the 7.5 and 9.0 to 11.5 inch length groups.



- Figure 36: Length-frequency distribution for Yellowstone cutthroat, brown trout, and brook trout and mountain whitefish sampled in the Zimmerman Section of the Shields River in 2014.

Dailey Lake Fish Stocking

Dailey Lake has been stocked with rainbow trout, Yellowstone cutthroat trout, and walleye in order to maintain a fishery for these species. In 2014, Dailey Lake was stocked with rainbow and Yellowstone cutthroat trout.

Walleye

In 2014, Dailey Lake was not stocked with walleye. This is part of a stocking plan change that was initiated in 2012. Walleye stocking was changed from annually to every other year in the lake and the number of walleye stocked was reduced from 10,000 to 5,000. The intent of the change is to increase the survival of walleye by reducing competition within and among the fish species in the lake. This change will be monitored to determine success and will be changed as necessary.

Stocking rates for walleye from 2009 through 2013 are presented in the table below (Table 5). As indicated above, walleye were not stocked in 2012 and 2014 as part of the new stocking plan.

- Table 5: Walleye stocking information from 2009-2013.

Year	Date	Strain	Length (in)		Number
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
2013	Sept. 9	Fort Peck	4.5		5,000
				Total	5,000

Rainbow Trout and Yellowstone Cutthroat Trout

A total of 5,152 Arlee rainbow trout young-of-the-year (YOY) from Giant Springs Trout Hatchery were stocked on April 21, 2014 (Table 6). The Arlee rainbow trout averaged 4.4 inches in length. On May 29, 2014, a total of 5,000 Eagle Lake strain YOY rainbow from Bluewater Springs Trout Hatchery were stocked, and they had an average length of 3.38 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.

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 rainbow trout by reducing the competition within the species. This change will be monitored and modified if needed.

- Table 6: Trout stocking information from 2010-2014.

Year	Date	Strain	Length (in)	Number
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
2013	Apr. 29	Arlee	4.4	4,988
	Apr. 29	Yellowstone	7.0	5,000
	May 28	Eagle lake	3.15	5,500
			Total	14,988
2014	Apr. 21	Arlee	4.4	5,152
	Apr. 22	Yellowstone	7.3	5,000
	May 29	Eagle lake	3.38	5,500
			Total	15,652

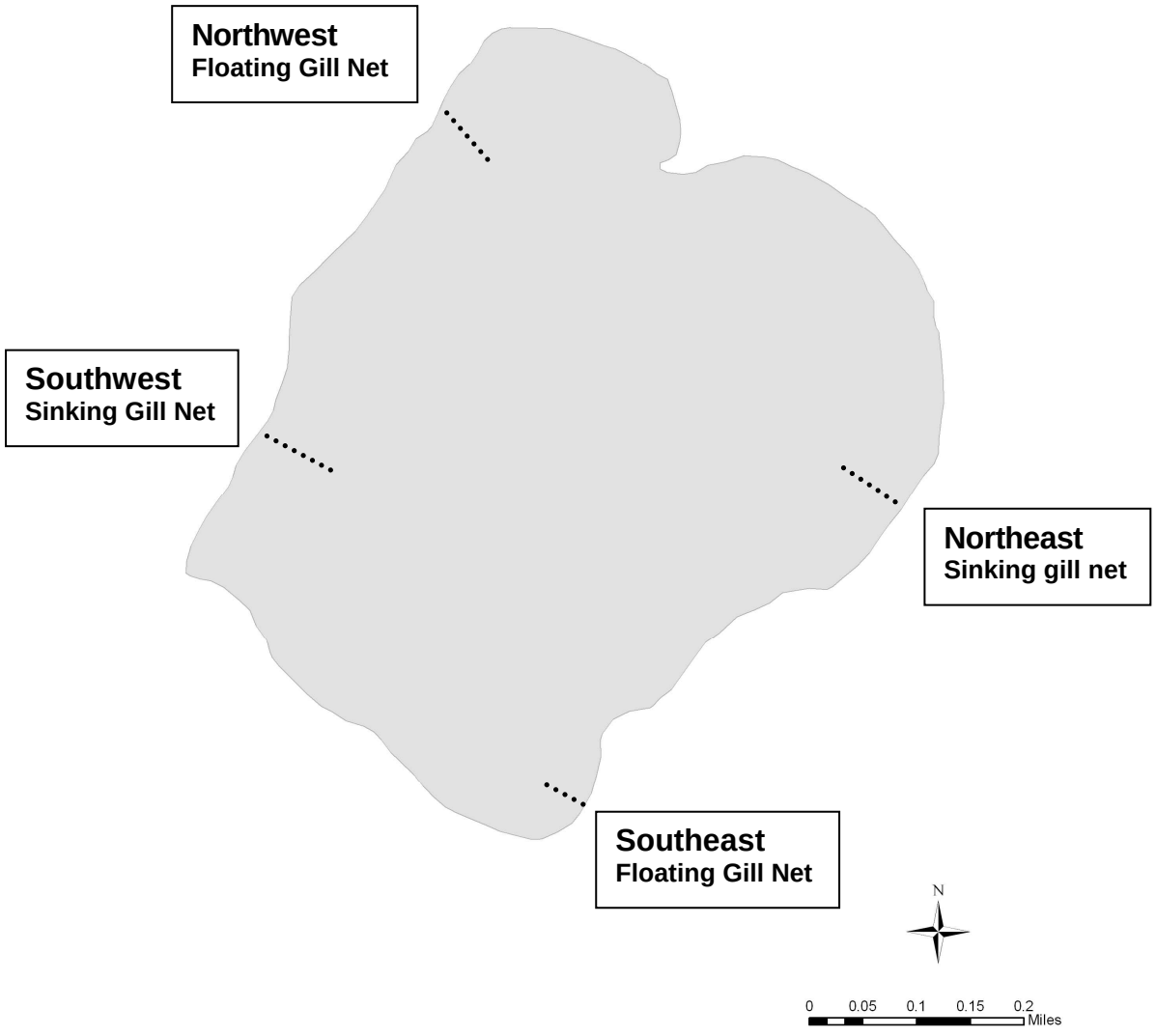
On April 22, 2014, Dailey Lake was stocked with 5,000 Yellowstone cutthroat trout YOY from the Yellowstone River Hatchery (Table 6). These fish had an average length of 7.3 inches.

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 2014. The lake was not sampled in 2013 due to timing conflicts. The long-term series of gill nets were set the evening of May 12, 2014. This set consists of four gill nets located in the four corners of the lake (Figure 37).

The nets were pulled on the morning of May 13, 2014. 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 37: Map of Dailey Lake showing locations of gill nets in 2014.

Dailey Lake Results

Gill Netting

Catch-Per-Unit-Effort

Rainbow Trout

Catch-per-unit effort (CPUE) for rainbow trout in all nets, in 2014, decreased to 2.8 fish/net night, down from 5.8 fish/net night in 2012 (Figure 38). The CPUE for rainbow trout in floating nets in 2012 was 7.0 fish/net night and decreased to 2.0 fish/net night in 2014 (Figure 39). CPUE in sinking nets also decreased slightly from 4.5 fish/net night in 2012 to 3.5 fish/net night in 2012 (Figure 40).

Yellow Perch

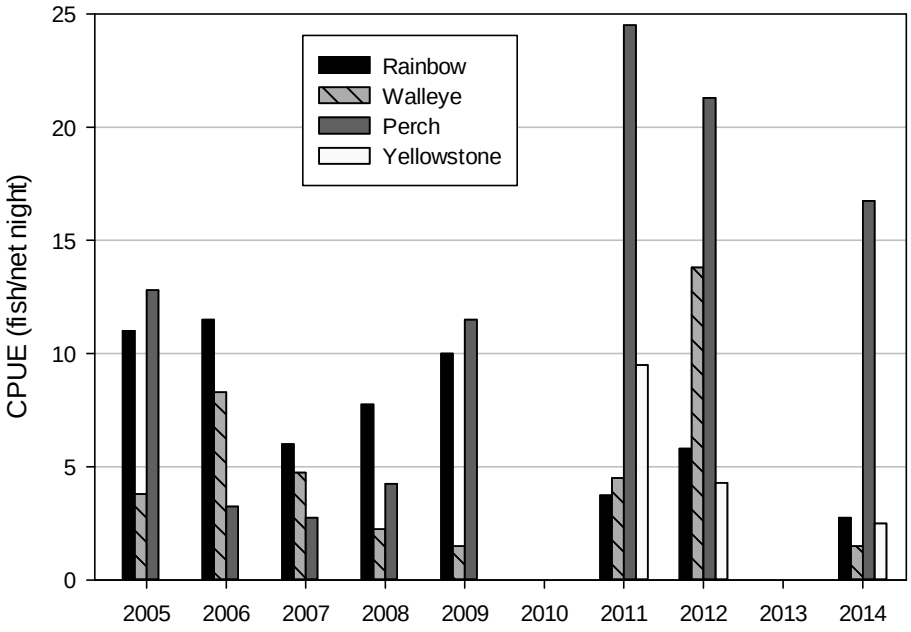
In 2014, the CPUE for yellow perch in all nets was 16.8 fish/net night compared to 21.3 fish/net night in 2012 (Figure 38). In 2012, CPUE for yellow perch in the floating nets was 24.0 fish/net night and decreased to 19.5 fish/net night in 2014 (Figure 39). The CPUE for sinking gill nets was 11.0 fish/net night in 2014, a decrease from 18.5 fish/net night in 2012 (Figure 40).

Walleye

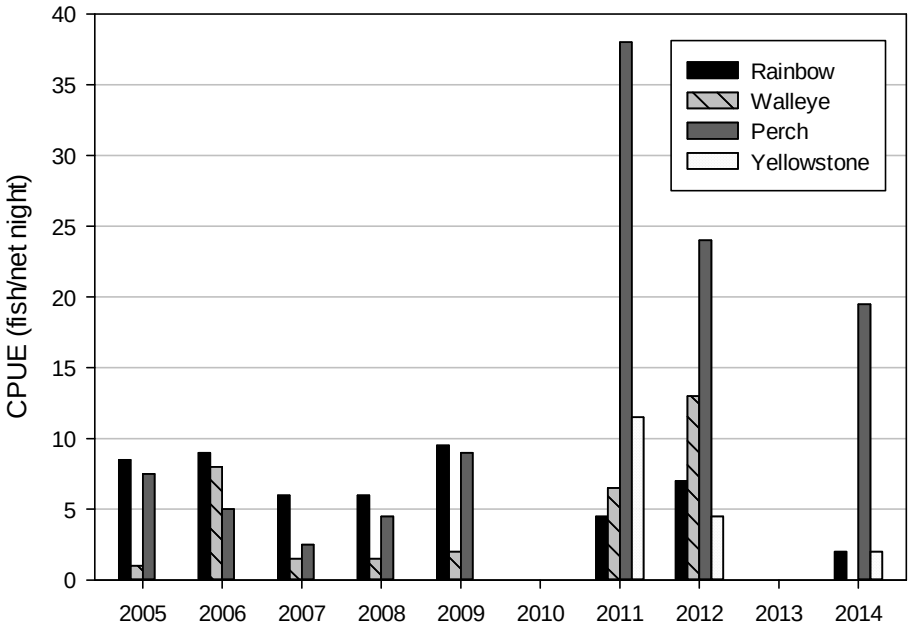
CPUE for walleye in all nets dropped back down to a low of 1.5 fish/net night in 2014 from 13.8 fish/net night in 2012 (Figure 38). In 2014, no walleye were captured in floating nets (Figure 39). The CPUE of 3.0 fish/net night was down from 14.5 fish/net night for the sinking nets in 2012 (Figure 40).

Yellowstone Cutthroat Trout

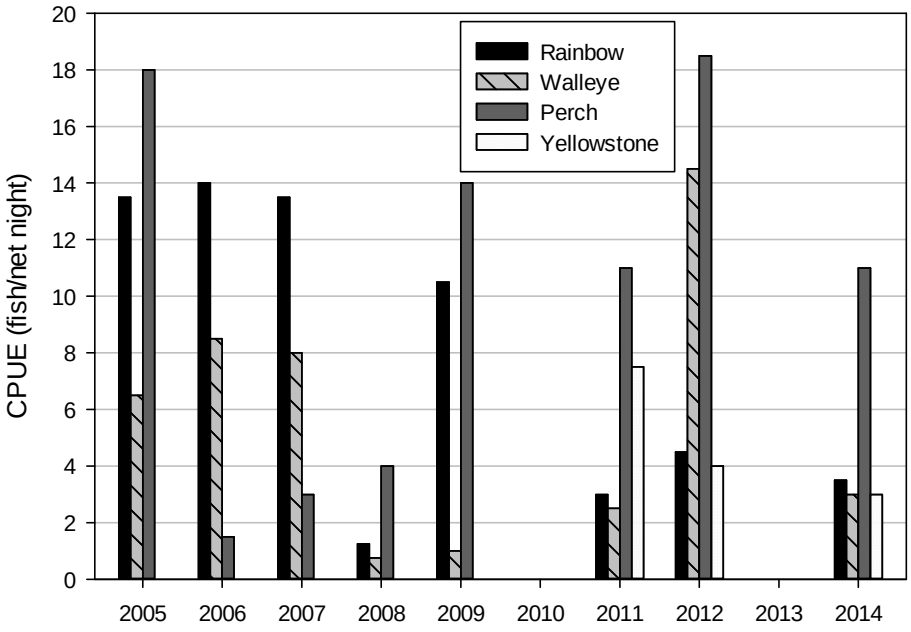
The CPUE for Yellowstone cutthroat in all nets was 2.5 fish/net night in 2014 and continued to drop from the high of 9.5 fish/net night in 2011 (Figure 38). In 2014, CPUE for floating nets decreased from 4.5 fish/net night in 2012 to 2.0 fish/net night (Figure 39). The CPUE for the sinking nets in 2012 was 4.0 fish/net night and decreased to 3.0 fish/net night in 2014 (Figure 40). Yellowstone cutthroat have been stocked in the lake since 2008. The 2014 sample is only the third time Yellowstone cutthroat have been sampled in gill nets since their introduction to the lake.



- Figure 38: Catch-per-unit-effort for rainbow trout, walleye, yellow perch, and Yellowstone cutthroat trout in all gill nets for 2005-2014. No gill net sampling was completed in 2010 and 2013.



- Figure 39: Catch-per-unit-effort for rainbow trout, walleye, yellow perch, and Yellowstone trout in floating gill nets for 2005-2014. No gill net sampling was completed in 2010 and 2013.



• Figure 40: Catch-per-unit-effort for rainbow trout, walleye, yellow perch, and Yellowstone cutthroat trout in sinking gill nets for 2005-2014. No gill net sampling was completed in 2010 and 2013.

Average Length

Rainbow trout

The average length of rainbow trout increased to 18.4 inches in 2014 and remained below the 2009 high of 19.7 inches (Figure 41). The 2014 average length remains higher than the average lengths for 2005 through 2008. Rainbow trout captured in 2014 ranged from 13.4 to 24.5 inches in total length.

Yellow Perch

In 2014, the average length of yellow perch increased from 8.9 inches in 2011 and 2012 to 9.6 inches and remains just below the high of 10.0 inches in 2009 (Figure 41). Captured yellow perch ranged from 7.5 to 11.4 inches in total length.

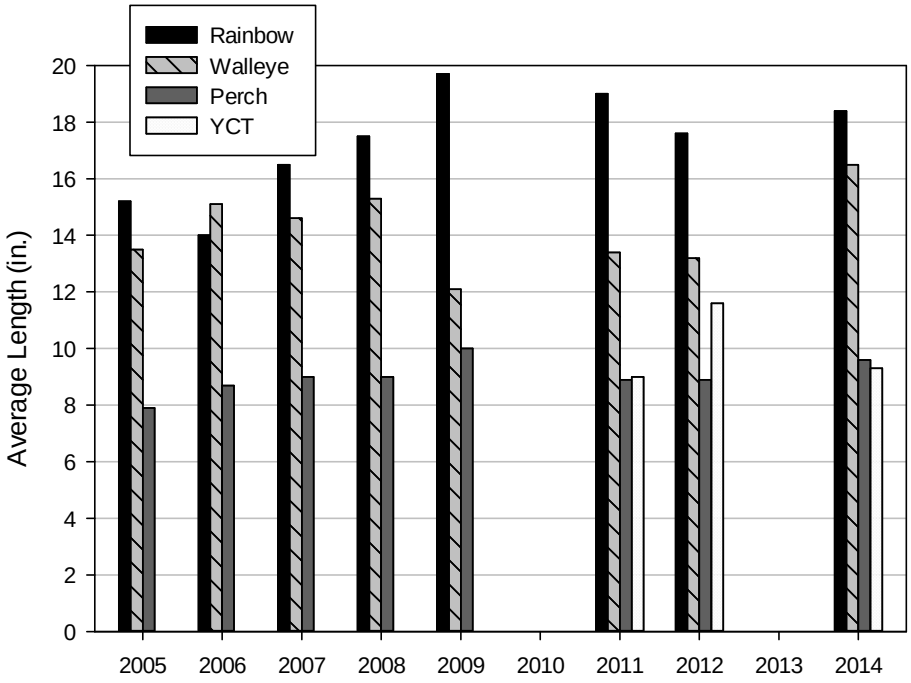
Walleye

The average length of walleye in 2014 was 16.5 inches. This is the highest average length for 2005 through 2014 (Figure 41). Captured walleye ranged from 11.3 to 23.8 inches in total length.

Yellowstone Cutthroat Trout

The average length of Yellowstone cutthroat trout in 2014 was 9.3 inches in total length. This down from the high of 11.6 inches in 2012 (Figure 41). Captured Yellowstone cutthroat trout ranged from 8.5 to 10.2 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, 2012, and 2014.

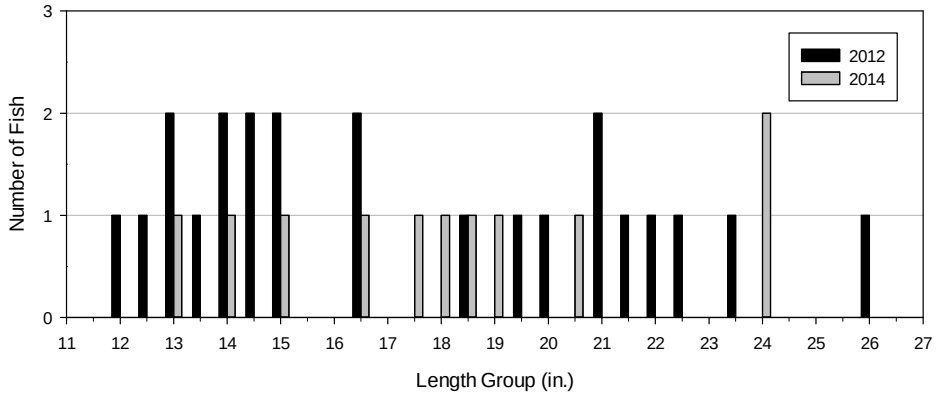


- Figure 41: Average lengths of rainbow trout, walleye, yellow perch and Yellowstone cutthroat trout captured in gill nets in Dailey Lake for 2005-2014. Nets were not set in 2010 and 2013.

Length-Frequency

Rainbow Trout

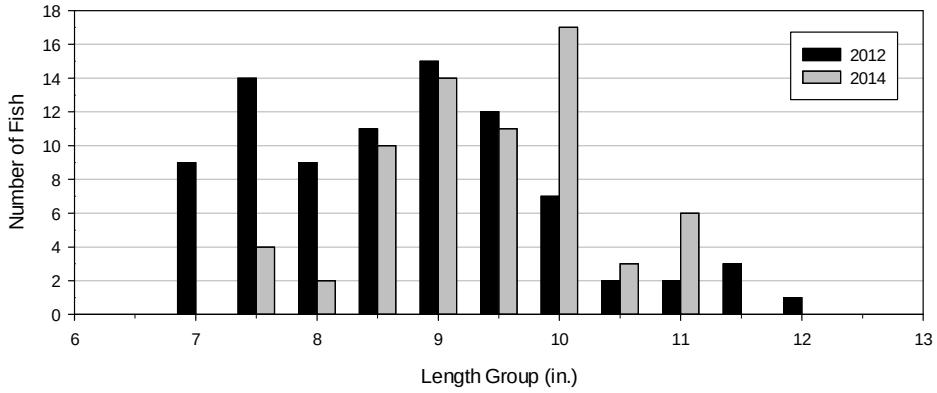
In 2014 and 2012, the length-frequency distribution of rainbow trout in Dailey Lake was spread across a similar range of length groups (Figure 42). Rainbow trout were not sampled in length groups less than 12.0 inches both years and the largest length group with fish decreased from 26.0 in 2012 to 24.0 inches in 2014. 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 42: Length-frequency distribution for Dailey Lake rainbow trout in 2012 and 2014.

Yellow Perch

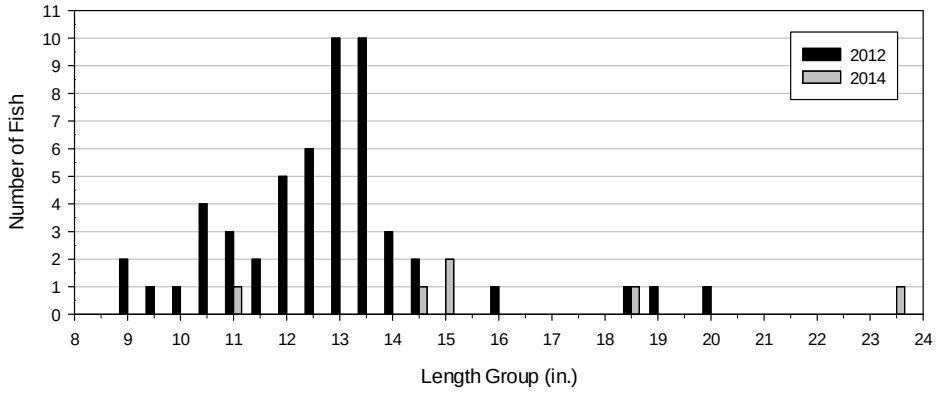
The length-frequency distribution for yellow perch in 2014 indicates fewer fish in the 7.5 to 9.0 length groups and an increase in the 10.0 to 11.0 inch length groups when compared to 2012 (Figure 43). No perch were captured in the 7.0, 11.5, and 12.0 inch length groups in 2014.



• Figure 43: Length-frequency distribution for Dailey Lake yellow perch in 2012 and 2014.

Walleye

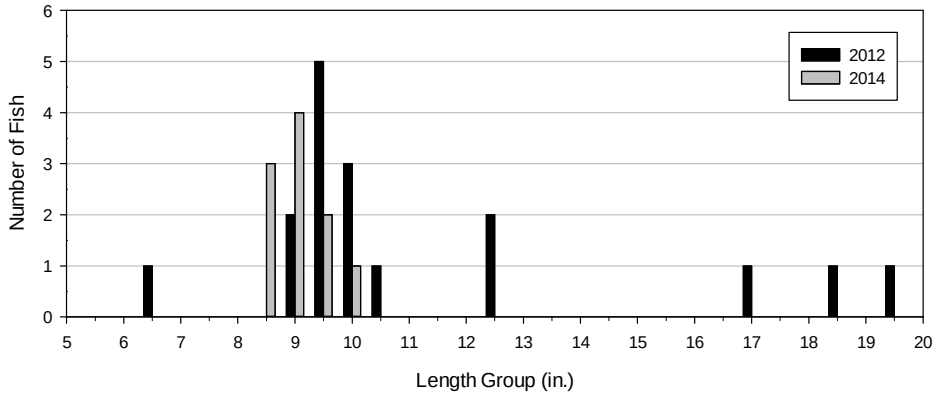
The length-frequency distribution of walleye in 2014 shows a much smaller distribution of fish compared to 2012 (Figure 44). Numbers of fish decreased in all length groups with the exception of the 15.0 and 18.5 inch length groups. The largest length group with fish was 23.5 in 2014 compared to 20.0 in 2012. Further sampling will provide insight to the changes noted between 2013 and 2014.



• Figure 44: Length-frequency distribution of Dailey Lake walleye in 2012 and 2014.

Yellowstone Cutthroat Trout

In 2014, the length-frequency distribution of Yellowstone cutthroat trout shows a narrower range of lengths of fish captured than 2012 (Figure 45). The number of fish in the 9.0 inch length group increased from 2012 to 2014 while the number of fish the 9.5 and 10.0 inch groups decreased. Yellowstone cutthroat have been stocked in the lake since 2008. These are the two most recent of three years that Yellowstone cutthroat have been sampled in gill nets. Continued monitoring is needed to clearly understand stocking survival and capture efficiency.



• Figure 45: Length-frequency distribution of Dailey Lake Yellowstone cutthroat trout in 2012 and 2014.

Dailey Lake Summary

CPUE for all species were down in 2014 compared to 2012. As a result most length frequencies had narrower distributions and frequencies for a number of length groups were down. Even though catch rates were down the average lengths for rainbow trout, walleye, and perch were up from 2012, while average length for Yellowstone cutthroat trout decreased. It is too early to tell how the new stocking plan is affecting walleye and rainbow trout populations in the lake. Further monitoring will provide the needed information to evaluate the plan.

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.