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

Annual Report for 2011

Scott Opitz
Matt McCormack

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Montana Fish, Wildlife & Parks
1400 South 19th Ave.
Bozeman MT 59715

Table of Contents

List of Figures

List of Tables

Abstract

The Carbella, Mill Creek, and Pig Farm Sections on the Yellowstone River were sampled in 2011. The Carbella and Pig Farm Sections have not been previously sampled. Due to inadequate sampling conditions, abundance estimates were not produced for these three sections. A total of 76 Yellowstone cutthroat trout *Oncorhynchus clarki bouvieri*, 41 rainbow trout *Oncorhynchus mykiss*, and 58 brown trout *Salmo trutta* were sampled in the Carbella Section. In the Mill Creek Section, 83,423, and 274 Yellowstone cutthroat trout, rainbow trout, and brown trout were sampled. In the Pig Farm Section, 55 Yellowstone cutthroat trout, 205 rainbow trout, and 153 brown trout were sampled. In the Shields River, the Zimmerman and Convict Grade Sections were sampled. In the Convict Grade Section, brown trout abundance was estimated at 327 fish/mile (≥7 in) and was down slightly from 2009. Rainbow trout abundance increased slightly to 320 fish/mile (≥7 in). Low numbers of Yellowstone cutthroat trout prohibited the calculation of an abundance estimate. Forty-five Yellowstone cutthroat trout were sampled in the Convict Grade Section and is the highest since 2007. Abundance of brown trout, 59 fish/mile (≥7 in), in the Zimmerman Section was the lowest it has been since 2006. The abundance estimate for mountain whitefish in the Zimmerman Section was 80fish/mile (≥10 in) and is an increase from 2009. Low numbers of Yellowstone cutthroat and eastern brook trout in the Zimmerman Section prohibited the calculation of abundance estimates. A total of nine Yellowstone cutthroat trout, the most since 2006, and two eastern brook trout were sampled in the Zimmerman Section. Results from the long-term gill netting series in Dailey Lake show that catch-per-unit-effort (CPUE) for yellow perch *Perca flavescens* and walleye *Stizostedion vitreum* increased and rainbow trout decreased. Yellowstone cutthroat trout are now being captured in nets after being stocked annually starting in 2008. Average lengths of rainbow trout, yellow perch, and walleye were similar to past years. A new net series was done in 2011with limited success in further describing fish populations in the lake.

Objectives

Funds for this project are provided through the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777k) supporting the Montana Statewide Fisheries Management Program. This program consists of two elements: Fisheries Management in Montana and Statewide Program Coordination. The Fisheries Management element includes four activities, each with associated objectives:

State Program Activities and Objectives

1. Survey and Inventory

   To survey and monitor the characteristics and trends of fish populations, angler harvest and preferences, and to assess habitat conditions in selected waters.

2. Fish Population Management

   To implement fish stocking programs and/or fish eradication actions to maintain fish populations at levels consistent with habitat conditions and other limiting factors.

3. Technical Guidance

   To review projects by government agencies and private parties that have the potential to affect fisheries resources, provide technical advice or decisions to mitigate effects on these resources, and provide landowners and other private parties with technical advice and information to sustain and enhance fisheries resources.

4. Aquatic Education

   To enhance the public's understanding, awareness and support of the state's fishery and aquatic resources and to assist young people to develop angling skills and to appreciate the aquatic environment.

   Statewide activities and objectives are addressed locally by ongoing fisheries investigations and management activities intended to enhance aquatic habitats and recreational fisheries in the upper Yellowstone and Shields River basins.

Local Project Objectives

In 2011, project objectives for state project number 3350 (the Yellowstone and Shields drainage areas) were identical to the statewide objectives listed above. Project objectives are intended to guide continuing efforts to maintain and enhance local fisheries. In support of these efforts, the following data collections, compilations, and analyses are reported here under separate headings:

A. Monitoring of trout abundance and composition in the Yellowstone River based on spring sampling in 2011.

B. Monitoring of trout and whitefish abundance and composition in the Shields River based on spring sampling in 2011.

C. Summary of monitoring and stocking at Dailey Lake: 2011.

State survey, inventory, and fish population management objectives are addressed under headings A through C. Technical guidance and aquatic education objectives are addressed on an ongoing basis by meetings with various angler groups, school groups, journalists, and the public. In fiscal year 2011, these meetings included work supporting the Shields Valley Watershed Group and the Upper Yellowstone Watershed Basin Group, educational seminars for local school children, and meetings with local angling groups such as Trout Unlimited, Upper Yellowstone Walleyes Unlimited, and Livingston Schools to discuss a variety of fisheries topics. Landowner contacts and consultations occurred routinely each month in conjunction with administration of the Montana Natural Streambed and Land Preservation Act and the Montana Stream Protection Act.

Electrofishing Procedures

Mark-recapture methodology was used to estimate trout populations in the Yellowstone and Shields Rivers. Marking and recapture run(s) consist 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 are marked with a fin clip, which can be detected during subsequent sampling events. The fish are then released back into the section and allowed to redistribute themselves for 7-10 days. After this redistribution period the recapture run is completed. Fish are examined and those that have the first fin clip are noted as recaptured. All fish collected during the recapture run are given a second fin clip on a different fin so they are not counted twice if they are captured again during the recapture run.

Yellowstone River Procedures

In spring 2011, trout were sampled in the Pig Farm, Mill Creek and Carbella Sections of the Yellowstone River (Table 1 and Figure 1). The Mill Creek Section is a long-term monitoring section. The Pig Farm and Carbella Sections were added in 2011to investigate abundance, composition, and distribution of fish communities in sections that have little or no historical sampling data.

Electrofishing of the Pig Farm and Carbella sections was completed through the use of drift boats mounted with boom electrofishing equipment. The drift boats used a Coffelt VVP-15 with a 5,000-watt Honda EG5000CL generator. The anodes on both boats were steel droppers suspended from twin booms at the bow, and a steel band around the bottom of the drift boat served as the cathode. Electrofishing of the Mill Creek Section was completed through the use of a jet boat mounted with boom electrofishing equipment. The 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 anodes were stainless steel droppers suspended from twin booms at the bow, and the hull served as the cathode.

A mark-recapture, without replacement, effort was made on the Pig Farm Section. Inventories, but no mark-recapture efforts were made on the Carbella and Mill Creek Sections. 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 first marking run on the Pig Farm Section, the recapture effort was made.

In all three sections genetic samples were collected from Yellowstone cutthroat trout for later analysis. The sample consisted of a small clip of one of the pelvic fins that was stored in 100% denatured ethanol. Captured Yellowstone cutthroat, twelve inches and longer in total length, were tagged with a yellow, numbered, Floy™ tag to allow for large-scale monitoring of movement and growth of individual fish.

- Table 1: Survey sections where trout abundance and composition was sampled in the Yellowstone River in 2011.

Section Name	Survey Date	Length (ft)	Approximate Location		
Carbella	04/20/11	18,111	Upper Boundary	North West	45.21228 110.90174
			Lower Boundary	North West	45.25266 110.87199
Mill Creek	05/10/11	24,816	Upper Boundary	North West	45.64994 110.56211
			Lower Boundary	North West	45.69826 110.51517
Pig Farm	04/5/11	13,392	Upper Boundary	North West	45.71109 110.37103
			Lower Boundary	North West	45.69634 110.30380

- Coordinates in decimal degrees are NAD83 datum.

Carbella Section

Inventory runs were completed in the Carbella Section on April 25, 26, and 27, 2011. The section was split into three subsections. On April 25, one boat sampled the left bank and a second boat sampled the right bank. The boats then switched banks on April 26 and then again on April 27. All captured trout were given a left pelvic fin clip.

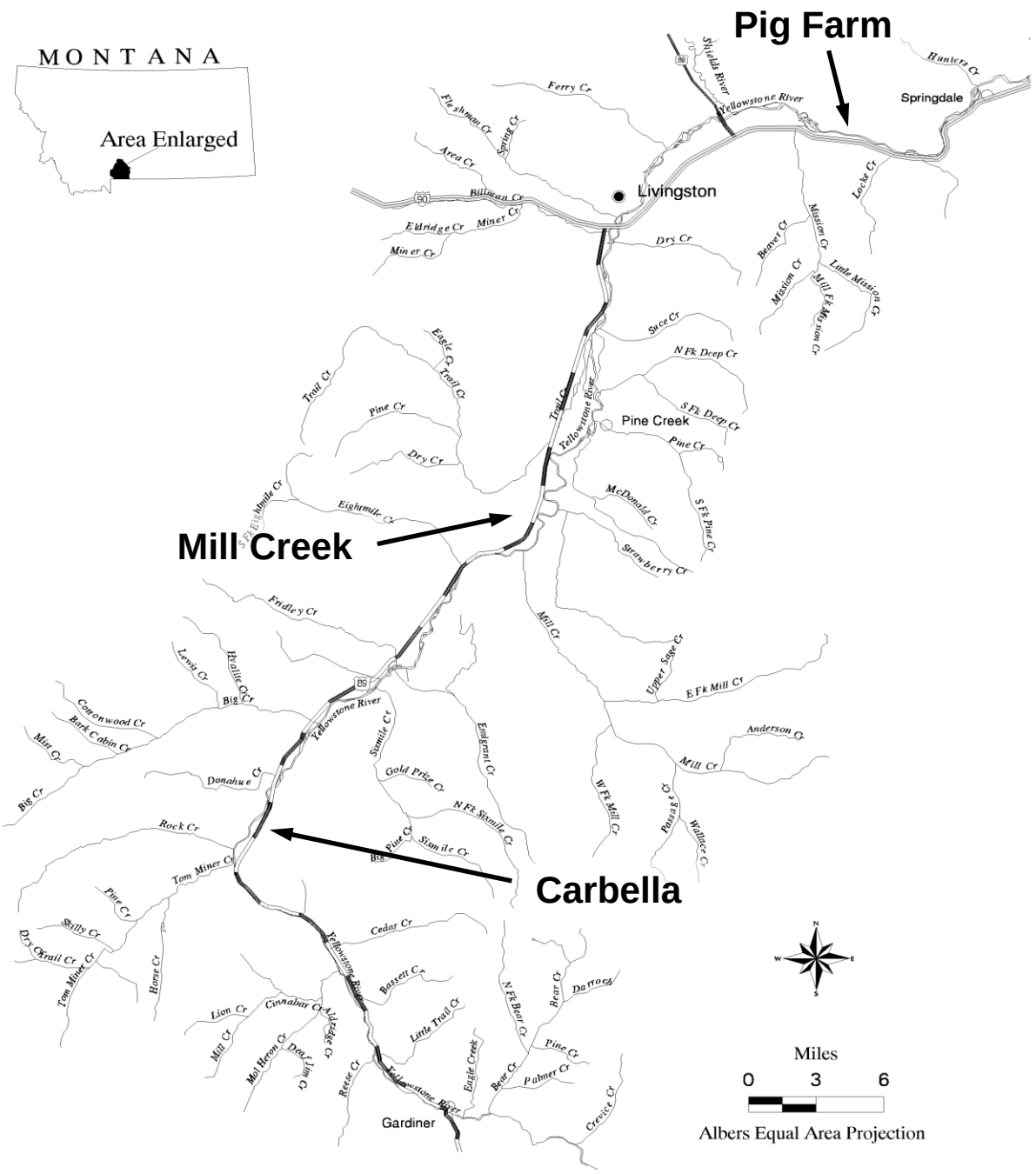
Mill Creek Section

Survey runs were made on the Mill Creek Section on May 10 and 12, 2011. The section was split into five subsections. On May 10, the right and left bank of the first two subsections and part of the third were sampled. The electrofishing equipment was not working correctly and prohibited the completion of the third section. On May 12, both banks of the third through the fifth subsections were sampled. All trout were marked with a left pelvic fin clip.

No further efforts were made to get an estimate on this section as a result of high and extremely turbid water due to spring runoff.

Pig Farm Section

Marking runs were made on the Pig Farm Section on April 5 and 6, 2011. Recapture runs were made on April 12, 13, and 14, 2011. The right bank was sampled on April 5 and 12 and the left bank was sampled on April 6 and 13. On April 14 two boats were used to sample, one on each bank. All trout were marked with a left pelvic fin clip. Low recapture rates of all fish species prevented calculation of abundance estimates.



- Figure 1: Map of the Upper Yellowstone River drainage displaying the location of the 2011 sampling sections.

Yellowstone River Results

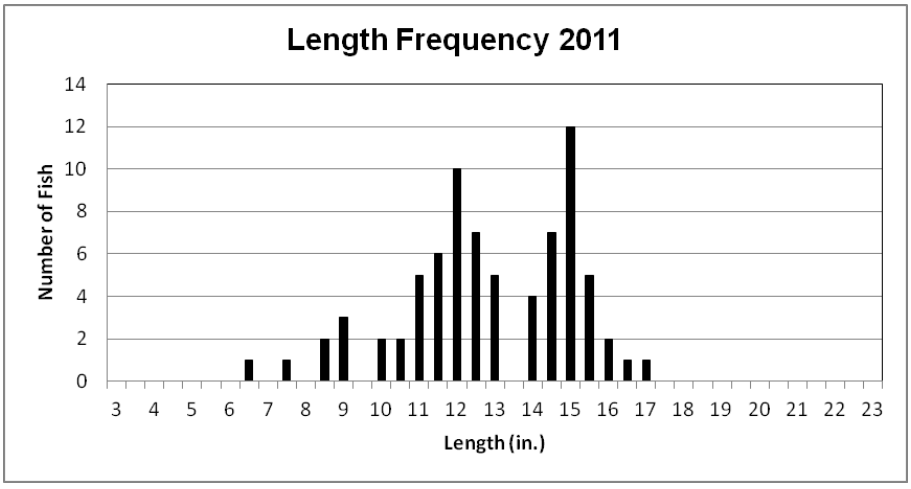
Yellowstone River Trout Abundances

No abundance estimates were calculated for rainbow, brown, or Yellowstone cutthroat trout in the Carbella, Mill Creek, and Pig Farm Sections. Low recapture rates of all fish species prevented calculation of abundance estimates in the Pig Farm Section and recapture runs were not completed in the Carbella and Mill Creek Sections.

Yellowstone Cutthroat Trout

Carbella Section

In 2011, a total of 76 Yellowstone cutthroat trout were captured in the Carbella Section. Yellowstone cutthroat trout with morphological indications of hybridization were not included in this analysis. They ranged in length from 6.6 to 17.4 inches in total length. The majority of the captured fish were 12.0 and 15.0 inches in total length (Figure 2). Since 2011 was the first time this section has been sampled, future sampling is needed to further understand characteristics of the fish community.

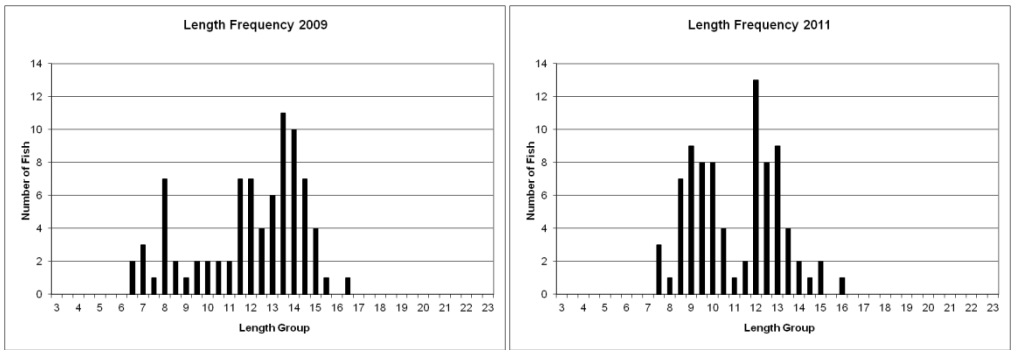


- Figure 2: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Carbella Section of the Yellowstone River during 2011.

Mill Creek Section

A population estimate for Yellowstone cutthroat trout was not calculated for this section, in 2011. A total of 83 Yellowstone cutthroat were captured in this section. In 2009, 62 Yellowstone cutthroat were captured in this section during the mark-recapture effort. Yellowstone cutthroat trout that showed morphological signs of hybridization were not included.

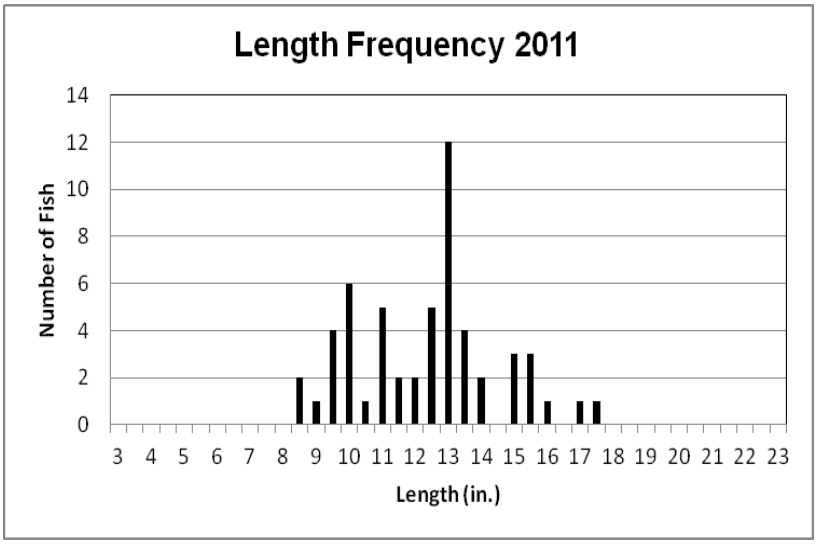
Comparison of length-frequency distributions from 2011 and 2009 tentatively indicate changes in population size structure. Comparing length data collected in 2009 to the 2011 sample, the proportion of fish in the 6.5-8.0 inch range and 13.5-16.5 inch range decreased, and fish in the 8.5-13.0 inch range increased (Figure 3). Both recruitment of juveniles and survival of older fish appear to be down in 2011, compared to 2009; however, this may be a result of the limited sampling that was completed in 2011.



- Figure 3: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Mill Creek Section of the Yellowstone River during 2009 and 2011.

Pig Farm Section

A total of 55 Yellowstone cutthroat trout were captured in the Pig Farm Section. Yellowstone cutthroat trout that showed morphological signs of hybridization were not included. The fish ranged in length from 8.5 to17.5 inches in total length. The length frequency distribution shows a general decline in numbers as fish length increases from 10.0-17.5 inches in total length. The exception to this is fish in the 13.0 inch range (Figure 4). Since 2011 was the first time this section has been sampled, future sampling is needed to further understand characteristics of the fish community.

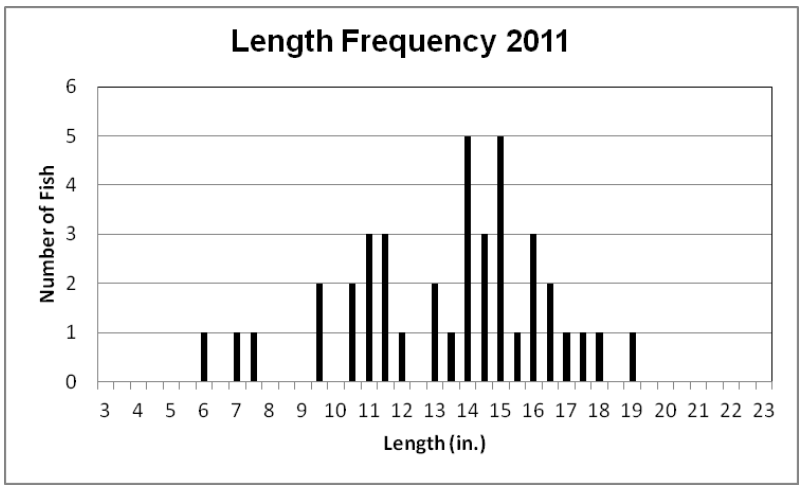


- Figure 4: Length-frequency distribution for Yellowstone cutthroat trout sampled in the Pig Farm Section of the Yellowstone River during 2011.

Rainbow Trout

Carbella Section

In 2011, 41 rainbow trout were captured in the Carbella section. Rainbow trout ranged in from 6.4 to19.3 inches in total length. Based on length frequency, many age classes of rainbow trout are present in the Carbella Section (Figure 5). This is the first time this section has been sampled and future sampling is needed to further understand the characteristics of the fish community.

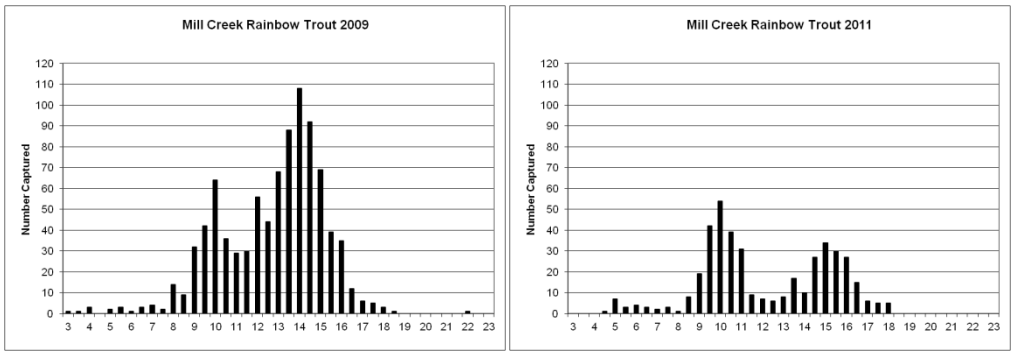


- Figure 5: Length-frequency distribution for rainbow trout sampled in the Carbella Section of the Yellowstone River during 2011.

Mill Creek Section

In the Mill Creek Section, a total of 423 rainbow trout were captured during 2011 sampling efforts. This is less than half of the 889 that were captured during the mark-recapture effort in 2009, and reflects the reduced sampling effort conducted in 2011.

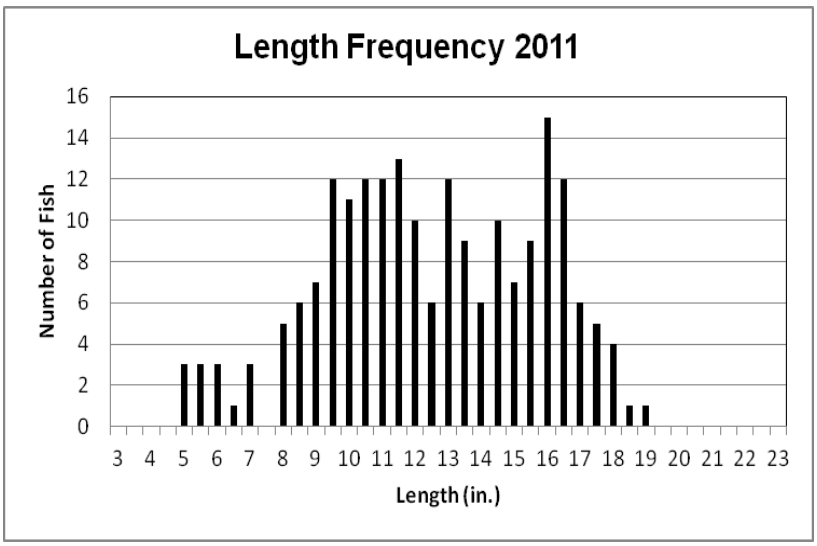
As would be expected, the number of rainbow trout by length are much lower in 2011 compared to 2009. Again, reflecting reduced sampling efforts in 2011. Rainbow trout captured in 2011 ranged in length from 4.6 to18.4 inches in total length (Figure 6).



- Figure 6: Length-frequency distributions for rainbow trout sampled in the Mill Creek Section of the Yellowstone River during 2009 and 2011.

Pig Farm Section

In this section, a total of 205 rainbow trout were captured during sampling in 2011. These fish ranged in length from 5.3 to19.2 inches in total length (Figure 7). 2011 is the first time this section has been sampled and future sampling is required to further understand the characteristics of this fish community.

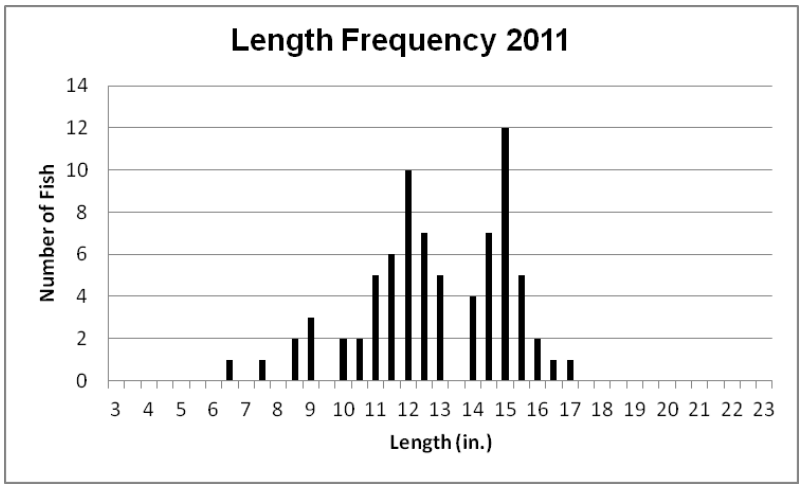


- Figure 7: Length-frequency distributions for rainbow trout sampled in the Pig Farm Section of the Yellowstone River in 2011.

Brown Trout

Carbella Section

In 2011, a total of 58 brown trout were captured in the Carbella Section. These fish ranged from 6.8 to 20.6 inches in total length. Based on length frequency, many age classes of brown trout are present in the Carbella section (Figure 8). 2011is the first time this section has been sampled and future sampling is needed to understand the characteristics of the fish community.

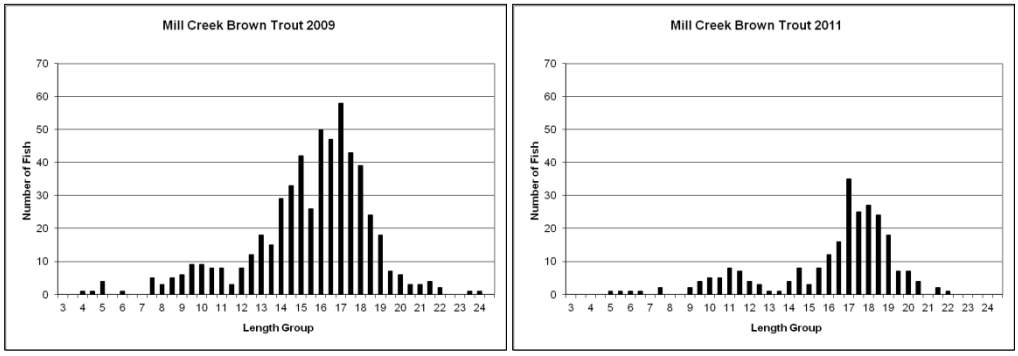


- Figure 8: Length-frequency distributions for brown trout sampled in the Carbella Section of the Yellowstone River in 2011.

Mill Creek Section

In 2011, 274 brown trout were captured in the Mill Creek Section. This is just less than half of the 552 that were captured during the mark-recapture effort in 2009.Captured brown trout

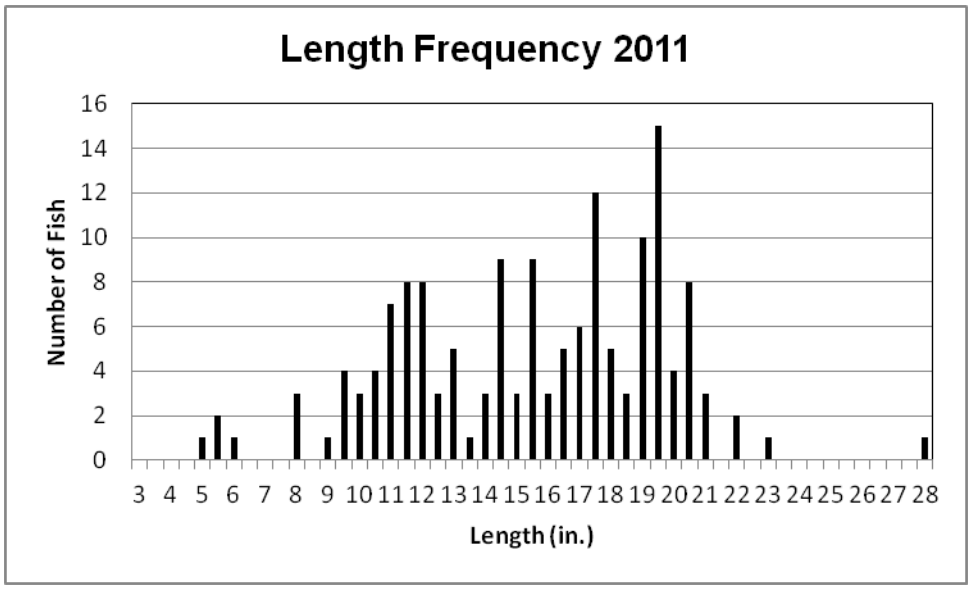
ranged in length from 5.4 to 22.2 inches in total length, in 2011. The length-frequency diagrams show similar patterns of distribution, yet lower numbers in 2011 compared to 2009 (Figure 9). This reflects the limited sampling in 2011.



- Figure 9: Length-frequency distributions for brown trout sampled in the Mill Creek Section of the Yellowstone River in 2009 and 2011.

Pig Farm Section

In 2011, 153 brown trout were captured during the sampling completed in this section. Captured brown trout ranged in length from 5.0 to 28.0 inches in total length. Numbers of fish generally increased as fish length increased from 5.0 inches to a peak at 19.5 inches. Abundances then declined as would be expected for larger, older fish (Figure 10). Future sampling will provide more information for comparison of the brown trout population in this section.



- Figure 10: Length-frequency distribution for brown trout sampled in the Pig Farm Section of the Yellowstone River for 2011.

Summary

Yellowstone Cutthroat Trout

A total of 76, 83, and 55 Yellowstone cutthroat trout were sampled in the Carbella, Mill Creek, and Pig Farm Sections, respectively. All three sections had similar ranges of total

length, between 6.6 and 17.5 inches in total length, for sampled Yellowstone cutthroat trout. The length-frequency of fish distribution was similar for the Carbella and Mill Creek Sections and was lower and skewed more toward larger fish for the Pig Farm Section.

Rainbow Trout

In the Carbella, Mill Creek, and Pig Farm Sections total of sampled rainbow trout were41, 423, and 205, respectively. Although sampling efforts varied among sections, results indicate that rainbow are more common in lower sections of the river. All three sections contained rainbow trout that were between 4.6 and 19.3 inches. The Mill Creek Section had the highest length-frequencies and the Carbella Section had the lowest length-frequencies as would be expected by the numbers of rainbow trout sampled in each section.

Brown Trout

A total of 58,274, and153 brown trout were sampled in the Carbella, Mill Creek, and Pig Farm Sections, respectively. All three sections had brown trout between 5.0 and 23.2 inches in total length. The Pig Farm Section had the largest brown trout of all three sections at 28.0 inches in total length. Length-frequency distributions for all three sections were similar with the Mill Creek Section having the highest numbers.

Shields River Procedures

In spring 2011, the Convict Grade and Zimmerman Sections of the Shields River were sampled (Table 2 and Figure 11).

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 a steel 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.

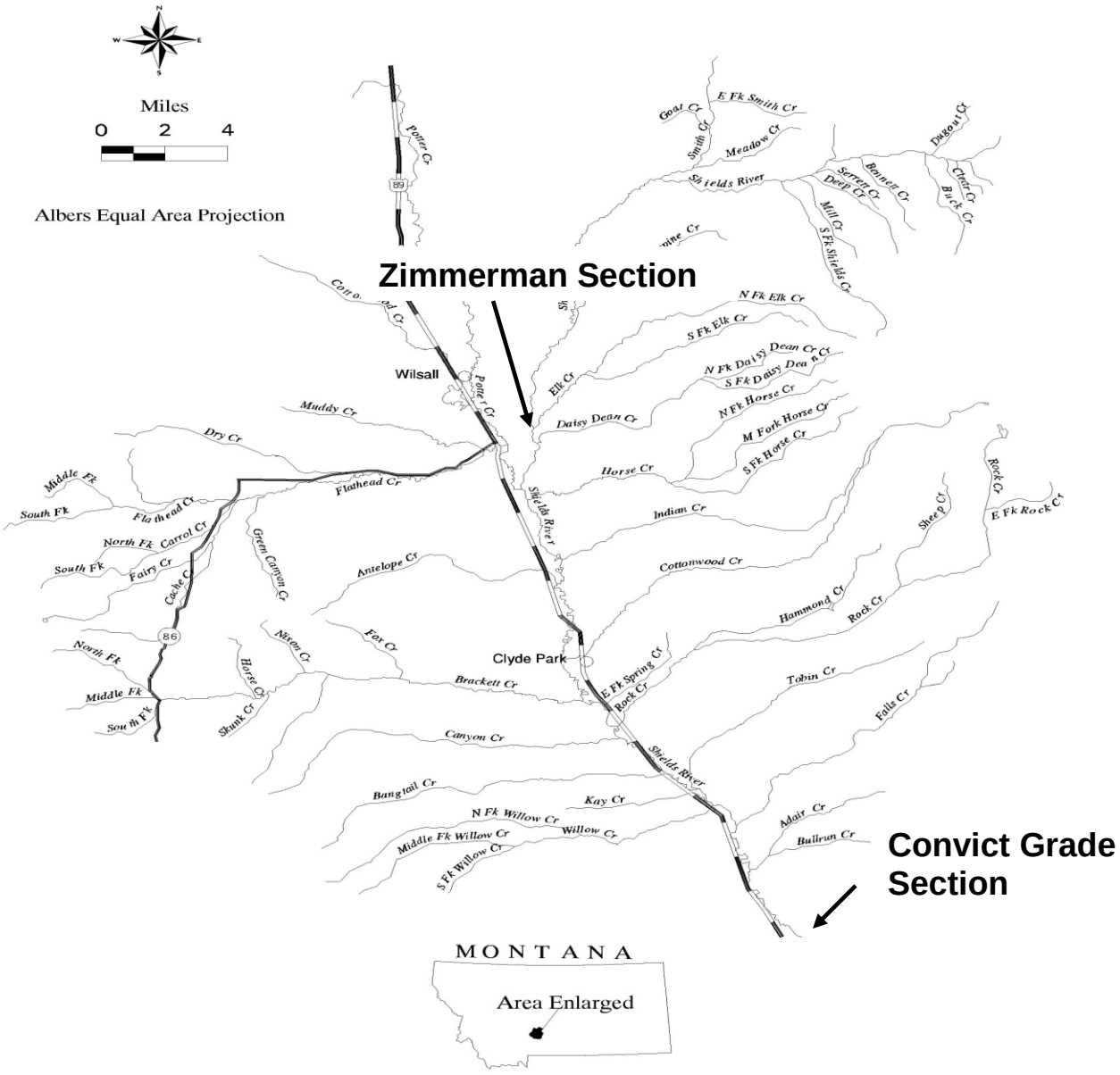
In both sections genetic samples were collected from Yellowstone cutthroat trout for later analysis. The sample consisted of a small clip of one of the pelvic fins that was stored in 100% denatured ethanol. Captured Yellowstone cutthroat, twelve inches and longer in total length, were tagged with a red, numbered, Floy™ tag to allow for large-scale monitoring of movement and growth of individual fish.

Population abundance was estimated using FA+ (MFWP 2004). The partial log-likelihood model was used for the Convict Grade Section estimates. For the partial log-likelihood model, fish were separated into one-inch length groups for analysis and estimate reliability was evaluated at alpha = 0.05. The modified Peterson method was used to calculate the

estimates for the Zimmerman Section. Population estimates were calculated for brown and rainbow trout ≥ 7 inches for in the Convict Grade Section. Population estimates for brown trout ≥ 7 and whitefish ≥ 10 inches were calculated in the Zimmerman Section.

- Table 2: Survey Section where trout abundance was estimated in the Shields River in 2011.

Section Name	Survey Date	Length (ft)	Approximate Location		
Convict	03/21/11	6,758	Upper Boundary	North West	45.74036 110.48224
			Lower Boundary	North West	45.72618 110.46231
Zimmerman	03/13/11	4,224	Upper Boundary	North West	46.02599 110.64086
			Lower Boundary	North West	46.01728 110.64012



• Figure 11: Map of the Shields River drainage displaying the 2011 sampling locations.

Convict Grade Section

On March 21 and 22, 2011, marking runs were completed on the Convict Grade Section. Captured trout were marked with a left pelvic fin clip.

The recapture run was conducted in the section on March 29, 2011, and 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 and violating assumptions of mark-recapture without replacement.

Zimmerman Section

The marking run for this section was completed on March 31, 2011. Captured trout were marked with a left pelvic fin clip.

On April 7, 2011, the recapture run was 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 and violating the assumptions of mark-recapture with out replacement.

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 3).

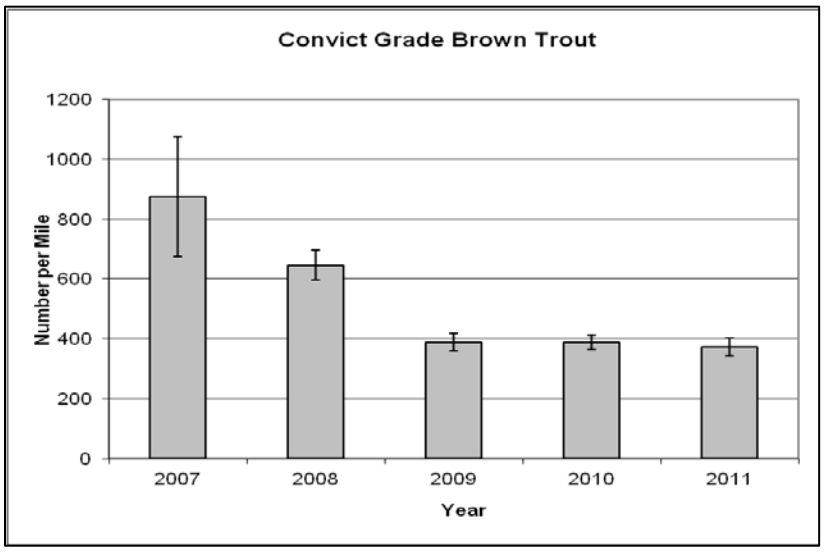
- Table 3: Population abundance model results for the Convict Grade Section of the Shields River by species in 2011. N represents the number of trout (≥7 inches) per mile for Convict Grade, trout (≥7 inches) per 1,000 ft. for Zimmerman and mountain whitefish (≥10 inches) per 1,000 ft. for Zimmerman. * indicates that Modified Peterson method was used.

Section (mark date)				Overall model			Pooled model	
Fish Species	**N**	**SD**	**DF**	**Chi-square**	**P**	**DF**	**Chi-square**	**P**
Convict Grade (3/21)								
Brown Trout	372	14.4	7	9.59	0.213	14	9.59	0.213
Rainbow Trout	320	38.4	5	10.83	0.055	4	9.38	0.052
Zimmerman (3/31)								
Brown Trout	59	5.6	*	*	*	*	*	*
Mountain Whitefish	80	7.4	*	*	*	*	*	*

Brown Trout

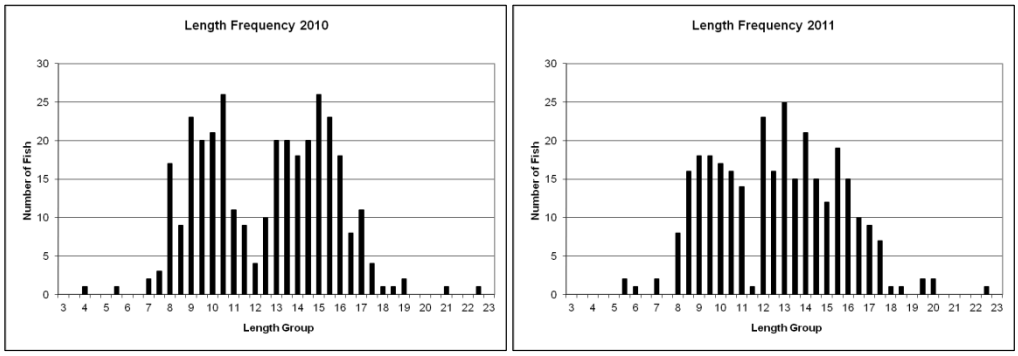
Convict Grade Section

In 2010, the abundance estimate for brown trout in the Convict Grade Section was 388 fish/mile (≥ 7 in) This estimate decrease slightly to 372 fish/mile (≥ 7 in) in 2011, and remains below the 875 fish/mile (≥ 7 in) estimate in 2007(Figure 12).



- Figure 12: Abundance estimates for brown trout (≥ 7 in) in the Convict Grade Section of the Shields River from 2007-2011. Error bars represent +/- 2 SD.

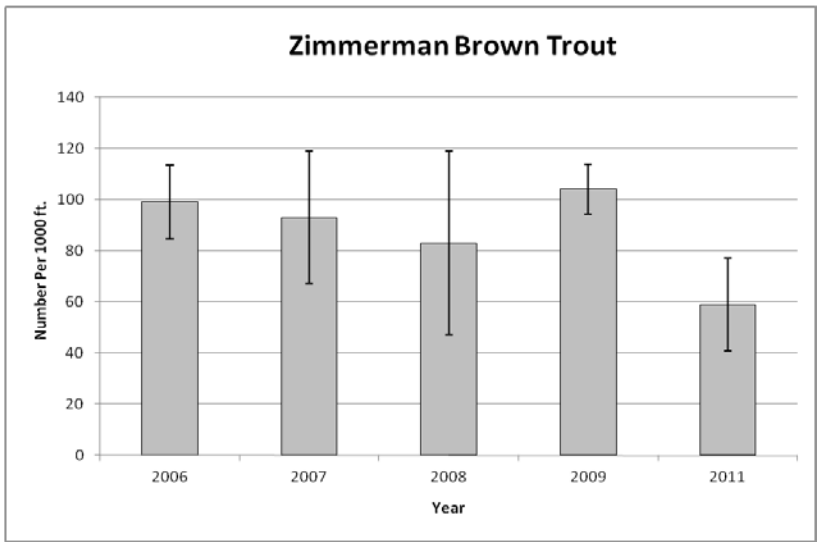
The length-frequency distribution for brown trout in the Convict Grade Section shows moderate changes from 2010 to 2011. Fish in the 8 to 11 inch and 15 to 18 inch range showed a slight decrease in the sample while fish in the 12 to 14 inch range showed an increase in the sample (Figure 13). These data indicate that recruitment of brown trout and survival of the older aged brown trout remains good.



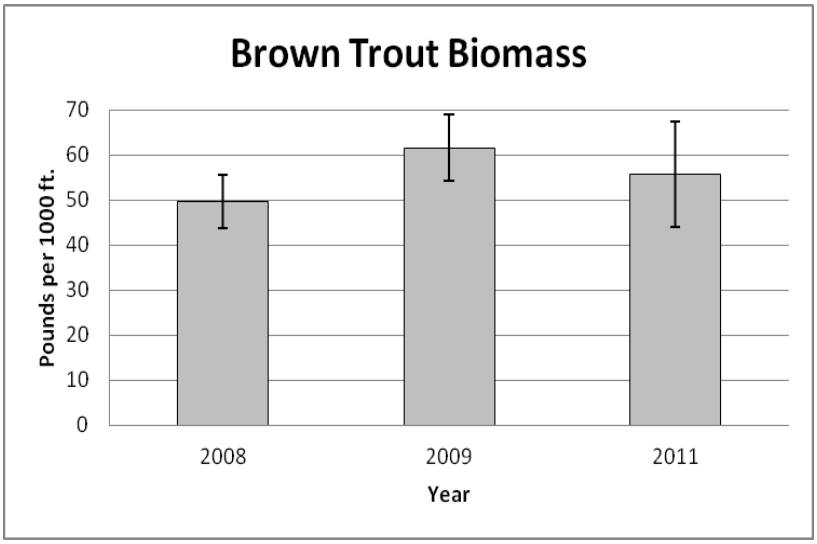
- Figure 13: Length-frequency distributions for brown trout sampled in the Convict Grade Section of the Shields River in 2010 and 2011.

Zimmerman Section

The 2011 abundance estimate for brown trout in the Zimmerman Section was the lowest it has been since 2006 at 59 fish/1,000 feet (≥7 in) (Figure 14). Although the abundance estimate was just more than half of the 2009 estimate of 104 fish/1,000 feet (≥7 in) the biomass estimate was only slightly lower than the 2009 estimate and was higher than the 2008 estimate (Figure 15). This result indicates that the sample in 2011 was represented by larger fish.

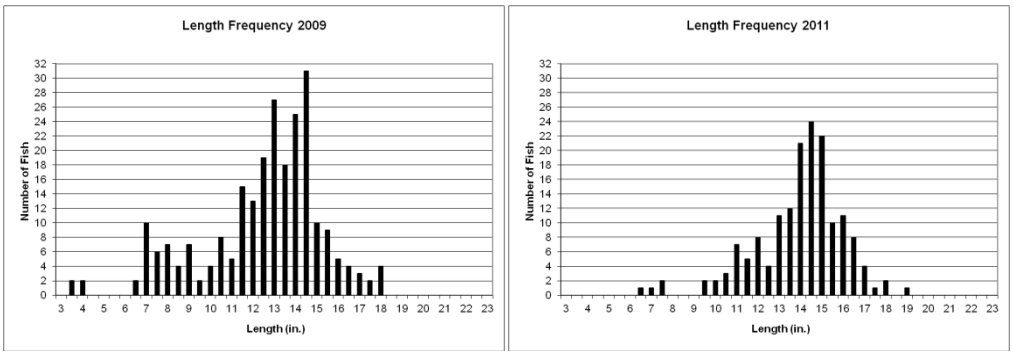


- Figure 14: Abundance estimates for brown trout (≥ 7 in) in the Zimmerman Section of the Shields River from 2006-2011. No estimate was made in 2010. Error bars represent +/- 2 SD.



- Figure 15: Biomass estimates for brown trout (≥ 7 in) in the Zimmerman Section of the Shields River from 2008-2011. No estimate was made in 2010. Error bars represent +/- 2 SD.

The length-frequency distribution for brown trout in the Zimmerman Section shows decreases in the sample of fish in the 3.0 to 14.5 and increases in the 15.0 to19.0 inch ranges from 2009 to 2011 (Figure 16). This further supports the shift in biomass and the reduced abundance of fish. Further, these results indicate good recruitment of larger, older fish and suggest poor reproduction or recruitment of smaller, younger fish.



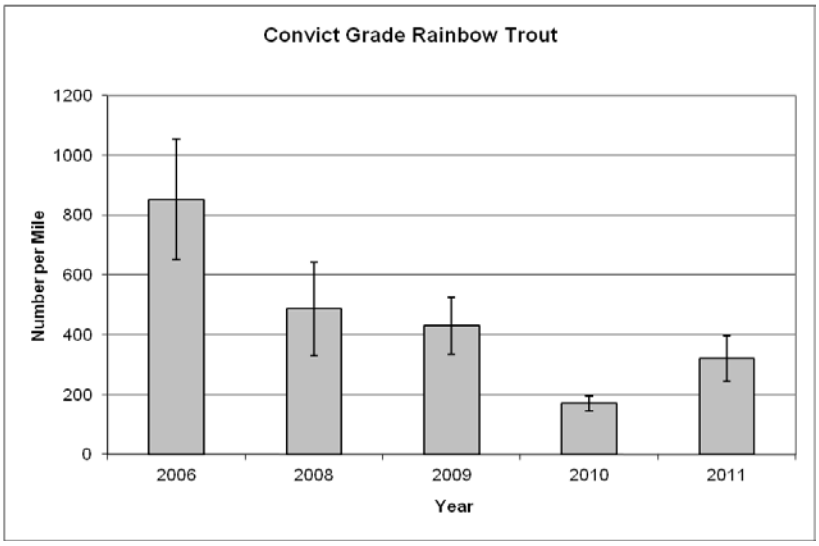
- Figure 16: Length-frequency distributions for brown trout sampled in the Zimmerman Section of the Shields River in 2009 and 2011.

Rainbow Trout

Convict Grade Section

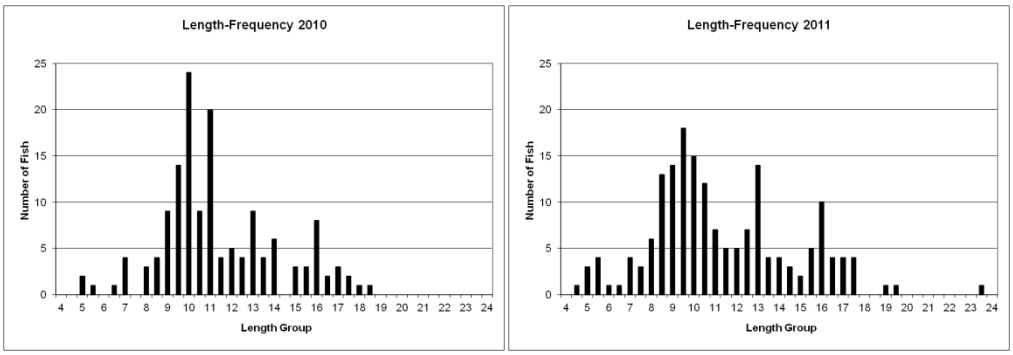
The 2010 abundance estimate for rainbow trout in was 170 fish/mile (≥ 7in) and was the lowest point on a downward trend from a high of 852 fish/mile (≥ 7in) in 2006. The 2011 estimate of 320 fish/mile (≥ 7in) was a significant increase, but remains below the 2006 through 2009 estimates (Figure 17).

Abundance estimates for this section include rainbow trout that are migrating from the Yellowstone River into the lower Shields River to spawn. This fish movement biases the abundance estimate and is expected to be variable among years. The influx of fish from the Yellowstone River and the fish movement out of the sampling section, indicated by the large number of marked fish compared to captured fish and the low numbers of recaptured fish, likely explain much of the variation in the estimates.



- Figure 17: Abundance estimates for rainbow trout (≥ 7in) in the Convict Grade Section of the Shields River from 2006-2011. Error bars represent +/- 2 SD. Data were insufficient in 2007 to conduct a population estimate.

Length-frequency distributions from 2010 and 2011 show a decrease in the sample of rainbow trout in the 10.0 to11.0 inch groups, and an increase for fish in the 4.0 to 7.5 and 11.5 to 17.5 inch groups (Figure 18). This suggests that this population has experienced an increase in recruitment and survival of larger fish.

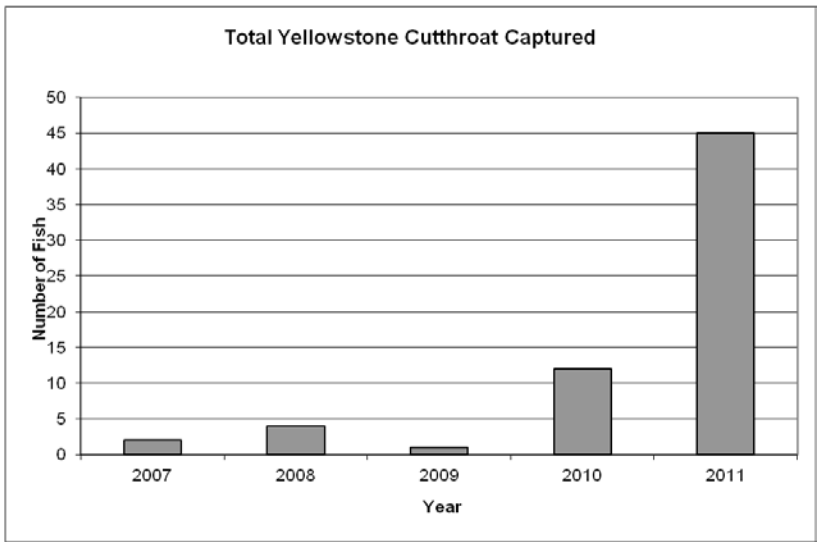


- Figure 18: Length-frequency distributions for rainbow trout sampled in Convict Grade Section of the Shields River in 2010 and 2011.

Yellowstone Cutthroat Trout

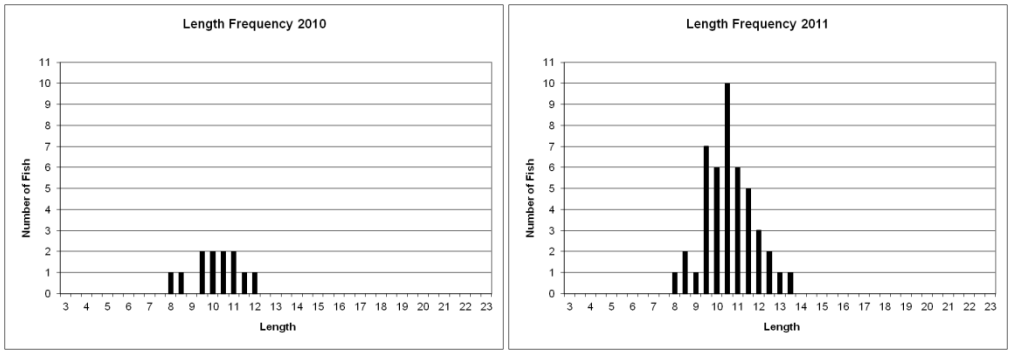
Convict Grade Section

In 2011, a total of 45 Yellowstone cutthroat trout were captured in the Convict Grade Section. This is the highest value since 2007 (Figure 19). Captures of Yellowstone cutthroat trout in this section have ranged from 1 to 45 fish during this time period. Cutthroat trout with indications of hybridization with rainbow trout were not included in the analyses. There were not enough fish recaptured to produce a population estimate for Yellowstone cutthroat trout in this section.



- Figure 19: Number of Yellowstone cutthroat trout sampled in the Convict Grade Section of the Shields River for 2007-2011.

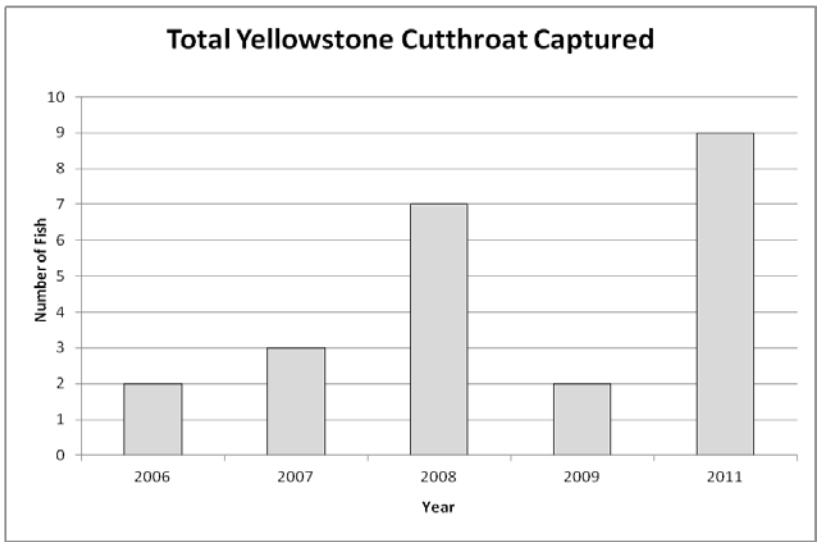
The 2010 and 2011 length frequencies for Yellowstone cutthroat trout are presented below. The distribution increased slightly and the number of fish in the sample increased in 2011 suggesting improved recruitment and survival. These changes are likely a result of the good water year in 2010. The fish ranged from 8.3 to 12.2 inches in total length in 2010 and from 8.2 to 13.5 inches in total length in 2011 (Figure 20).



- Figure 20: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Convict Grade Section of the Shields River in 2009 and 2010.

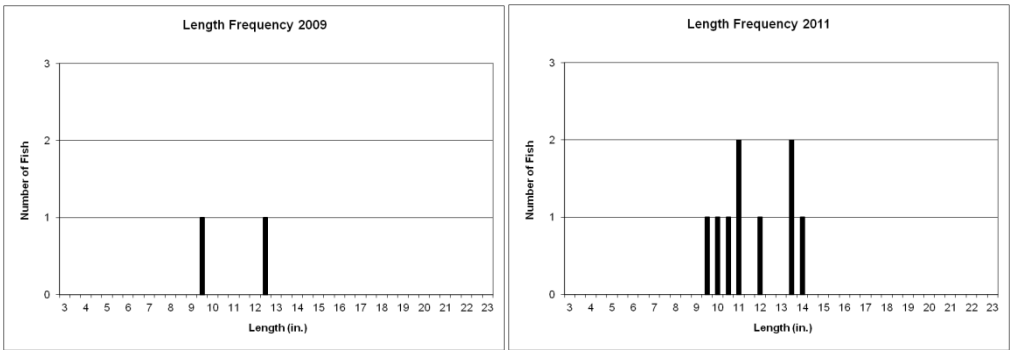
Zimmerman Section

In 2011, a total of nine Yellowstone cutthroat trout were captured in the Zimmerman Section. This is up from only two in 2009 and is the highest catch since 2006 in this section (Figure 21). Cutthroat trout with indications of hybridization with rainbow trout were not included in the analyses. Yellowstone cutthroat remain rare in this section in early spring.



- Figure 21: Total numbers of Yellowstone cutthroat trout captured in the Zimmerman Section of the Shields River 2006-2011. No sampling occurred in 2010.

The length-frequency distributions for Yellowstone cutthroat in this section are presented below. Number of fish in the sample increased in 2011. Fish from 9.5 to 12.5 inches were collected in 2009 and from 9.6 to 14.2 inches in 2011(Figure 22).

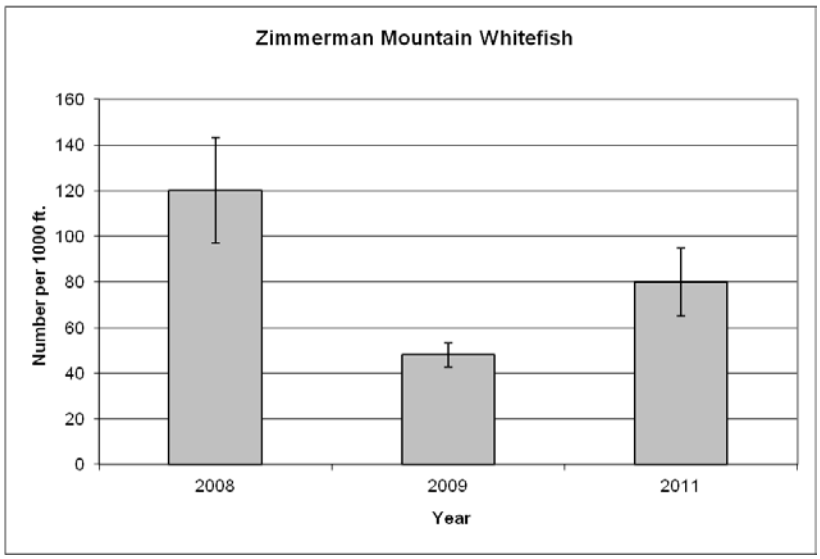


- Figure 22: Length-frequency distributions for Yellowstone cutthroat trout sampled in the Zimmerman Section of the Shields River in 2009 and 2011.

Mountain Whitefish

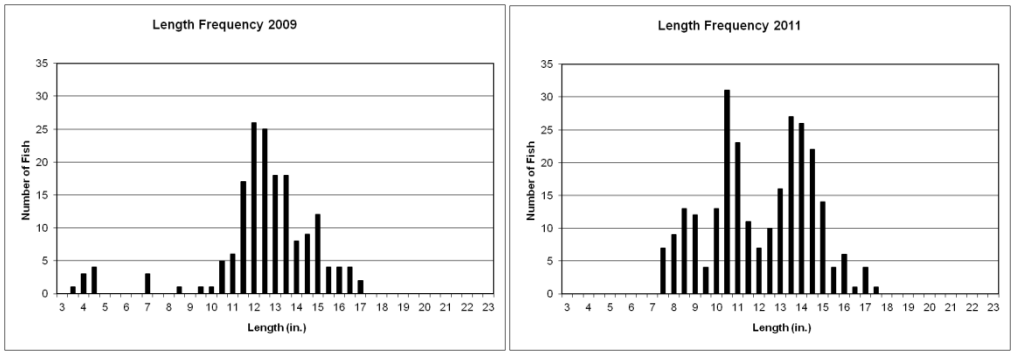
Zimmerman Section

The abundance estimate for mountain whitefish in the Zimmerman Section was 80 fish/1,000 feet (≥ 10in). This is significantly higher than the 2009 estimate of 48 fish/1,000 feet (≥ 10in) and significantly lower than the 2008 estimate of 120 fish/1,000 feet (≥ 10in) (Figure 23).



- Figure 23: Abundance estimates for mountain whitefish (≥ 10in) in the Zimmerman Section of the Shields River from 2008-2011. Error bars represent +/- 2 SD. The section was not sampled in 2010.

In the Zimmerman Section, in 2011, the distribution of fish was narrower and the frequency was higher compared to 2009. In 2011, fish ranged from 7.6 to17.5 inches in total length compared to 3.6 to 17.1 inches in total length in 2009(Figure 24). In 2009, the distribution was skewed toward larger fish. In 2011, there are no smaller fish like those sampled in 2009, suggesting limited recruitment and survival of young fish. The distribution, in 2011, does suggest good recruitment and survival of larger, older fish.

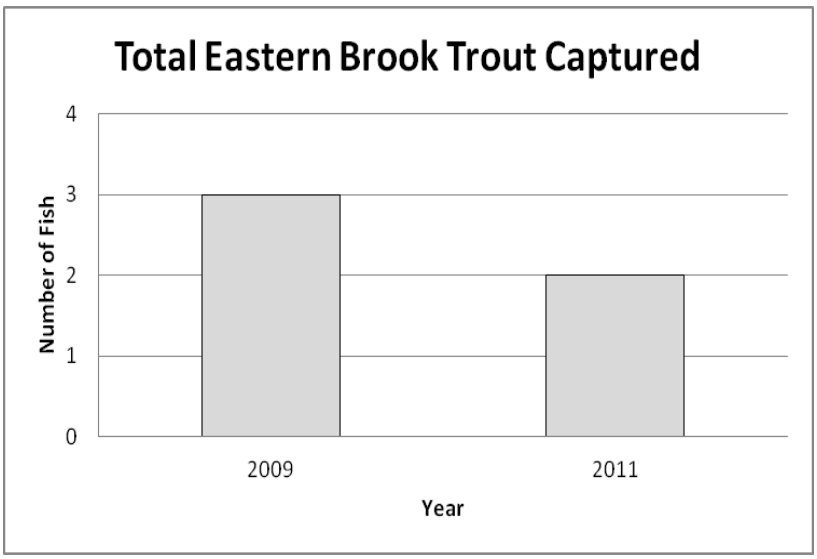


- Figure 24: Length-frequency distributions for mountain whitefish sampled in the Zimmerman Section of the Shields River in 2009 and 2011

Eastern Brook Trout

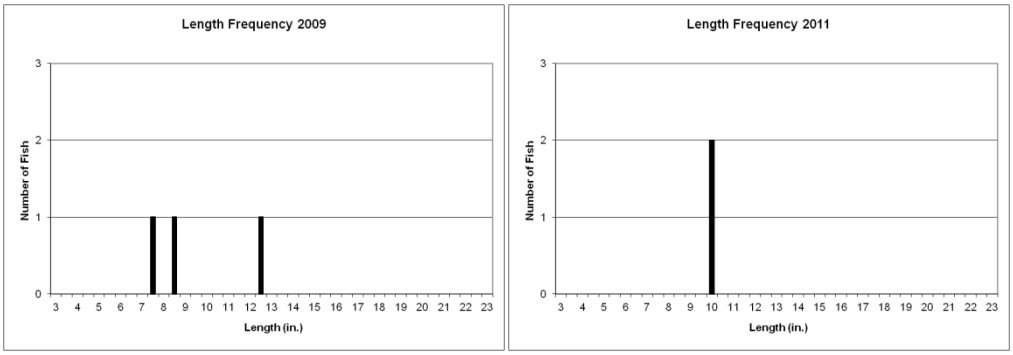
Zimmerman Section

In 2011, two eastern brook trout were captured in the Zimmerman Section. This is down from three fish in 2009 (Figure 25). Eastern brook trout remain at a low level, but appear to be establishing in the main stem Shields River in this section. Future monitoring will determine the ability of eastern brook trout to establish a population in this section.



- Figure 25: Total number of eastern brook trout captured in the Zimmerman Section of the Shields River in 2009 and 2011. No sampling was completed in 2010.

In 2009, three eastern brook trout were captured in the Zimmerman Section. These fish ranged in length from 7.7to 12.7 inches. In 2011, two brook trout were captured and were 10.0 and 10.2 inches in total length (Figure 26). This is the only monitoring section on the Shields River that eastern brook trout were captured in for 2009 and 2011.



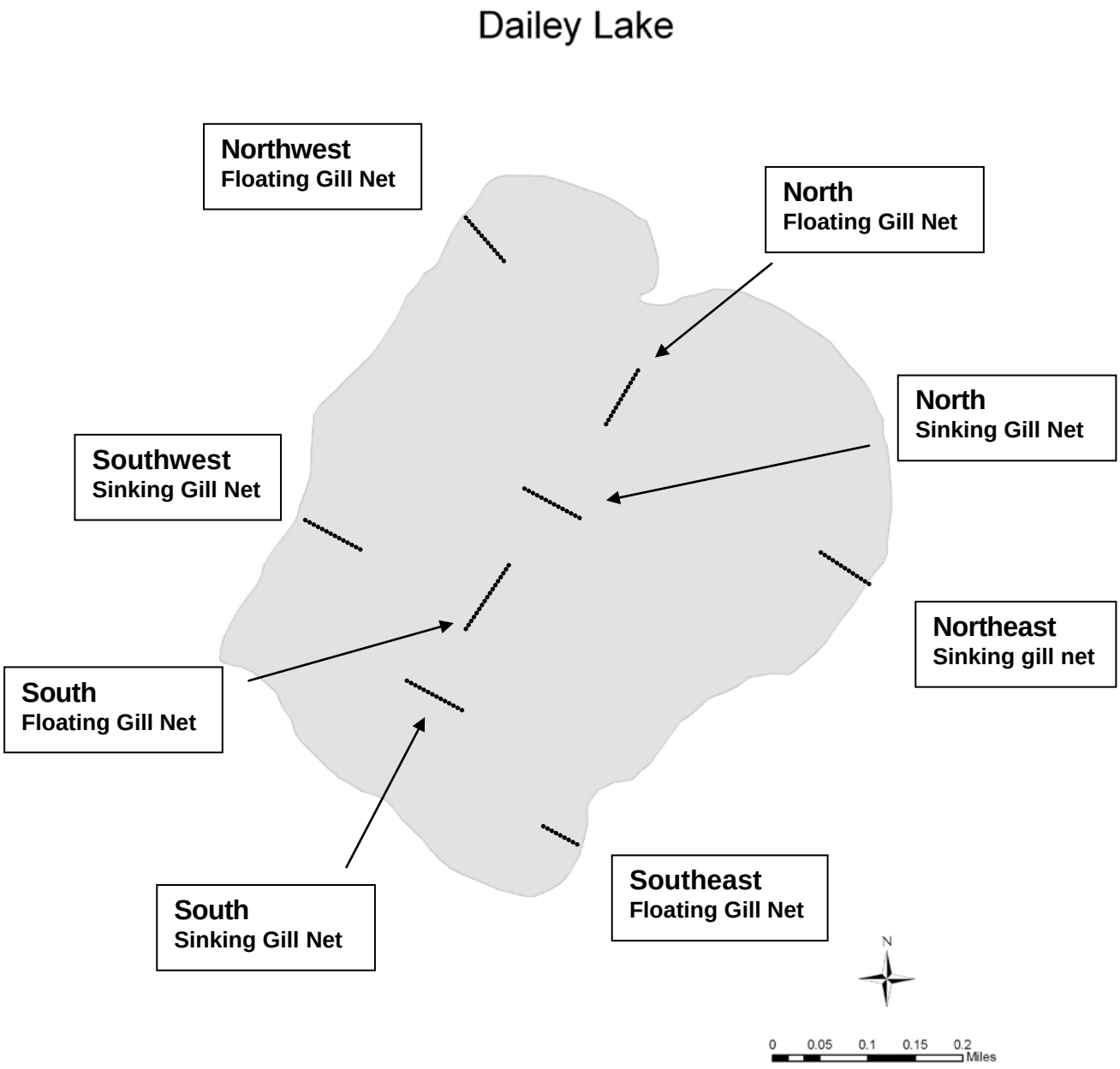
- Figure 26: Length-frequency distribution for all eastern brook trout sampled in the Zimmerman Section of the Shields River in 2009 and 2011. No sampling occurred in 2010.

Dailey Lake Procedures

Gill Netting

Gill nets were used to sample Dailey Lake in 2011. The long-term series of gill nets were set the evening of May 3, 2011. This set consists of four gill nets located in the four corners of the lake. A second set of gill nets were set to further characterize the fish community in Daily Lake. The second set consisted of four gill net down the middle of the lake (Figure 27). The second set of gill nets were set on the afternoon of May 4, 2011.

The long-term set of nets were pulled on the morning of May 4, 2011. The new set of gill nets were pulled on the morning of May 5, 2011. Lengths were recorded on all fish to the nearest 0.1 inch and weights were recorded to the nearest 0.01 pound. All live fish were released back into the lake.



• Figure 27: Map of Dailey Lake showing locations of gill nets in 2011.

Dailey Lake Results

Catch-Per-Unit-Effort

Long-Term Net Series

Rainbow Trout

Catch-per-unit effort (CPUE) for rainbow trout in all nets decreased to 3.75 fish/net night in 2011. This is down from 10.0 fish/net night in 2009, 7.75 fish/net night in 2008 and 9.75 fish/net night in 2007 (Figure 28). The average CPUE for rainbow trout in all nets was 9.25 fish/net night for 2005-2009. The CPUE for rainbow in floating nets in 2011 was 4.5 fish/net night compared to 9.5 fish/net night in 2009(Figure 29). CPUE in sinking nets decreased significantly from 10.5 fish/net night in 2009 to 3.0 fish/net night in 2011 (Figure 30).

Yellow Perch

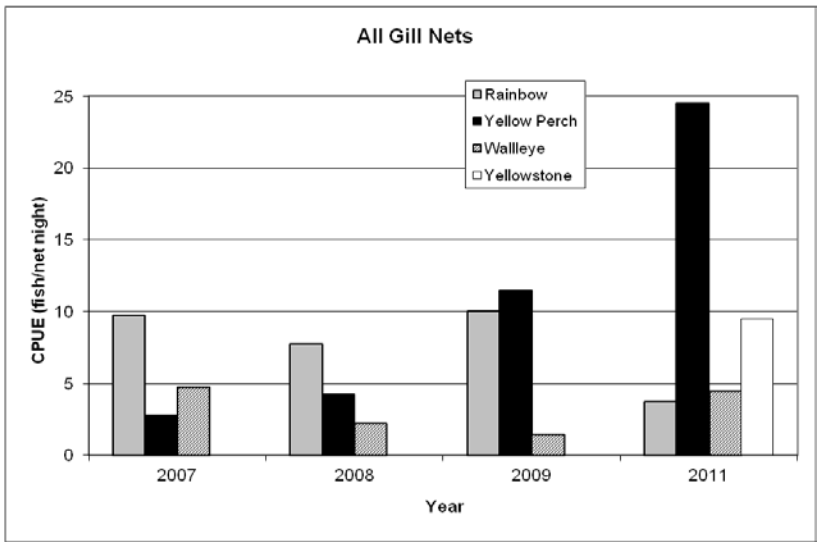
In 2011, the CPUE for yellow perch in all nets was 24.5 fish/net night compared to 11.5 fish/net night in 2009. This is the third increase that has been documented since the decline that began between 2003 and 2004 and continued through 2007 (Figure 28). The average CPUE for yellow perch in all nets was 6.91 fish/net night for 2005-2009. In 2011, CPUE for yellow perch in the floating nets was 38.0 fish/net night compared to 9.0 in 2009 (Figure 29). The CPUE for sinking gill nets was 11.0 fish/net night in 2011, a decrease from 14.0 fish/net night in 2009 (Figure 30).

Walleye

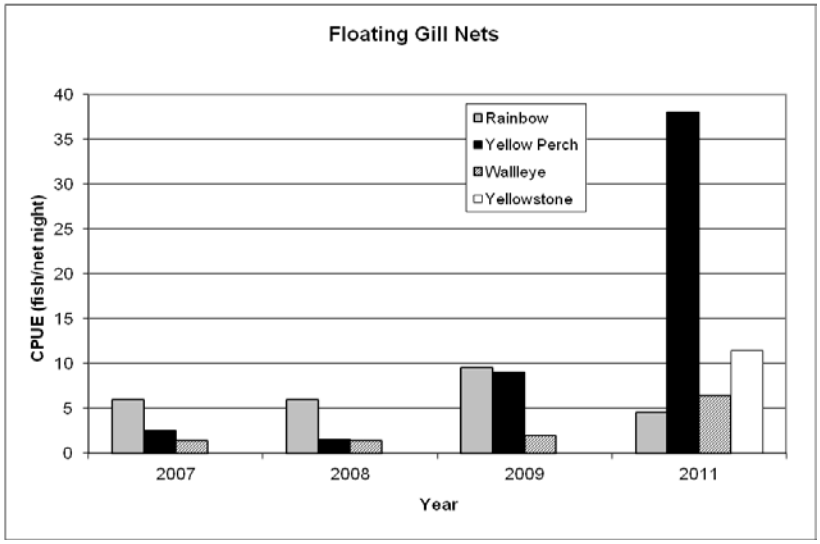
CPUE for walleye in all nets continued to decrease from 4.75 fish/net night in 2007 and 2.25 fish/net night in 2008 to 1.5 fish/net night in 2009. In 2011, the CPUE increased to 4.5 fish/net night (Figure 28). The average CPUE for walleye in all nets was 4.12 fish/net night for 2005-2009. In 2009, CPUE for floating nets was 2.0 fish/net night. In 2011, that increased to 6.5 fish/net night (Figure 29). The CPUE of 2.5 fish/net night was up from 1.0 fish/net night for the sinking nets in 2009 and 0.75 fish/net night in 2008 but still well below the 8.0 fish/net night in 2007 (Figure 30).

Yellowstone Cutthroat Trout

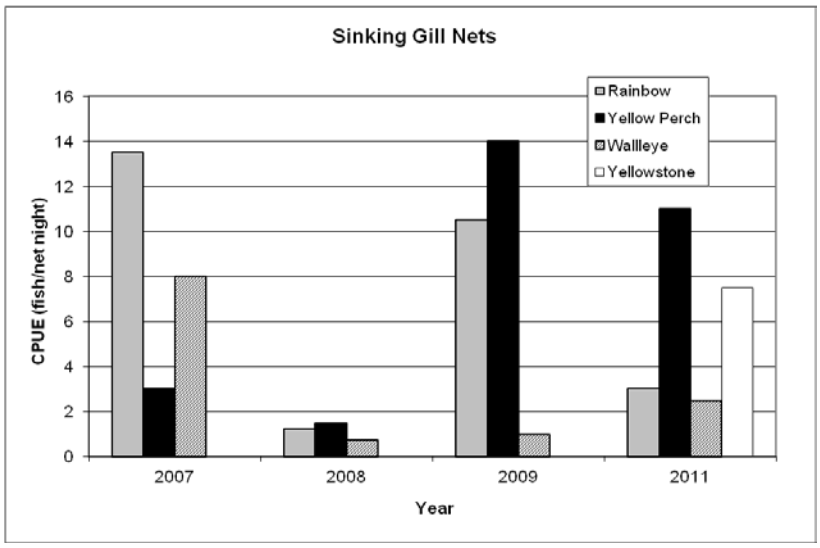
The CPUE for Yellowstone cutthroat in all nets was 9.50 fish/net night in 2011 (Figure 28). In 2011, CPUE for floating nets was 11.50 fish/net night (Figure 29). The CPUE for the sinking nets in 2011 was 7.50 fish/net night (Figure 30). Yellowstone cutthroat have been stocked in the lake since 2008. The 2011 sample is the first time Yellowstone cutthroat have been sampled in gill nets.



- Figure 28: Catch-per-unit-effort for rainbow trout, Yellowstone cutthroat trout, yellow perch, and walleye in all gill nets for 2007-2011. No gill net sampling was completed in 2010.



- Figure 29: Catch-per-unit-effort for rainbow trout, Yellowstone trout, yellow perch, and walleye in floating nets for 2007-2011. No gill net sampling was completed in 2010.



- Figure 30: Catch-per-unit-effort for rainbow trout, Yellowstone cutthroat trout, yellow perch, and walleye in sinking gill nets for 2007-2011. No gill net sampling was completed in 2010.

New Net Series

Rainbow Trout

Catch-per-unit effort (CPUE) for rainbow trout in all nets was 0.25 fish/net night in 2011. This is lower than the 3.75 fish/net night in the long-term net for 2011. The CPUE for floating nets was 0.0 fish/net night and sinking nets was 0.5 fish/net night in 2011 for rainbow trout.

Yellow Perch

The CPUE for yellow perch in all nets was 1.5 fish/net night in 2011. This was significantly lower than 24.5 fish/net night for the long-term net set in 2011. In 2011, CPUE for yellow perch in the floating nets was 3.0 fish/net night and in sinking gill nets it was 0.0 fish/net night.

Walleye

CPUE for walleye in all nets was 2.0 fish/net nights, just less than half of the 4.5 fish/net night seen in the long-term net set for 2011. In 2011, CPUE for floating nets was 0.0 fish/net night and for the sinking nets it was 4.0 fish/net night.

Yellowstone Cutthroat Trout

CPUE for Yellowstone cutthroat in all nets was 0.5 fish/net nights. In 2011, CPUE for floating nets was 0.0 fish/net night and for the sinking nets it was 1.0 fish/net night. Yellowstone cutthroat have been stocked in the lake since 2008. The 2011 sample is the first time Yellowstone cutthroat have been sampled in gill nets.

Average Length

Long-Term Net Series

Rainbow trout

The average length of rainbow trout captured in 2009 was 19.7 inches. This decreased slightly to 19.0 in 2011, but remains higher than 2006-2008 (Figure 31). This also remains

higher than the average length of 15.5 inches for the previous 10 years of sampling. Captured rainbow trout ranged from 11.8 to 23.4 inches in total length.

Yellow Perch

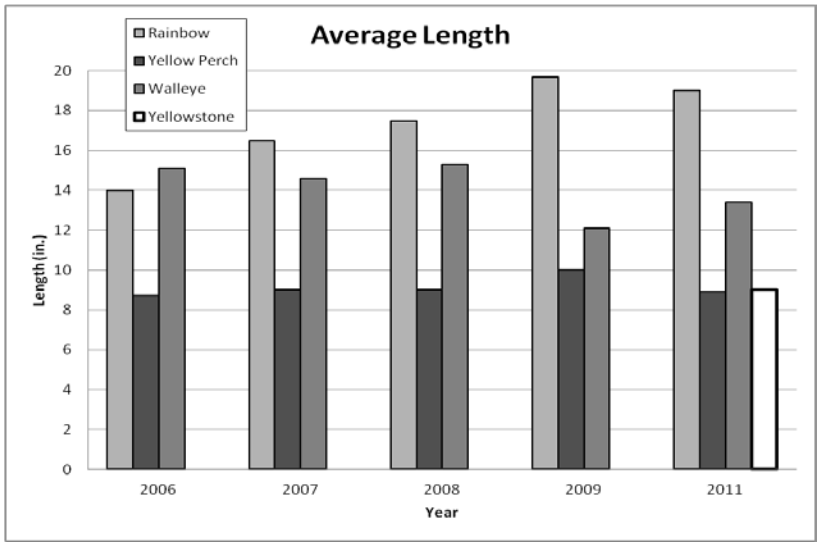
In 2011, the average length of yellow perch decreased to 8.9 inches from 10.0 inches in 2009 (Figure 31). This remains higher than the average length of 8.75 inches for the previous 10 years of sampling. Captured yellow perch ranged from 7.3 to12.5 inches in total length.

Walleye

The average length of walleye in 2009 was 12.1 inches. This increased to 13.4 inches in 2011, and remains lower than the average length of 13.62 inches for the previous 10 years of sampling (Figure 31). Captured walleye ranged from 10.4 to 20.0 inches in total length.

Yellowstone Cutthroat Trout

The average length of Yellowstone cutthroat trout in 2011 was 9.0 inches in total length (Figure 31). Captured Yellowstone cutthroat ranged from 6.8 to10.0 inches in total length. Yellowstone cutthroat have been stocked in the lake since 2008. The 2011 sample is the first time Yellowstone cutthroat have been sampled in gill nets.



- Figure 31: Average lengths of rainbow trout, yellow perch, walleye and Yellowstone cutthroat trout captured in gill nets in Dailey Lake for 2006-2011. Nets were not set in 2010.

New Net Series

Rainbow trout

Only one rainbow trout was captured in the new net set and it was 22.5 inches in total length. It was captured in the South Central sinking net.

Yellow Perch

In 2011, the average length of yellow perch was 8.4 inches in total length. This was just slightly lower that average of 8.9 inches captured in the long-term nets. Captured yellow perch ranged from 7.4 to10.8 inches in total length.

Walleye

The average length of walleye in 2011 was 14.5 inches. This was higher than the 12.1 inch average captured in the long-term nets. Captured walleye ranged from 11.0 to18.0 inches in total length.

Yellowstone Cutthroat Trout

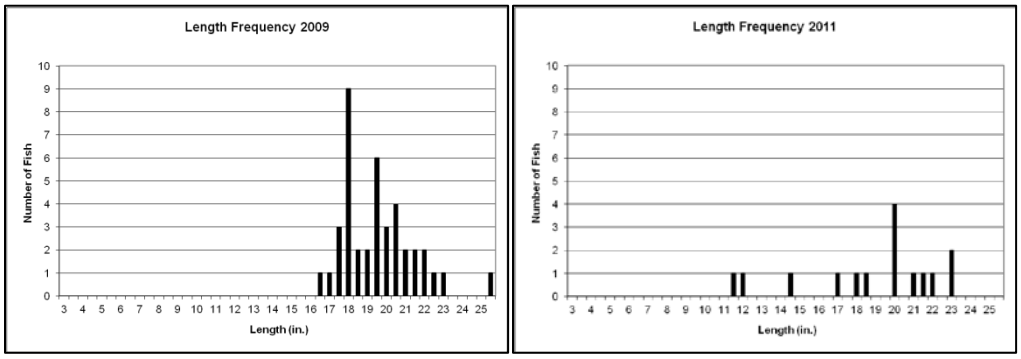
In 2011, only two Yellowstone cutthroat were captured. They were 10.7 and 11.0 inches in total length (average length equals10.9 inches). Yellowstone cutthroat have been stocked in the lake since 2008. The 2011 sample is the first time Yellowstone cutthroat have been sampled in gill nets.

Length Frequency

Long-Term Net Series

Rainbow Trout

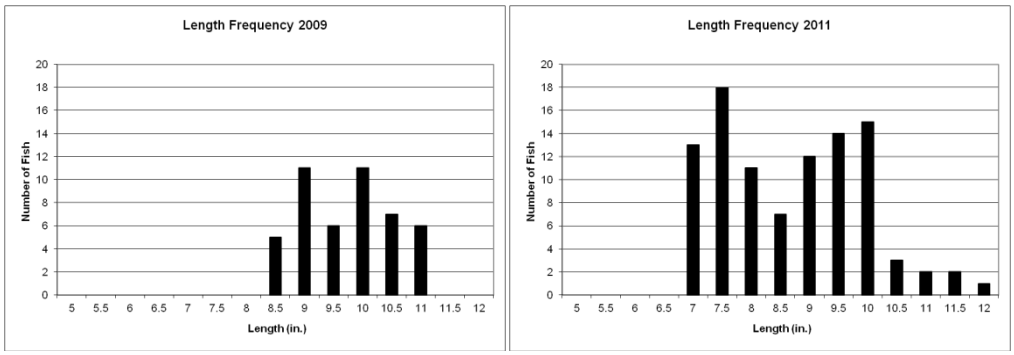
In 2009, the length-frequency distribution of rainbow trout in Dailey Lake was skewed toward fish 16 inches and larger. In 2011, total number in nets was down, but a few fish that were smaller than 16.0 inches appeared in the catch indicating that younger year classes are not completely missing from lake (Figure 32). The continued lack of smaller fish and lower abundance indicates a potential lack of survival and recruitment of smaller, younger fish. This has been the case since 2008. This may also be the result of sampling inefficiency on smaller fish. Future monitoring should determine if there is indeed a lack of recruitment or sampling inefficiency.



• Figure 32: Length-frequency distribution for Dailey Lake rainbow trout in 2009 and 2011.

Yellow Perch

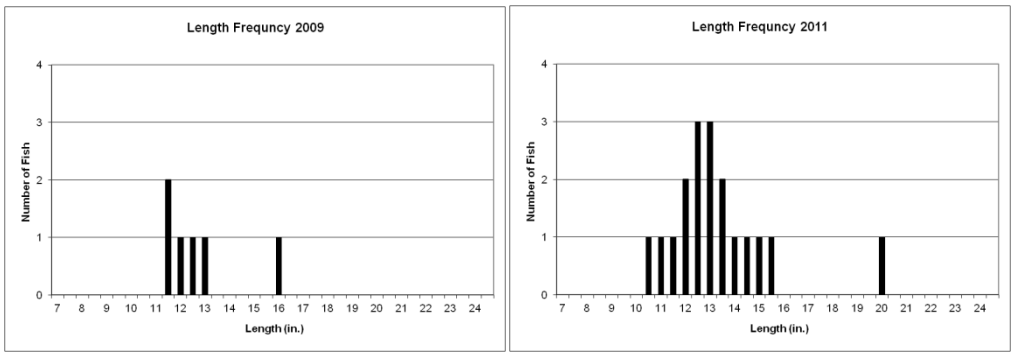
The length-frequency distribution for yellow perch in 2011 is skewed toward fish between 7.0 and 10.0 inches in total length and overall numbers in the sample increased from 2009. Smaller fish were absent from both samples and abundance of larger fish is up (Figure 33). The lack of smaller fish is likely an issue of recruitment to the gear.



• Figure 33: Length-frequency distribution for Dailey Lake yellow perch in 2009 and 2011.

Walleye

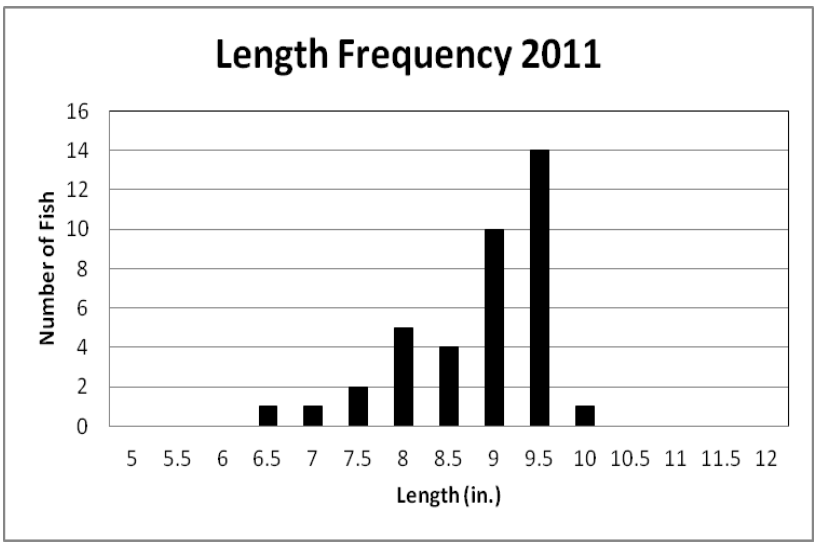
The length-frequency distribution of walleye in 2011 shows an increased distribution compared to 2009. Abundance of fish captured in 2011 is up as well (Figure 34).



• Figure 34: Length-frequency distribution of Dailey Lake walleye in 2009 and 2011.

Yellowstone Cutthroat Trout

In 2011, the length-frequency distribution of Yellowstone cutthroat shows an increased in number as the length of fish increases. The length of captured fish ranged from 6.8-10.0 inches in total length (Figure 34). Yellowstone cutthroat have been stocked in the lake since 2008. This is the first Yellowstone cutthroat have been sampled in gill nets.



• Figure 35: Length-frequency distribution of Dailey Lake Yellowstone cutthroat trout in 2011.

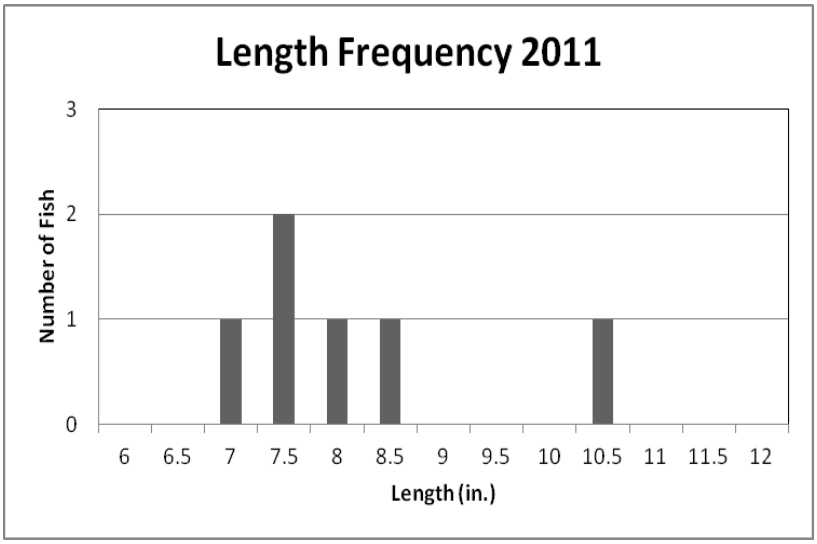
New Net Series

Rainbow Trout

Only one rainbow trout was captured in the new set. It was 22.5 inches in total length.

Yellow Perch

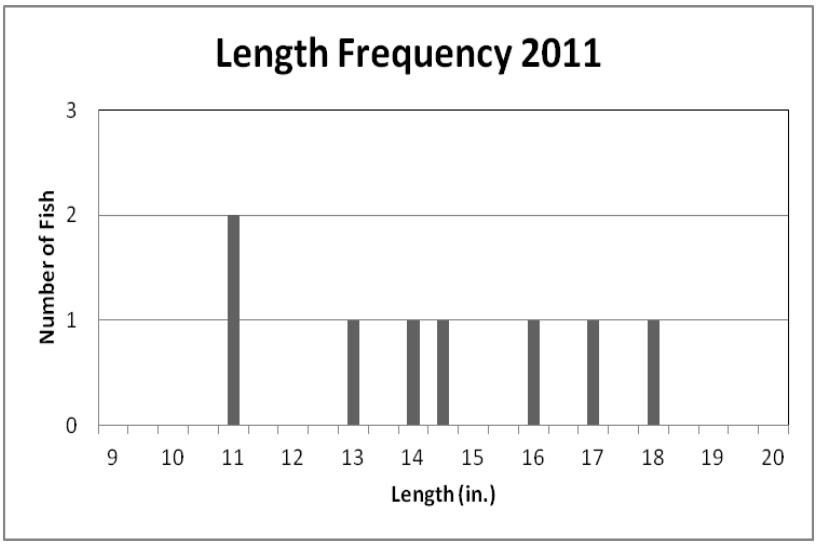
The length-frequency distribution for yellow perch in 2011 in the new net set was between 7.0 and 10.5 inches in total length and overall number sampled was low (Figure 36). This is likely the result of these nets being set in the middle of the lake where there is little cover for yellow perch to use.



• Figure 36: Length-frequency distribution of Dailey Lake yellow perch in new net set in 2011.

Walleye

The length-frequency distribution of walleye in 2011 in the new net set ranged from 11.0-18.0 and had a low number of fish captured (Figure 37).



• Figure 37: Length-frequency distribution of Dailey Lake walleye in the new net set in 2011.

Yellowstone Cutthroat Trout

Only two Yellowstone cutthroat trout were captured in 2011. They were 10.7 and 11.0 inches in total length. Yellowstone cutthroat have been stocked in the lake since 2008. This is the first time Yellowstone cutthroat have been sampled in gill nets.

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 approximately 20,000 rainbow trout and 5,000 Yellowstone cutthroat trout in 2011. These fish were from the Bluewater Springs, Giant Springs, and Yellowstone River hatcheries. Official numbers, average lengths, and stocking dates for these plants were not available at the time of this report. This information will be presented in the 2012 annual report.

In 2011, approximately 10,000 walleye were stocked in Dailey Lake. The fish were from the Miles City Fish Hatchery (egg source: Fort Peck Lake). Official numbers, average lengths, and stocking dates for these plants were not available at the time of this report. This information will be presented in the 2012 annual report.

Walleye

On July 1, 2010, Dailey Lake was stocked with 5,000 young-of the-year (YOY) fish from the Miles City Fish Hatchery. The fish averaged 1.4 inches in length. An additional 5,000 YOY walleye were stocked on September 14, 2009. These fish averaged 3.8 inches in length (Table 4). Exact numbers for the plants in 2011 were not available at the time of this report and will be reported in the 2012 report.

- Table 4: Walleye stocking information from 2006-2011. * = numbers are approximate and actual numbers will be reported in the 2012 annual report

Year	Date	Strain	Length (in)	Number
2006	June21	Fort Peck	1.4	5,000
	Aug. 26	Fort Peck	3.6	5,000
			Total	10,000
2007	June 22	Fort Peck	1.5	5,000
	Oct. 3	Fort Peck	3.8	5,000
			Total	10,000
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	July	Fort Peck	N/A	5,000*
	Sept.	Fort Peck	N/A	5,000*
			Total	10,000*

Rainbow and Yellowstone Cutthroat

On April 20, 2010, Dailey Lake was stocked with 10,000 young-of-the-year (YOY) Arlee rainbow trout from Giant Springs Trout Hatchery. The rainbow trout averaged 3.5 inches in length. Eagle Lake strain YOY rainbow from Bluewater Springs Trout Hatchery were stocked on May 17, 2010. There were 10,004 rainbow trout in this plant that had an average length of 2.95 inches. On April 16, 1,500 Yellowstone cutthroat trout were stocked from the Yellowstone River Hatchery. These fish had an average length of 7.25 inches. On May 5, 2011 and additional 3,300 Yellowstone cutthroat with an average length of 7.0 inches were stocked. These fish were also from the Yellowstone River Hatchery (Table 5). Exact numbers for the plants in 2011 were not available at the time of this report and will be reported in the 2012 report.

- Table 5: Trout stocking information from 2006-2011. * = numbers are approximate and actual numbers will be reported in the 2012 annual report

Year	Date	Strain	Length (in)	Number
2006	May 09	Eagle Lake	3.0	10,028
	Apr. 12	Arlee	3.2	11,000
	Apr.12	Wild	7.4	5,861
			Total	26,889
2007	Apr. 25	Arlee	3.5	10,000
	Apr. 25	Wild	5.8	5,000
	May 22	Eagle Lake	3.9	9,660
			Total	24,660
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
2010	Apr.	Arlee	N/A	10,000*
	Apr.	Yellowstone	N/A	1,500*
	May	Yellowstone	N/A	3,500*
	May	Eagle lake	N/A	10,000*
			Total	25,000*

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.