

I. Project Title: **Middle Yampa River northern pike removal and evaluation;  
smallmouth bass removal and evaluation**

II. Bureau of Reclamation Agreement Number: R13AP40029

Project/Grant Period: Start date: July 11, 2013  
End date: September 30, 2017  
Reporting period end date: December 30, 2017  
Is this the final report? No

III. Principal Investigator:

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IV. Abstract:

This project is one of several designed to facilitate the removal of northern pike and smallmouth bass within the Yampa River basin, with an evaluation of the efficiency of such efforts. The study area consisted of Yampa River miles 134.2 to 50.5 which were sampled to capture and remove smallmouth bass and northern pike. During the 2016 sampling season, 540 northern pike individuals were handled and euthanized during electrofishing removals in the Middle Yampa River. Compared to 2015, this river section yielded an overall decreased catch per unit effort, almost entirely attributable to a strong 2015 northern pike age class captured during the surge. See 2015 report #125 for a detailed analysis of smallmouth bass data collected in the study area.

V. Study Schedule:

Initial Year: 2005 (CDOW assisted Colorado State University (CSU) in 2004)  
Final Year: Ongoing

VI. Relationship to RIPRAP:

This study involved removing northern pike and smallmouth bass from the middle Yampa River, and evaluating the efficiency of that effort.

Green River Action Plan: Yampa and Little Snake Rivers:

III. Reduce negative impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management)

III.A.1. Implement Yampa Basin aquatic wildlife management plan in

reaches of the Yampa River occupied by endangered fishes. Each control activity will be evaluated for effectiveness and then continue as needed.

- III.A.1.b. Control northern pike.
- III.A.1.b. (1) Remove northern pike and other nonnative sport fishes from the Yampa River.
- III.B.2 Control nonnative fishes via mechanical removal
- III.B.2.e Remove smallmouth bass

## VII. Accomplishments of FY 2016 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

### A. FY 2016 Tasks and Deliverables

Task 1. Establish landowner contacts and obtain permission to access riverside and backwater property for fish sampling.

Schedule: February 2016

Deliverable: **Task Completed**

Task 2. Plan logistics, hire and train personnel, order and maintain equipment, and prepare for sampling.

Schedule: January-March, 2016

Deliverable: **Task Completed**

Task 3. Sample study area to capture and remove northern pike and smallmouth bass. Limited data entry

Schedule: April-Aug, 2016

Deliverable: **Task Completed**

Task 4. Maintenance of equipment. Data entry, data analysis, and prepare final report. Present findings during the Annual Nonnative Fish Control Workshop, and at the Annual Recovery Program Researchers Meeting.

Schedule: August-November, 2016

Deliverable: **Task Completed.**

### B. Discussion of Initial Findings and Shortcomings

#### **Study Area**

The study area for this project with regard to northern pike has been consistent since 2005. It includes the entire portion of the middle Yampa River sampled by CPW and CSU combined, from river mile (RM) 134.2 to 50.5 (Figure 1). CPW samples Reach 1 (RM 134.2 – 124.0), CSU samples Little Yampa Canyon (LYC; RM 124 – 100), CPW samples Reaches 2 through 5 (Juniper, Upper Maybell, Lower Maybell, Sunbeam, RM 100 – 60.6), and CSU samples Lily Park (RM 55.5 – 50.5) (Figure 1).

## **CPW Study Methods/Approach**

Since 2005, CPW has analyzed the combined northern pike removal efforts of CPW and CSU in the Middle Yampa River. As such, this report details the total efforts of both CPW and CSU for northern pike removal in the Middle Yampa River study area (described above). Conversely, fiscal year 2016 marks the seventh consecutive year in which all smallmouth bass data collected by CPW were submitted to CSU for a combined analysis of smallmouth bass removal. See 2016 report #125 for a detailed analysis of smallmouth bass data collected in the study area.

Between river-mile 134 and 50.5, crews conducted removal passes on each individual reach, although not every mile of river within a given reach was shocked on every pass. Pass numbers varied in order to maximize impacts to non-native species, to provide capture/recapture effort for a Colorado pikeminnow population estimate, and to target as much habitat as flows would allow. A total of 78.7 hours of electrofishing was conducted in Reach 1 (Southbeach: RM 134.2 – 124.0), 58.8 hours in Reach 2 (Juniper: RM 100 – 91.0), 22.6 hours in Reach 3 (Upper Maybell: RM 88.7 – 79.2), 37.9 hours in Reach 4 (Lower Maybell: RM 79.2 – 71.0) and 30.1 hours in Reach 5 (Sunbeam: RM 71.0 – 60.6). In CSU's study area, 257.9 hours of electrofishing was conducted in Little Yampa Canyon (RM 124 – 100 and 71.7 hours in Lily Park (RM 58.9 – 55.5).

Northern pike and smallmouth bass were captured using ETS boat-mounted electrofishing gear. Electrofishing effort was recorded by reach sampled and by date. In addition, “Block and shock” and “snare and scare” techniques were utilized with gill nets at the mouths of backwaters. Water conductivity and temperatures were recorded at the beginning of each sampling day. All northern pike captured were euthanized; none were translocated to any location. This was the third year in which no northern pike were translocated.

All northern pike, smallmouth bass, roundtail chub, flannelmouth sucker, and bluehead sucker were measured for total length to the nearest millimeter (mm) and most were weighed to the nearest gram (g). Northern pike and smallmouth bass captured were examined for the presence of FLOY tags and fin clips. Colorado pikeminnow, roundtail chub, flannelmouth sucker and bluehead sucker were scanned for the presence of passive integrated transponder (PIT) tags. Individuals without PIT tags were implanted with a new PIT tag. PIT tags for all the aforementioned species were implanted in accordance with the protocol of the Upper Colorado River Recovery Program. All Colorado pikeminnow, roundtail chub, flannelmouth suckers, and bluehead suckers were released back to the water immediately. In nearly all cases, incidental centrarchids, cyprinids, catostomids, ictalurids, and salmonids were also identified to species, measured for total length to the nearest millimeter (mm), and weighed to the nearest gram (g). This was the fourth year of CPW's “net everything” approach to sampling. Previously CPW had only netted the target species: smallmouth bass, northern pike, roundtail chub, and Colorado pikeminnow.

### Catch Per Unit Effort (CPUE)

Catch per unit effort (CPUE) was reported in terms of number of northern pike captured per electrofishing hour for the entire study area. In addition to overall catch per unit effort, CPUE

was reported for all seven sub-sections within the study area: (1) South Beach (RM 134.2 to 124.0), (2) Little Yampa Canyon (RM 124 to 100), (3) Juniper (RM 100 to 91.0), (4) Upper Maybell (RM 88.7 to 79.2), (5) Lower Maybell (RM 79.2 to 71.0), (6) Sunbeam (RM 71.0 to 60.6) and (7) Lily Park (RM 55.5 to 50.5). For these three sub-sections CPUE was broken down into four categories and reported for each pass. The four categories for which CPUE was reported were: (1) NPK < 300mm TL, (2) NPK  $\geq$  300mm TL, (3) NPK  $\geq$  450mm TL, and (4) Total NPK.

## **Results and Discussion**

A total of 22 different fish species, including sucker hybrids, were captured within CPW study reaches. Summary data for all species captured and handled by CPW in 2016 are presented in Table 1.

### Northern Pike

#### *Overview*

Overall, CPW and CSU captured 540 individual northern pike during electrofishing operations. The total number of northern pike capture events in 2016 decreased substantially from 1132 captured by electrofishing in 2015. All northern pike were euthanized in 2016, as this was the third year that no fish were translocated to any water body.

Four hundred sixty two of 540 northern pike removed from the Middle Yampa River by electrofishing in 2016 were considered adult northern pike ( $\geq$  300mm; Table 2 and Figure 2). One hundred twenty seven of 540 northern pike removed were  $\geq$ 450mm (Table 2 and Figure 2). The first date in 2016 when northern pike were captured by electrofishing was April 19<sup>th</sup> and the last date was July 28<sup>th</sup> (Table 3). No northern pike captured had been previously marked with Floy tags. Northern pike recaptures are increasingly rare due to the fact that northern pike have not been marked and released into the Yampa River since 2012.

#### *Population Size Structure*

Northern pike total length frequency histograms for the entire section of river sampled by CPW and CSU from 2007 to 2016 are presented in Figure 2. Compared with 2015, the 2016 northern pike electrofishing catch featured a greater proportion of adult fish ( $\geq$  300mm), 85.6% of total capture events, and fewer juvenile northern pike (< 300mm), 14.4% of total capture events (Table 2). Electrofishing in 2015 captured very large numbers of juvenile northern pike and they accounted for 71% of electrofishing captures; this large number of YOY northern pike was not observed again in 2016 (Figure 2). The catch in 2016 is very similar to 2014, when 81% of northern pike captured were adults and 19% juveniles. The proportion of northern pike  $\geq$ 450mm captured in 2016, was 23.5%, a substantial increase compared to 11% in 2015, which is likely due to the unusual numbers of YOY captured in 2015. The largest northern pike captured in 2016 was 960 mm.

As noted above, a substantial decrease in YOY northern pike captures was observed in 2016. Northern pike YOY were defined as 1-200mm fish captured after June 1 of each corresponding

year. Two hundred seventy eight YOY were captured in 2011, 8 in 2012, 18 in 2013, 64 in 2014, 673 in 2015 and 83 in 2016. The first YOY of 2016 was captured on June 15 (compared to June 22, 2015) and was 104 mm. Very large numbers of YOY northern pike were captured in 2015 and that strong age class can be seen in increased numbers of fish between 301 and 400mm captured in 2016 (Figure 2).

#### *Catch Per Unit Effort (CPUE)*

CPUE was calculated for all sub-sections of the study area (South Beach, Little Yampa Canyon, Juniper, Upper Maybell, Lower Maybell, Sunbeam and Lily Park) and separately for three size categories in each reach (<300mm, ≥ 300mm, ≥ 450mm; Table 2 and Figure 3).

The largest number of northern pike captured by electrofishing was in Little Yampa Canyon (n = 215) followed by Southbeach (137). Lower Maybell (n = 9) and Sunbeam (n =12) produced the fewest. The highest CPUE in 2016 was in the Upper Maybell reach (2.48 per hr) followed by Southbeach (1.74 per hr). The lowest CPUE was in Lower Maybell (0.24 per hr) followed by Sunbeam (0.40 per hr).

Runoff in 2016 was somewhat above average but did not feature the increased flows in March that were seen in 2015 (Figure 4). Compared with earlier years, a sharp spike in electrofishing CPUE was seen 2015 (Figure 5) which may have been associated with the unusual flow pattern that year. Captures of YOY were much lower in 2016 (Figure 2) and the overall CPUE in the study area (0.97 NPK per hour) was substantially lower than 2015. The 2016 CPUE was the fifth lowest since 2004, but is similar to that seen in 2009. If CPUE is a reliable measure of northern pike abundance, this suggests that little progress is being made to reduce population sizes in the Middle Yampa River. The evaluation of a species' abundance based solely on CPUE is simplistic, however, and does not take into consideration major factors that affect capture probability, such as, river flows, turbidity, gear selectivity, etc.

#### *Concentration Areas*

Northern pike distribution is not geographically uniform, which is why our removal efforts are not constant in all river reaches. Specific types of habitat, mainly backwaters, tributary mouths, eddies and other slack water areas, generally hold more northern pike and availability of these types of habitat varies substantially between reaches. Most northern pike captured by electrofishing were removed from Southbeach and Little Yampa Canyon (Figure 6). The utility of targeting removal efforts in areas where northern pike concentrate most was balanced against various other goals of the field activities. Removal of smallmouth bass is an important consideration, and their preferred habitat often does not overlap with northern pike. The electrofishing activities in 2016 were varied to accommodate sampling for a Colorado pikeminnow population estimate. Electrofishing effort was increased on the Lower Maybell and Sunbeam reaches in order to accommodate the population estimate, even though these reaches are not productive for northern pike (Figure 3).

#### Colorado Pikeminnow

In 2016, two Colorado pikeminnow were captured by CPW on the Yampa River. This is an

increase over the last two previous years, 2015, when none were captured and 2014 when one was captured. The first Colorado pikeminnow captured was 639 mm and was captured at river mile 64 on the Sunbeam Reach (Table 4). That fish was previously marked with a PIT tag and that number was scanned and recorded. The second Colorado Pikeminnow encountered was captured in a gill net during a block and shock operation on the Sand Creek backwater at river mile 72.9 on the Lower Maybell reach (Table 4). That Colorado pikeminnow did not have a PIT tag and one was implanted before it was released.

### Roundtail Chub

A total of 33 roundtail chub were captured during electrofishing efforts in 2016 (Table 5). Only a single roundtail chub was captured in 2015 and 34 were captured in 2014 (Figure 7). Of those captured, 19 were encountered in the Lower Maybell reach and 14 in the Sunbeam Reach (Table 5 and Figure 8). None were captured above river mile 75.6 and 11 of the individuals were captured in the Sand Creek Backwater at river mile 72.9 in two separate Block and Shock events (Figure 8). The two smallest roundtail chub captured were 73 and 75mm and the largest captured was 515mm (Figure 7).

### Spring Backwater Netting:

Backwater netting was funded as part of the 98a Scope of Work for the first time in 2016. This method of non-native fish control is simple, efficient, effective, and inexpensive. Back water netting commenced on April 4<sup>th</sup>, 2016 and ended on April 22<sup>nd</sup>, 2016, when the effort was abandoned in order to meet main-channel electrofishing obligations. Nets were set and fished seven days a week for the duration of the project. Setting and working the nets was a collaborative effort between CPW, CSU and USFWS. The backwater netting takes place as soon as ice has melted and runoff causes flows to rise enough that the backwaters become connected to the main channel. In 2016, this did not occur until the first week of April. This method is very effective to target northern pike, which will enter the backwaters during this time of year to spawn. An ancillary benefit to this type of removal is that it frequently removes adult northern pike before they are able to spawn. When a ripe female is removed it also eliminates tens of thousands of larval fish from entering the system.

In 2016, 15 nets were set in 12 different backwaters (Figure 8). Two nets were set in each of the three largest backwaters (Lower Carpenter, 151, and Weber) in order to maximize capture probability and to compensate for damage to the nets caused by rodents, drifting wood and other debris. Gillnets were set and pulled depending on water conditions and the practicality of keeping them set. A net was not set until the backwater was inundated, and were pulled when the backwater disconnected from the river. Some locations had nets set for the entire duration of the project. Other locations either were not inundated at the start of the project or had nets pulled when the upper end of the backwater connected to the river converting the location to a flowing side channel.

Overall, 469 northern pike were removed in the course of the backwater netting. Of these, the majority were in excess of 450mm and the largest size category was for fish between 501 and

550mm (Figure 10). Catch per unit effort was highly variable depending on location (Figure 11). Overall, the backwater gill nets produced an average of 1.89 northern pike per net-night. The highest CPUE, 7.00 fish per net-night, was observed at Round Bottom. This backwater was set on April 4<sup>th</sup> 2016 and had to be pulled on April 11<sup>th</sup>, 2016 because rising water connected the upper end to the main river channel. Once connected and flowing, the location was deemed unsuitable for further netting due to water velocity and debris causing rapid damage to the nets. The shortened set period at Round Bottom may have increased the CPUE by only having nets set during the most productive portion of the project period. The least productive backwater was Wyman, with only 0.31 pike per net-night. That location had substantial beaver activity very close to the location where the net was set. The gill net was frequently and seriously damaged during the project period, which negatively affected the capture efficiency.

No native fish were captured in gill nets during the course of the backwater project in 2016 (Figure 12). Overall, a total of 848 fish were captured in the nets (Table 6). Of those, a large majority were invasive northern pike ( $n = 469$ ) and white suckers ( $n = 344$ ). White sucker hybrids were the next most common fishes captured (WXF = 15, WXB = 1). Non-native brown trout ( $n = 9$ ) and rainbow trout ( $n = 8$ ) were also captured. A single black bullhead and a single green sunfish were captured as well (Figure 12).

When looking at the length frequency diagrams for northern pike captured by both electrofishing and by backwater gillnets (Figure 13) it appears that there is potential for gear biases in both methods of capture. Many of the fish being captured are adult pike that are entering the backwater to spawn. Younger fish, especially age 1 (350 – 450 mm), are not being captured as frequently in gillnets as they are by electrofishing. This could be due to that age class either being absent in the backwaters, or due to gillnet mesh that is too large to capture them or, possibly, due other factors that may not be well understood. Electrofishing appears to be less efficient at capturing northern pike in the size range between 450 – 750 mm (Figure 13).

Younger age classes are subject to natural mortality and the majority of smaller northern pike will die before they are able to reproduce or prey on many native fishes. It follows that removing these younger age fish has less impact on the overall population size in the Yampa River. Basing non-native removal effort on methods with gear selection that reduces catch of larger adults will likely perpetuate a cycle of recruitment and replacement. Removal of spawning northern pike when they are most vulnerable, will likely have a more substantial impact on that population. In the last several years, CPW has pulled effort from backwater netting in order to meet obligations for electrofishing passes. While this time is also the most effective for electrofishing removals, day for day and dollar for dollar, the backwater netting is much more efficient and more likely to have a lasting impact on northern pike.

#### Significant Work Outside of Scope of Work:

##### Elkhead Spillway Gillnetting

Due to substantial runoff and limited flow-through capacity, Elkhead Reservoir passed water over the spillway in 2016. In an attempt to limit escapement from the reservoir, CPW set gillnets in the stilling basin below the spillway starting on May 10<sup>th</sup> 2016. The nets were pulled on June 7<sup>th</sup>, 2016. Overall, 83 fish were captured in the spillway gillnets (Table 7). The majority of fish

captured were white suckers (n = 35), followed by northern pike (n = 18), black crappie (n = 13), smallmouth bass (n = 11), and bluegill (n = 6) (Figures 14, 15, 16). All northern pike, smallmouth bass and white sucker were lethally removed. Any black crappie and bluegill that were encountered alive in the gillnets were released alive back into the reservoir. Very high flows over the spillway both limited the ability to safely pull fish from the gillnets and to maintain gillnets in positions that blocked fish from leaving the stilling basin. Large debris, including logs, were washed down the spillway and also contributed to the impossibility of setting nets across the outflow of the stilling basin. Notably, since the spillway basin was not disconnected from Elkhead Creek, it is not possible to tell if the fish captured were released from the reservoir, or ran up from Elkhead Creek.

The installation of a spillway net inside the reservoir in 2016 will eliminate the need to set nets in the stilling basin in the near future. This portion of non-native control will not likely be repeated in future years.

### Elkhead Fishing Tournament

Management of smallmouth bass and northern pike in Elkhead Reservoir is being undertaken with the goal of reducing populations in order to minimize the risks of escapement and mitigate the downstream impacts of these predatory species. One tool being used to disadvantage northern pike and smallmouth bass is incentivized angler harvest. Various methods can be used to incentivize harvest of a species; in the case of Elkhead Reservoir, CPW has elected to use a tournament with valuable prizes awarded to anglers who harvest target species of fish. In 2016, the tournament was held from June 11<sup>th</sup> through 19<sup>th</sup> which encompassed two full weekends and ended on Father's Day.

A primary aspect of the tournament was to create the possibility of capturing northern pike and smallmouth bass that were marked with PIT tags. Anglers who turned in PIT tagged fish were entered into a drawing where they could win the highest valued prizes. Tournament rules specified that 10 fish of each target species would be PIT tagged and released into the reservoir. Only fish that were considered susceptible to angling capture were PIT tagged. These consisted of smallmouth bass over 200 mm and northern pike over 350 mm TL. Three nights of electrofishing, gillnetting, and trap netting effort were needed in order to capture 10 of each species over the target length.

During the nine days of the tournament, a total of 529 smallmouth bass (Figures 17 and 18) and 53 northern pike (Figures 17 and 19) were removed from the reservoir. CPW personnel staffed the check in station and any fish that were alive during check in were euthanized. Prizes were awarded daily for both the smallest and largest fish as well as the most fish of each species caught by a single angler. This provided incentive for anglers to harvest as many fish as possible from all age classes of each species. This initial effort at incentivized harvest shows very good potential for smallmouth bass harvest. Harvest of northern pike, however, was limited. Additional investigation into timing may be needed to get the best returns from the tournament. Additional public outreach in the local area will also be useful to improve the perception of the removal tournament and to increase participation. Overall, this will be a useful tool in managing problematic species in the reservoir.

### VIII. Additional Noteworthy Observations:

A summary of all fish species captured and processed during electrofishing is included in Table 1. Noteworthy observations, discussed above, included the 31 capture events of roundtail chub >150mm (Table 5). These captures occurred as a result of the CPW strategy to net all fishes, rather than only targeting smallmouth bass, northern pike, roundtail chub, and Colorado pikeminnow. As a result of netting and processing all fishes, thousands of <150mm white suckers were removed and 31 roundtail chub >150mm were captured, measured, weighed and PIT tagged. It is unclear how much these captures are influenced by the change in sampling regime or fluctuations in the roundtail chub population. Nonetheless, these captures are noteworthy and make netting all species of fish encountered worthwhile.

### IX. Recommendations:

- A. Establish predefined conditions under which a population estimate using mark/recapture techniques is appropriate to balance both the need to understand the population demographics of northern pike and the need to remove all individuals that may reproduce in the study area.
  - B. Shift effort from electrofishing to backwater netting during the ascending limb of the hydrograph. Backwater netting appears to be more efficient at capturing northern pike during the early season and runoff, and affords a greater chance of removing adults pre-spawn. This method should be used as much as possible and should be expanded in duration going forward.
  - C. Consider shifting effort to time periods and concentration areas where northern pike are most vulnerable to capture.
  - D. Continue work to control potential northern pike source populations. Prioritize work schedule to focus on populations of immediate concern.
  - E. Continue marking and documentation of the three species and endangered fishes, when they are encountered.
  - F. Evaluate the efficacy of netting all fish, including white suckers. Substantial effort is given to netting, processing and disposing of white suckers. The realized benefits of this practice should be better understood in order to inform the decision whether to continue the practice.
  - G. Continue contacts with Yampa River landowners and stakeholders before, after, and during the study.
  - H. Develop techniques that target larval and YOY northern pike to allow efficient exploitation of additional life stages.
- X. Project Status: This project is considered on track, with minor revisions to be considered. Additional evaluation of project commitments and efforts will be made internally by CPW in 2016. Additional refinement of the techniques used in the study is appropriate and will serve to further increase the efficiency of removal efforts.

### XI. FY 2016 Budget Status:

- A. Funds Provided: \$221,743
- B. Funds Expended: \$221,743
- C. Difference: \$0

- D. Percent of the FY 2016 work completed: 100%
- E. Recovery Program funds spent for publication charges: \$0

XII. Status of Data Submission: Data for Colorado pikeminnow collected by CPW will be provided to the database Manager by March 1, 2017.

XIII. Signed: Cory Noble November 6, 2016  
Principal Investigator Date

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## Appendix: Tables and Figures

Table 1. A summary of the total number of individuals captured during electrofishing for all species of interest by CPW, unless otherwise noted, in the Middle Yampa River in 2015. Non-natives that were lethally removed include: black bullhead, black crappie, brook stickleback, creek chub, common carp, green sunfish, white sucker, and all white sucker hybrids.

<b>Species</b>	<b>Number of Capture Events</b>
Northern Pike	540 (CSU 376 + CPW 164)
Smallmouth Bass	871
Colorado Pikeminnow	2
Roundtail Chub	33 (31 > 150mm)
Black Bullhead	27
Black Crappie	7
Bluehead Sucker	39
Brook Stickleback	12
Brown Trout	47
Creek Chub	64
Common Carp	18
Green Sunfish	28
Flannelmouth Sucker	40
Fathead Minnow	29
Mountain Whitefish	55
Rainbow Trout	46
Sand Shiner	210
Speckled Dace	7
White Sucker	3763
White x Bluehead Sucker Hybrid	9
White x Flannelmouth Sucker Hybrid	82
<b>Total CPW Capture Events (Individual Fish Processed)</b>	<b>5978</b>

Table 2. The number of northern pike captured for each separate reach in the 98a study area along with total effort and CPUE. Each parameter for reach is broken down further to show numbers for northern pike in three separate size categories: < 300 mm, ≥ 300 mm, and ≥ 450 mm.

	Southbeach	Little Yampa Canyon	Juniper	Upper Maybell	Lower Maybell	Sunbeam	Lily Park	Total: All Reaches
NPK Captured	137	215	36	56	9	12	75	<b>540</b>
< 300 mm	40	28	6	3	0	1	0	<b>78</b>
≥ 300 mm	69	163	27	33	5	9	29	<b>335</b>
≥ 450 mm	28	24	3	20	4	2	46	<b>127</b>
Effort (hr)	78.66	257.91	58.78	22.6	37.9	30.1	71.7	<b>557.65</b>
CPUE	1.74	0.83	0.61	2.48	0.24	0.40	1.05	0.97
< 300 mm	0.51	0.11	0.10	0.13	0.00	0.03	0.00	0.14
≥ 300 mm	0.88	0.63	0.46	1.46	0.13	0.30	0.40	0.60
≥ 450 mm	0.36	0.09	0.05	0.88	0.11	0.07	0.64	0.23

Table 3.

Middle Yampa River sampling season 2004 to 2016. 1<sup>st</sup> NPK Capture was the date for a given year when the first northern pike was captured by electrofishing. Last NPK Capture was the date for a given year when the last northern pike was captured by electrofishing. # Days Between 1<sup>st</sup> and Last Capture was number of calendar days between dates listed for a given year.

<b>Year</b>	<b>Date of 1st NPK Capture</b>	<b>Date of Last NPK Capture</b>	<b># Days Between 1st and Last Capture</b>
2004	4/21/2004	7/8/2004	78
2005	4/22/2005	7/21/2005	90
2006	4/21/2006	7/4/2006	74
2007	4/17/2007	6/30/2007	74
2008	4/15/2008	7/15/2008	91
2009	4/7/2009	7/14/2009	98
2010	4/13/2010	7/11/2010	89
2011	4/26/2011	8/22/2011	118
2012	4/17/2012	6/19/2012	63
2013	4/18/2013	7/12/2013	85
2014	4/21/2014	7/24/2014	94
2015	5/5/2015	6/25/2015	51
2016	4/19/2016	7/28/2016	70

Table 4. Location, date of capture, length and weight for Colorado pikeminnow captured by CPW in 2016.

<b>Reach</b>	<b>Date</b>	<b>River Mile</b>	<b>Length</b>	<b>Weight</b>
Sunbeam	4/26/2016	64	639	2704
Lower Maybell	5/19/2016	72.9	468	1604

Table 5. Number of roundtail chub (RTC) >150mm capture events, number of RTC marked, number of RTC recaptures, number of RTC released, number of RTC removed, and number of RTC mortalities for across all passes in 2016 performed by CPW

<u>CPW Reach</u>	<u>#RTC Capture Events</u>	<u>#RTC Marked</u>	<u>#RTC Recaptures</u>	<u>#RTC Released</u>	<u>#RTC Removed</u>	<u>#RTC Mortalities</u>
Southbeach	0	0	0	0	0	0
Juniper	0	0	0	0	0	0
Upper Maybell	0	0	0	0	0	0
Lower Maybell	19	12	6	19	0	0
Sunbeam	12	5	3	12	0	0
<u>Total</u>	31	17	9	31	0	0

Table 6. A summary of the total number of individuals captured for all species by CPW during spring backwater netting in 2016. Non-natives that were lethally removed are: black bullhead, green sunfish, northern pike, white sucker, and all white sucker hybrids.

<b>Species</b>	<b>Number of Capture Events</b>
Northern Pike	469
White Sucker	344
Black Bullhead	1
Brown Trout	9
Rainbow Trout	8
Green Sunfish	1
White x Bluehead Hybrid	1
White x Flannelmouth Hybrid	15
<b>Total</b>	<b>848</b>

Table 7. A summary of the total number of individuals captured for all species by CPW from gillnets set in the Elkhead Reservoir spillway while the reservoir was spilling in 2016.

<b>Species</b>	<b>Number of Capture Events</b>
Northern Pike	18
Smallmouth Bass	11
Black Crappie	13
Bluegill	6
White Sucker	35
<b>Total</b>	<b>83</b>

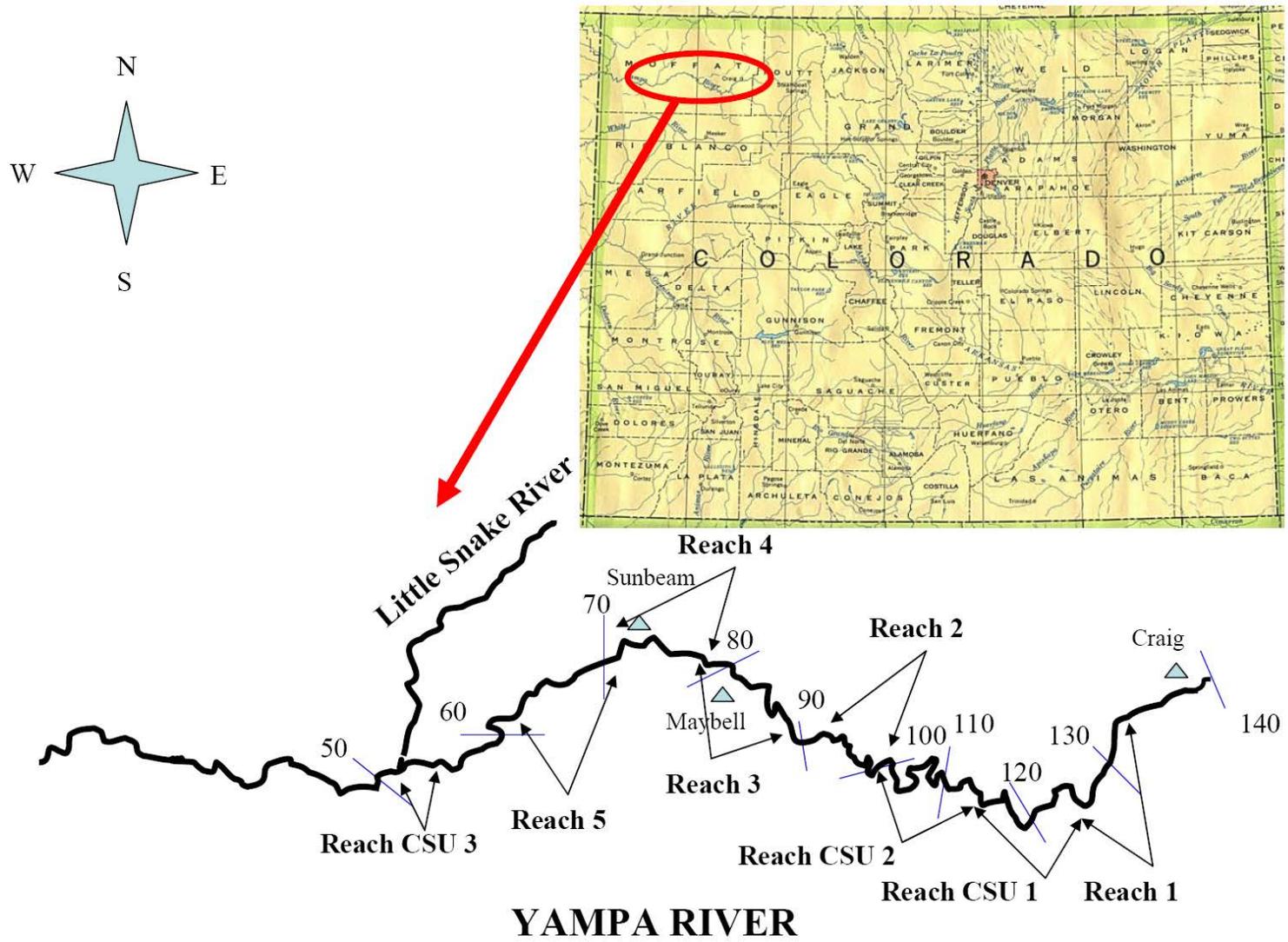


Figure 1. River reaches of the middle Yampa River sampled by the CDOW and CSU (Graphics courtesy of P. Martinez and R. Anderson)

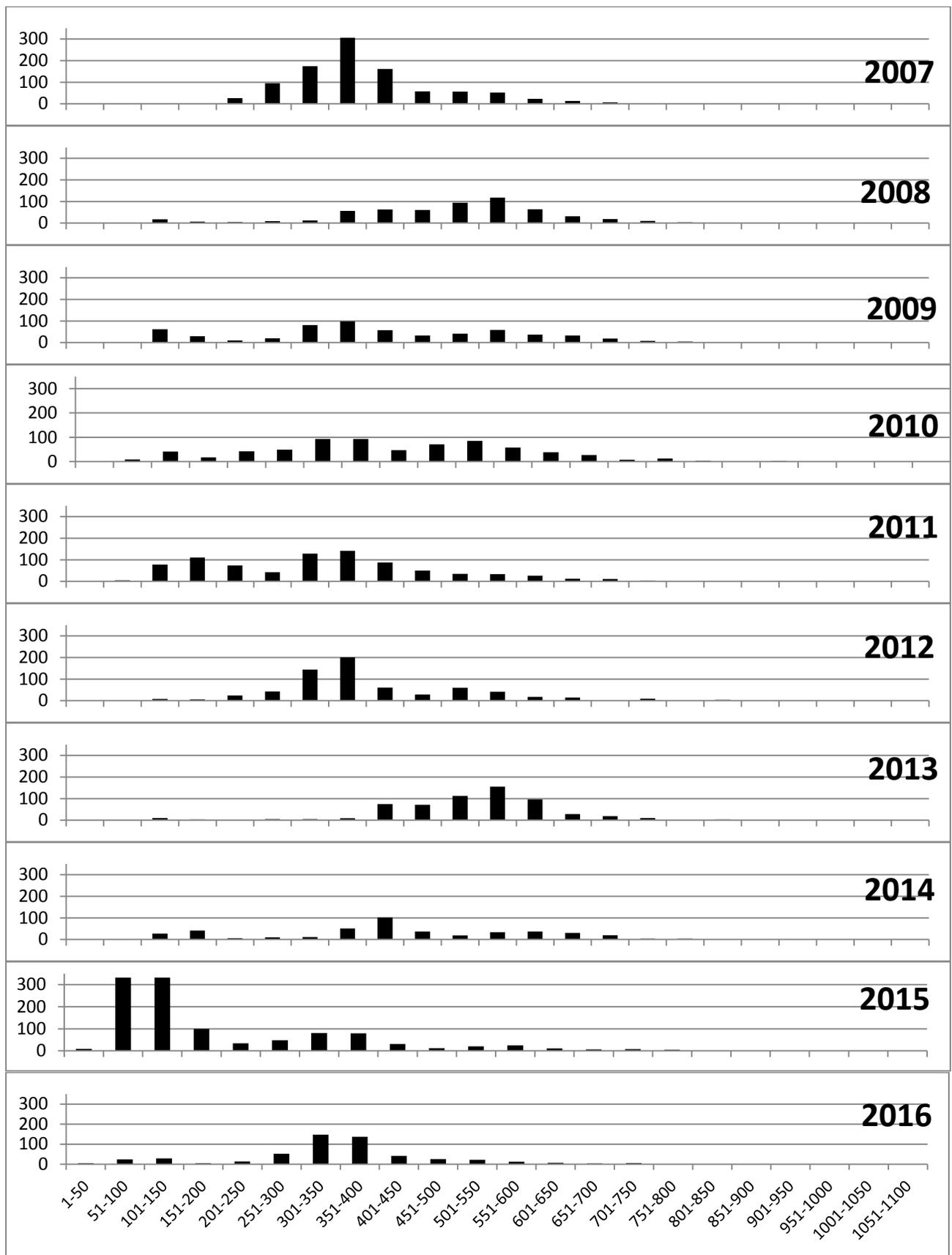


Figure 2. Northern pike total length frequency distributions, in the middle Yampa River, South Beach to Lily Park (RM 134.2-50.5)

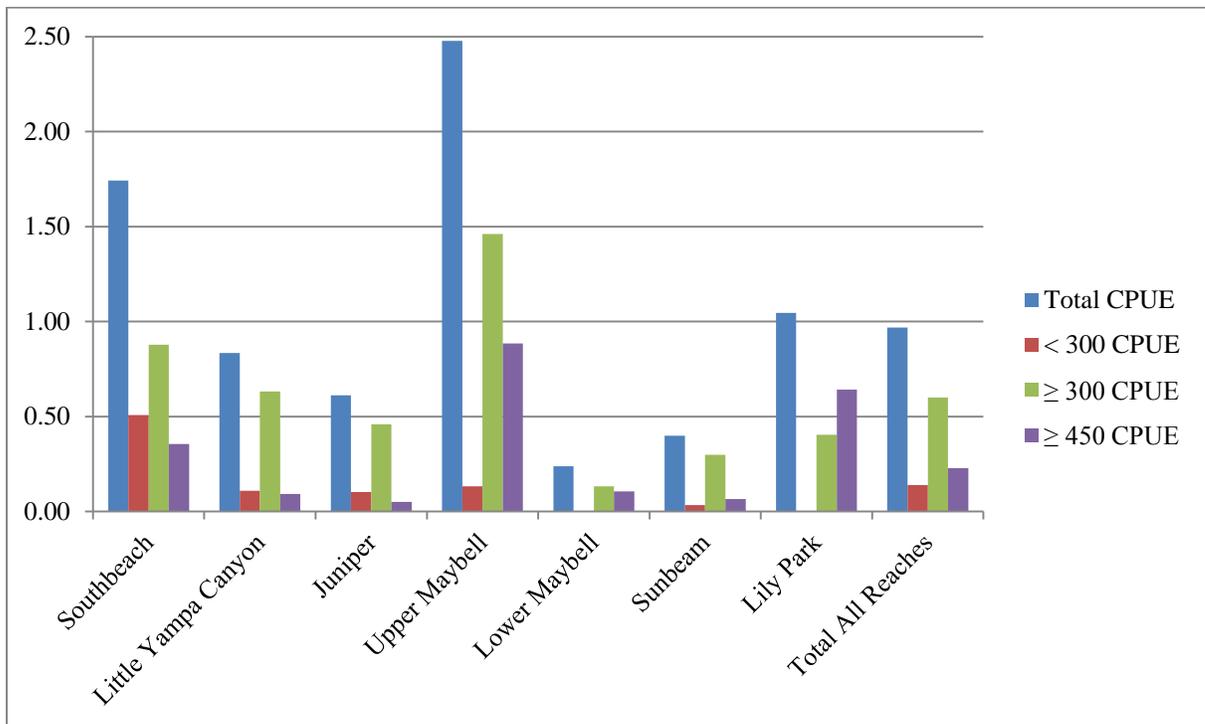


Figure 3. Northern pike catch per unit effort (CPUE) by project reach in the middle Yampa River.

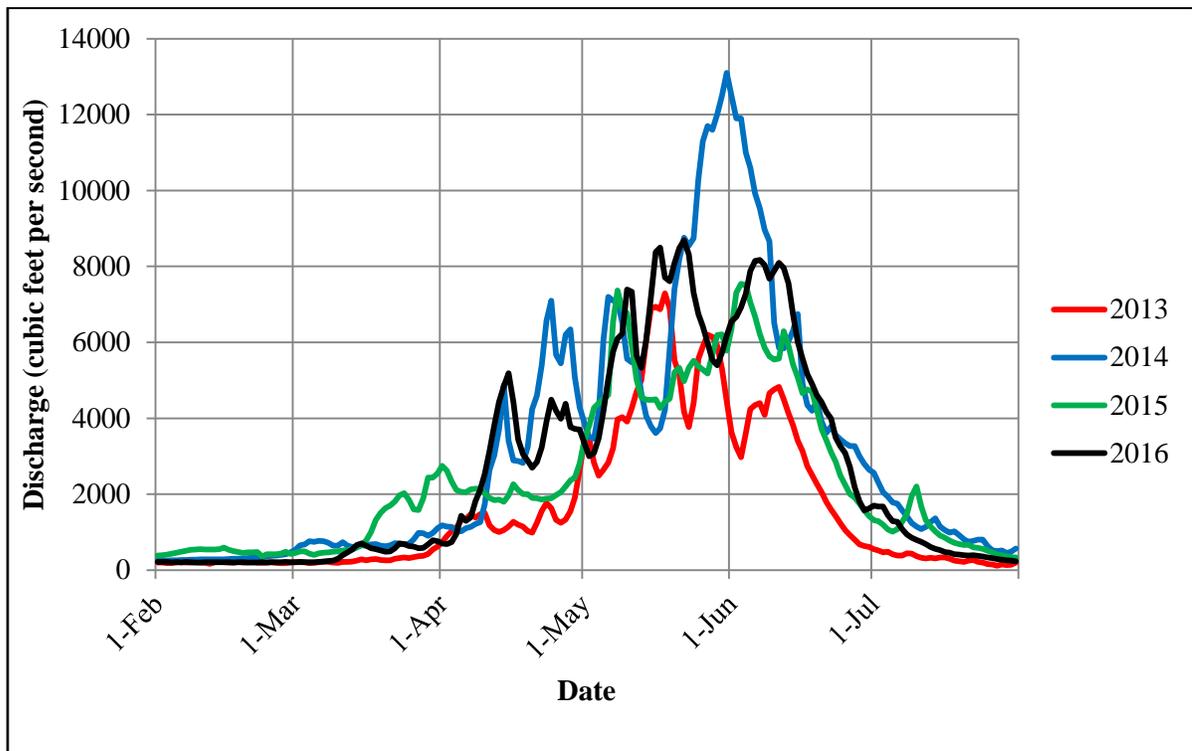


Figure 4. United States Geological Survey Maybell gaging station daily data for 2013 to 2016 spring runoff. Peak runoff in 2016 occurred on May 22nd (8690 cfs)..

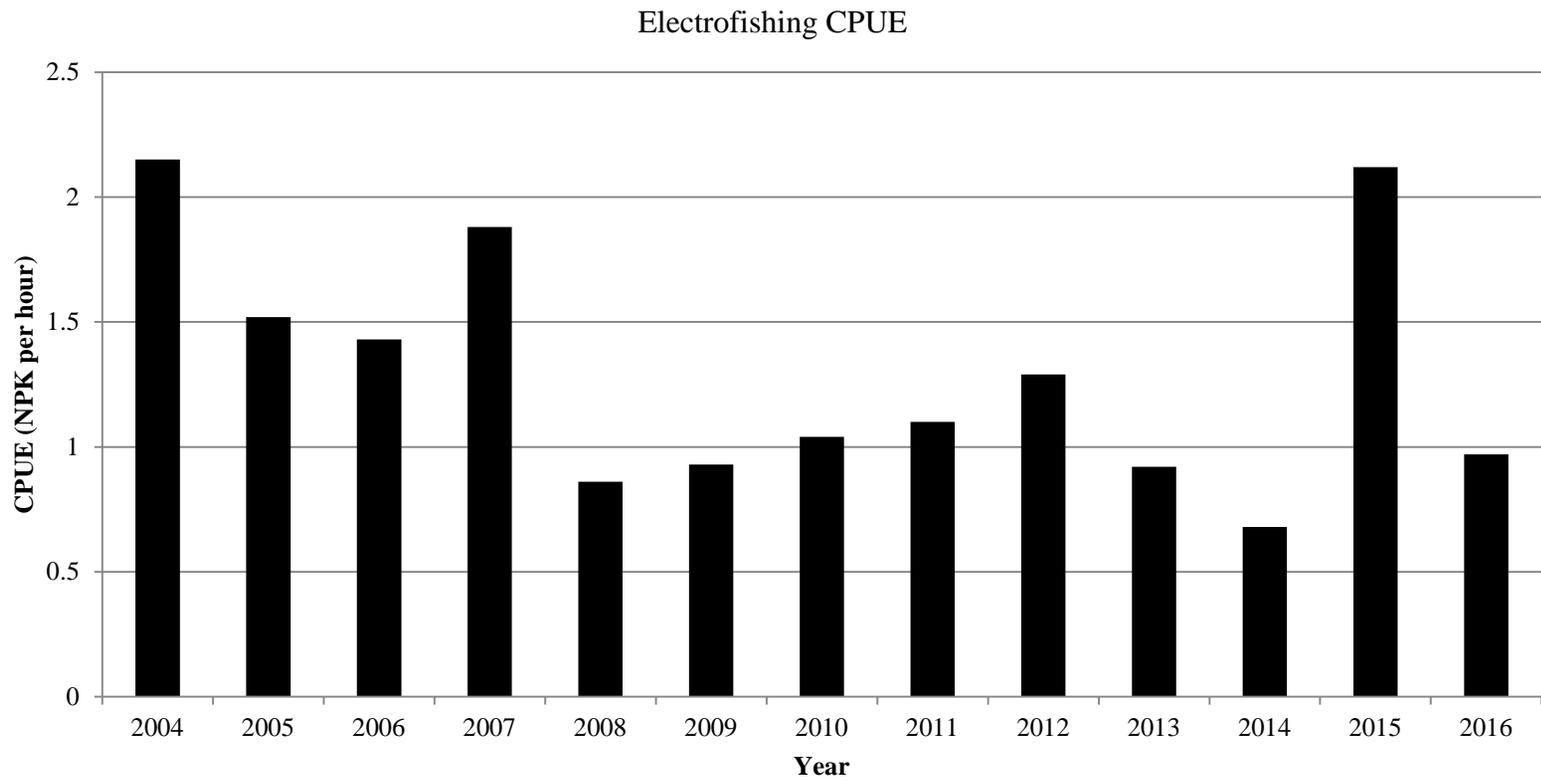


Figure 5. Northern pike Catch Per Unit Effort (CPUE; number of NPK/hour) across all passes in entire study area sampled by CPW and CSU, for 2004 through 2016.

# Number of NPK Caught by River Mile

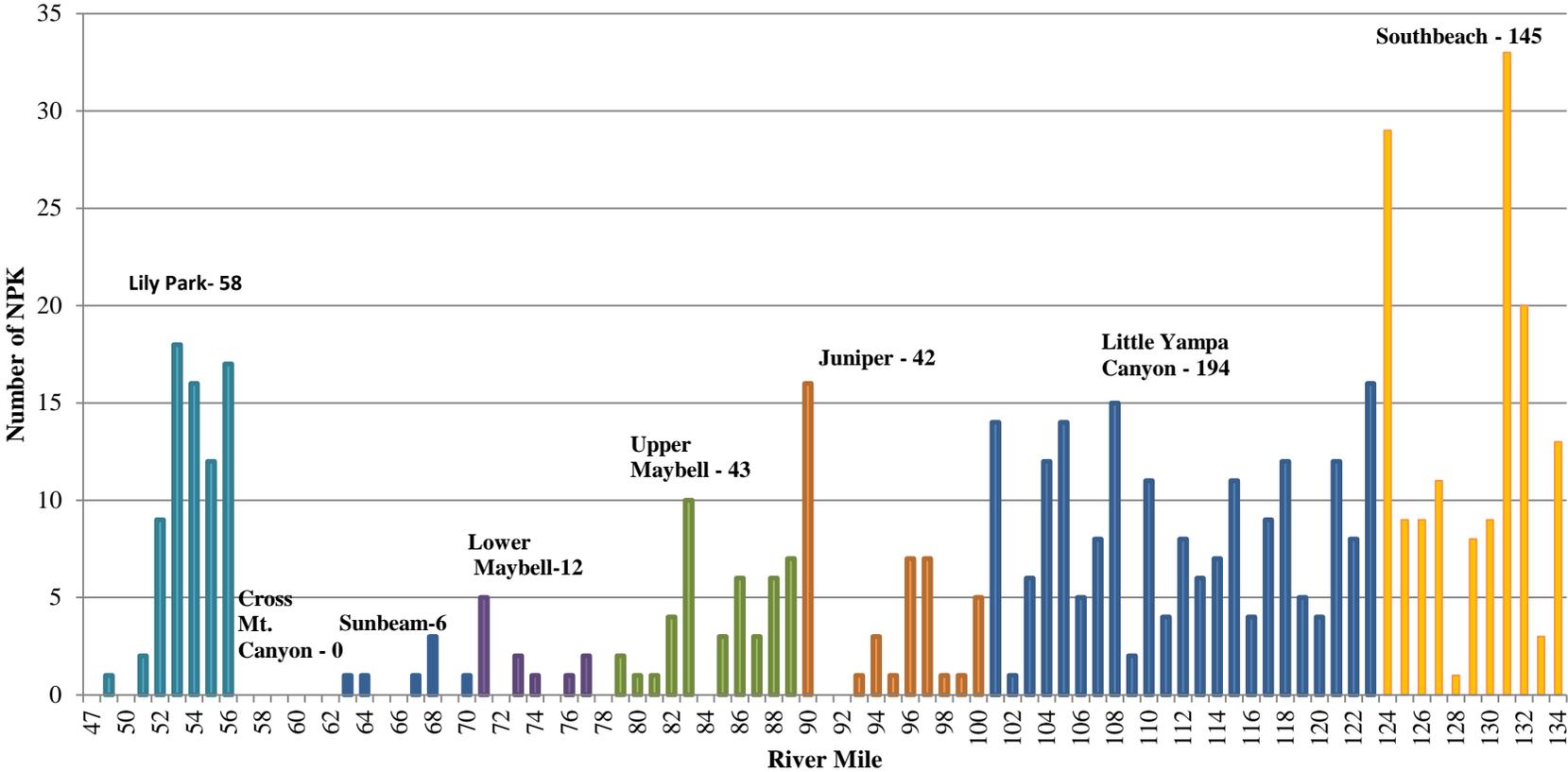


Figure 6. Number of northern pike captured within each river mile during 2016 sampling. Each color represents a different sampling reach (labeled above bars).

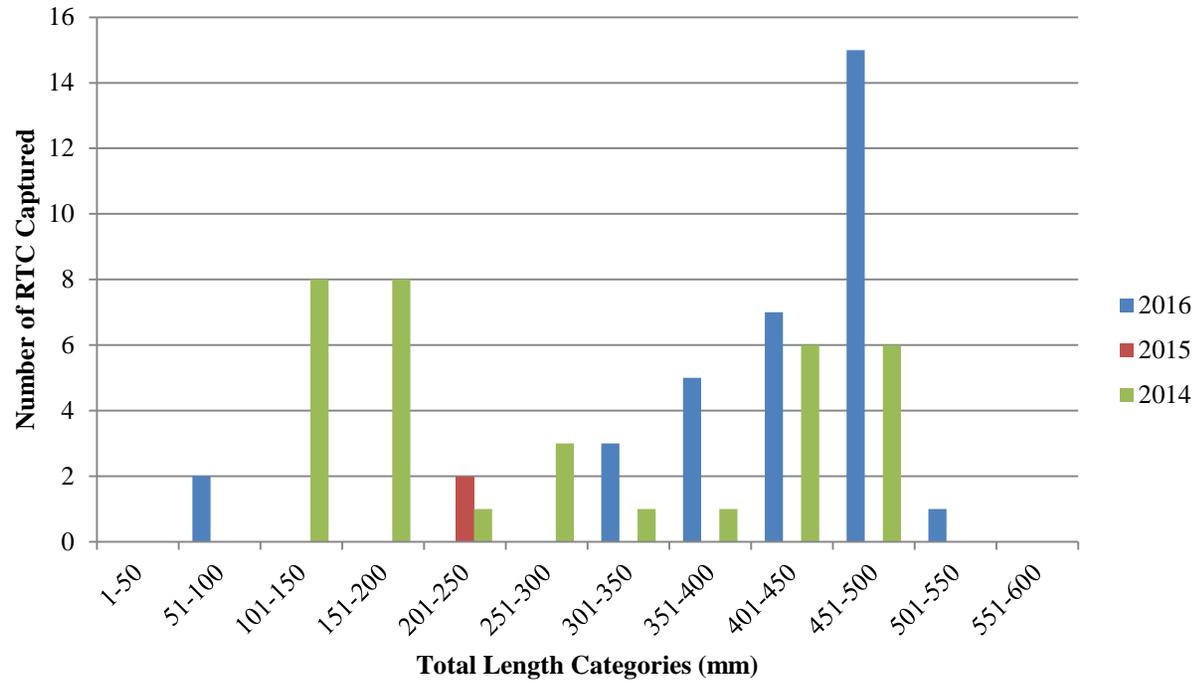


Figure 7. Roundtail chub (RTC) total length (mm) frequency distribution, with size classes in increments of 50 mm, for RTC captured by CPW in the five reaches of the middle Yampa River between 2014 and 2016.

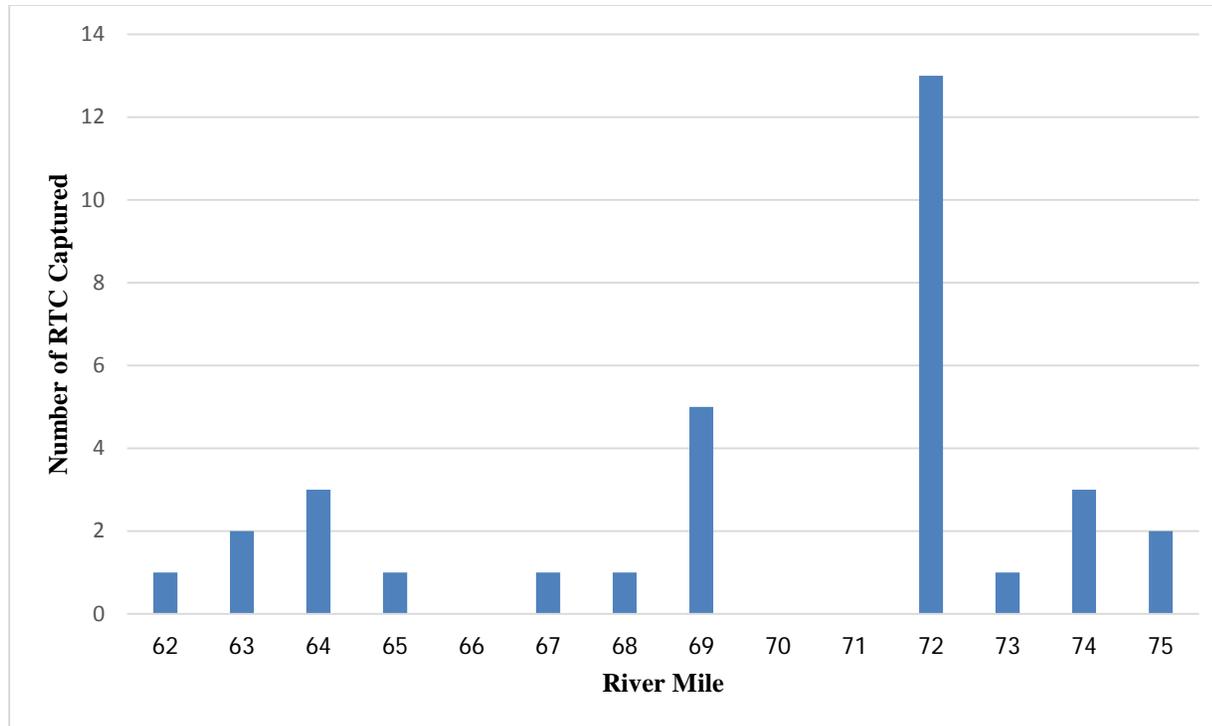


Figure 8.

CPW roundtail chub (RTC) 2016 capture locations in the Middle Yampa River. No RTC were captured above RM 75 during CPW electrofishing or gillnetting operations. River miles 62 through 71 are in the Sunbeam reach and 72 through 75 are in the Lower Maybell reach.

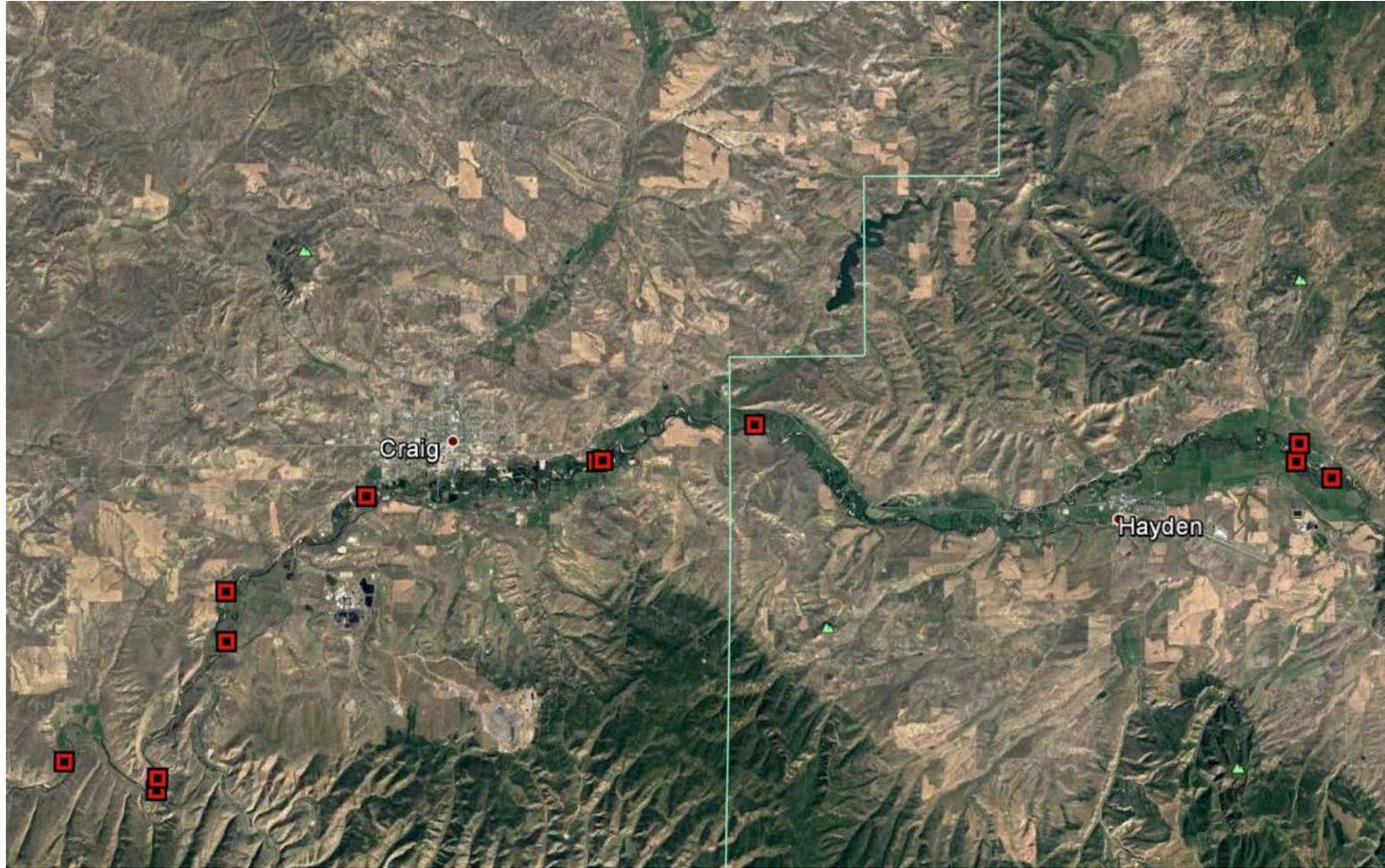


Figure 9. Satellite image showing 12 spring backwater netting locations. Backwater netting locations are spread along the Middle and Upper Yampa River between river miles 122.5 and 169.2 (imagery courtesy of Google Earth).

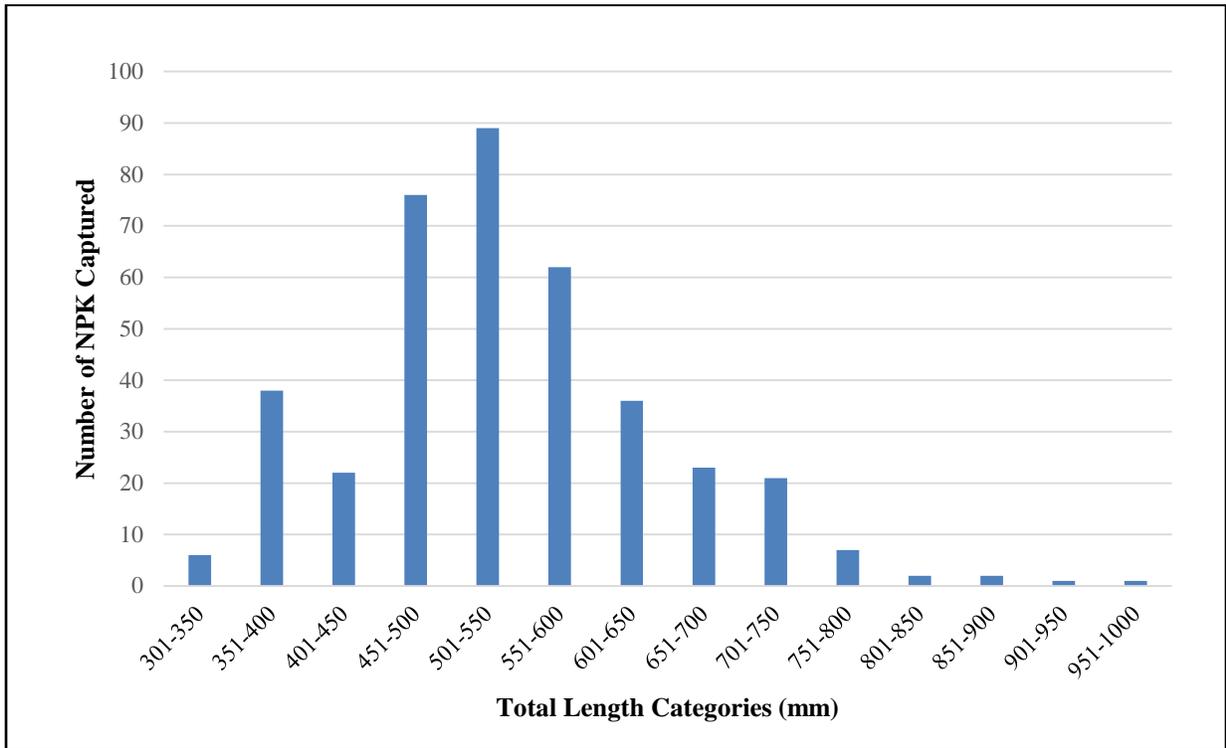


Figure 10. Length Frequency diagram for northern pike captured in backwater gillnetting operations in 2016.

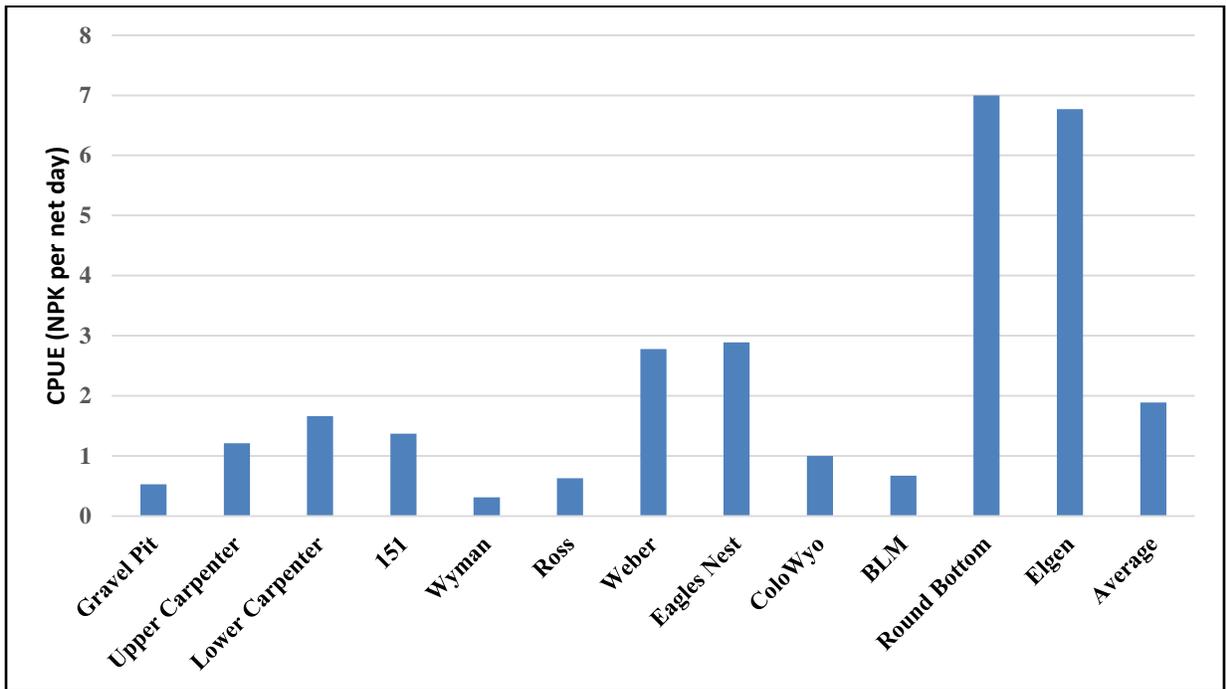


Figure 11. Catch per Unit Effort (CPUE) for northern pike captured in backwater gillnetting operation in 2016.

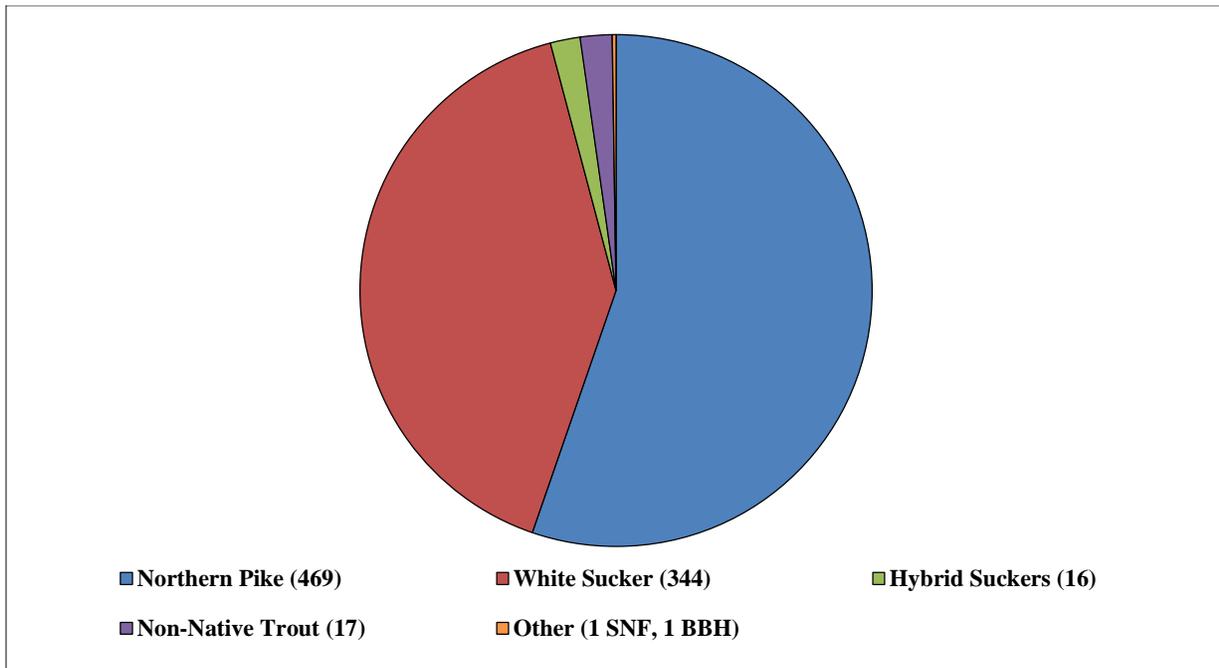


Figure 12. Species composition for fish captured during 2016 spring backwater gillnetting operations. Non-native trout species captured were rainbow trout and brown trout.

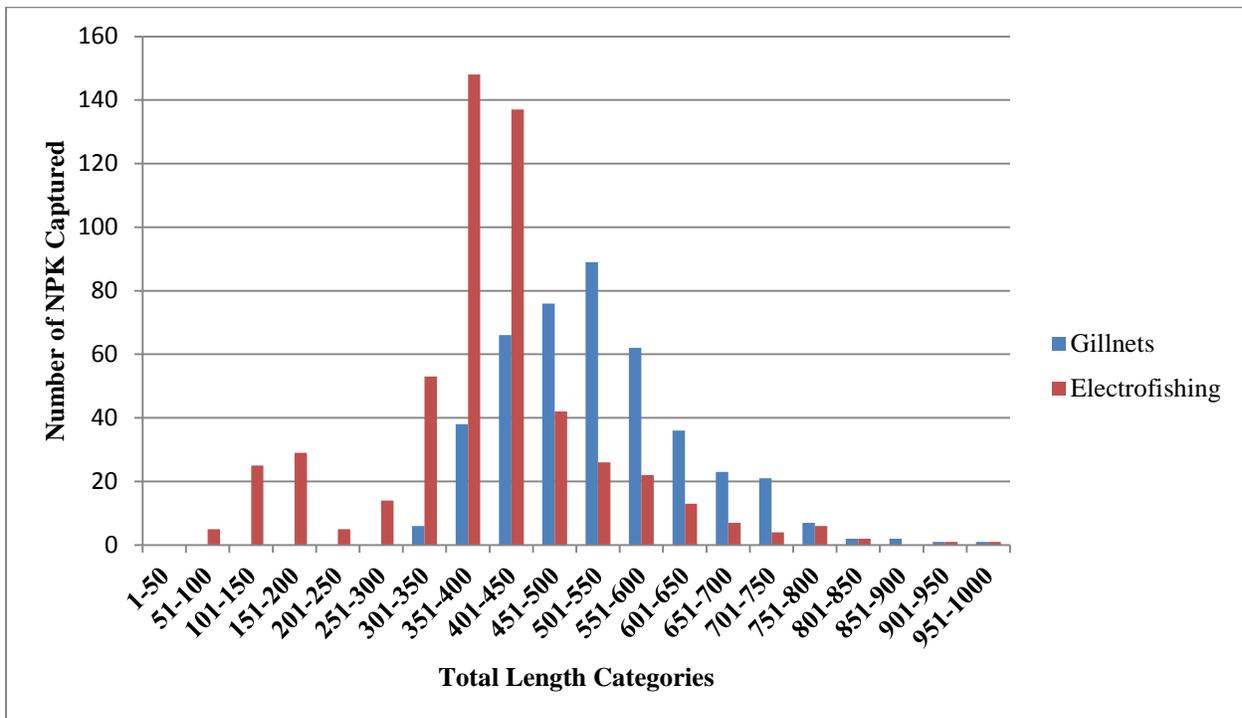


Figure 13. Comparison of Length Frequency for Northern Pike captured in Backwater nets and via electrofishing. A total of 39 northern pike from backwater gillnets could not be measured due to being partially eaten while in the net.

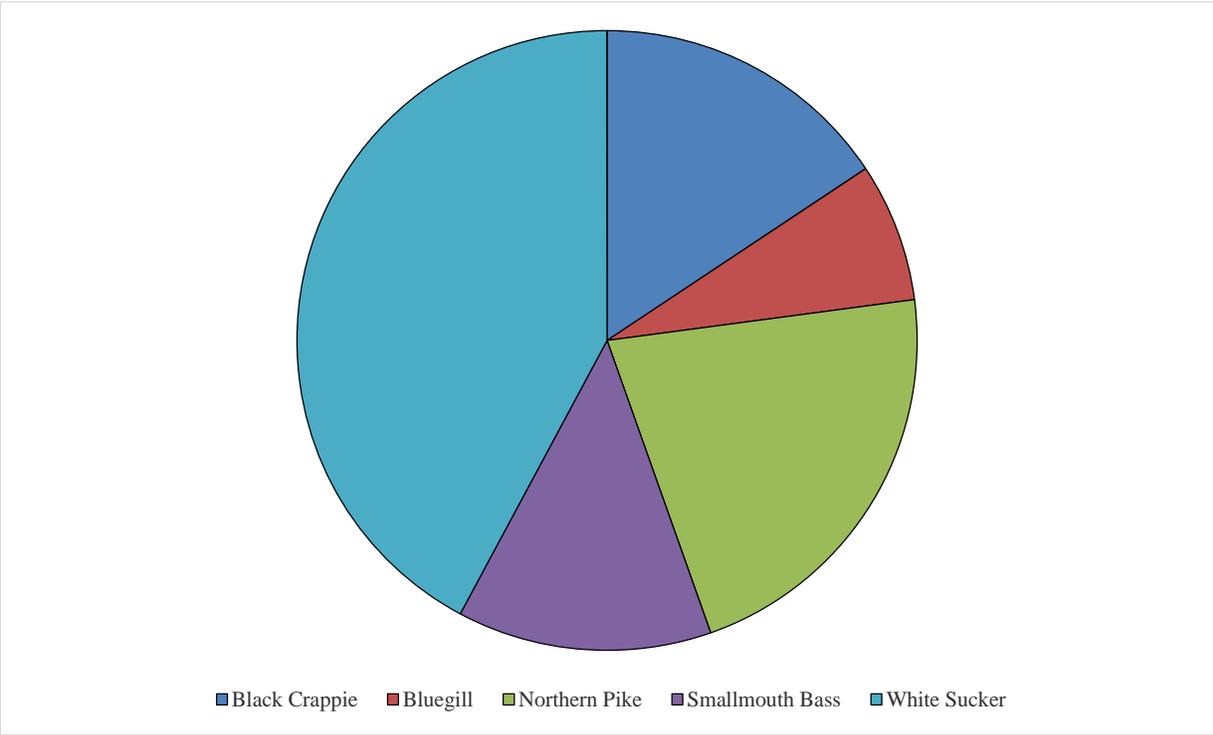


Figure 14. Species captured by gillnets set in the spillway of Elkhead Reservoir while it was spilling in 2016.

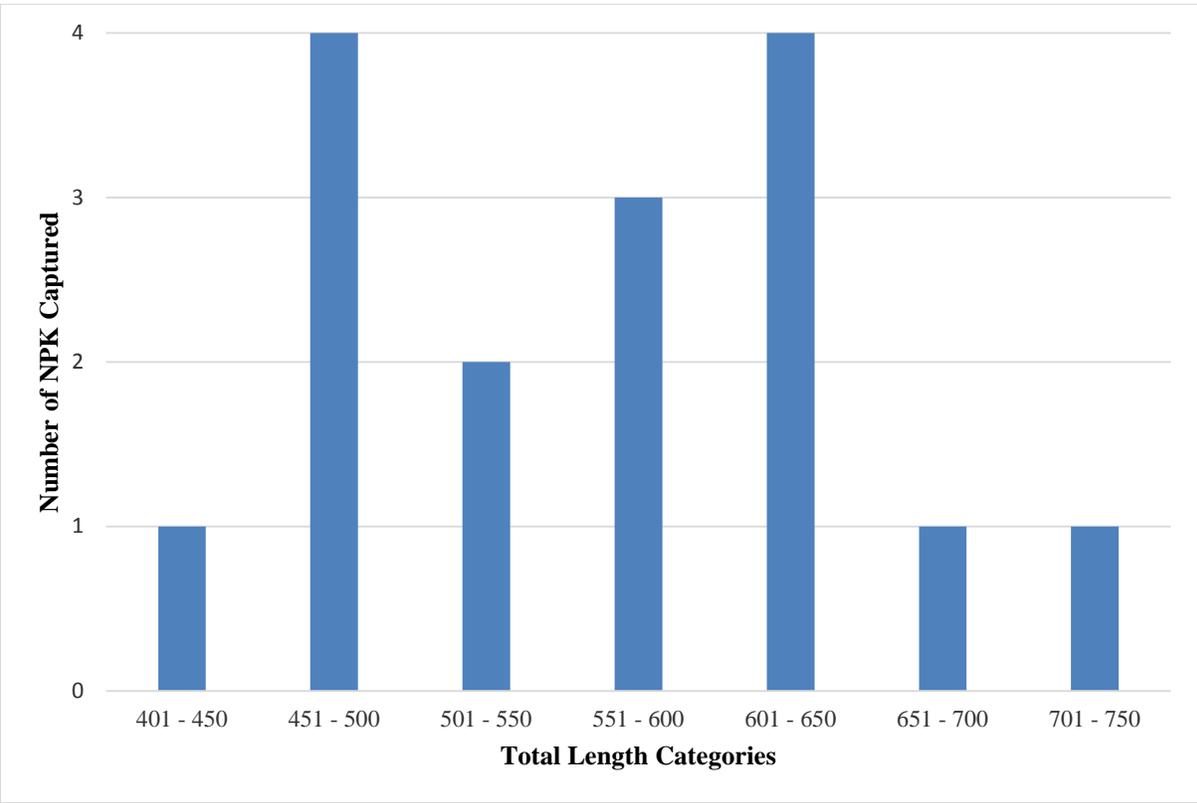


Figure 15. Length frequency for northern pike captured in gillnets set in the Elkhead Reservoir spillway while the reservoir was spilling in 2016.

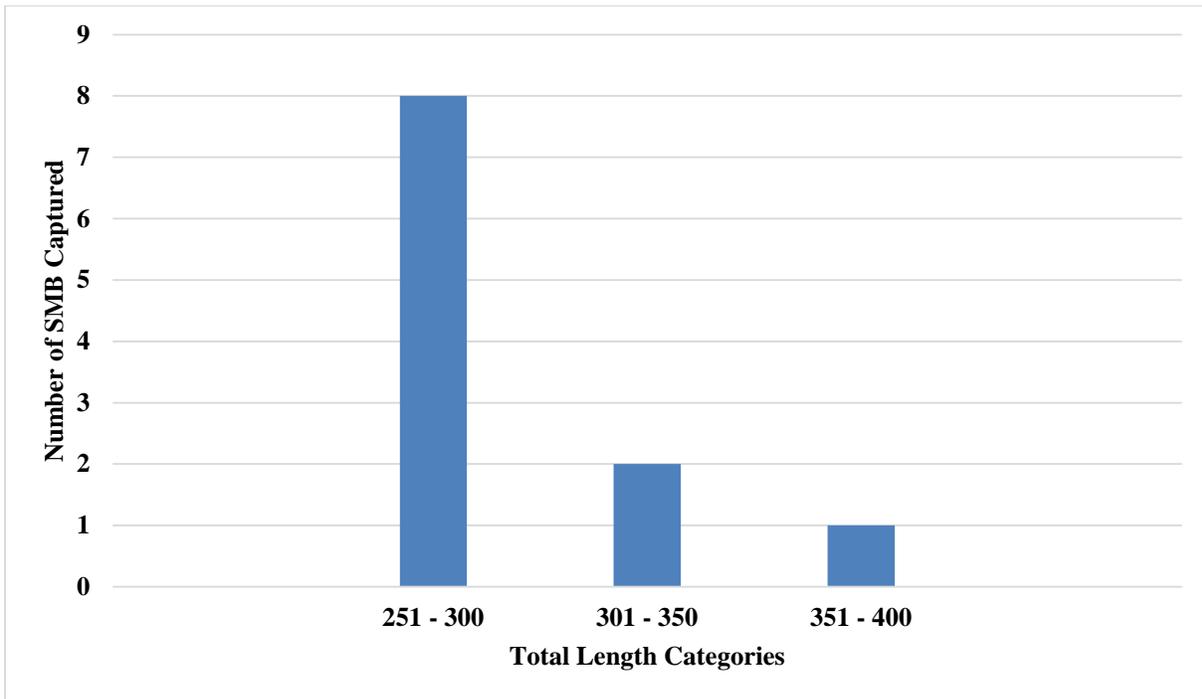


Figure 16. Length frequency for smallmouth bass captured by gillnets set in the spillway of Elkhead Reservoir while it was spilling in 2016.

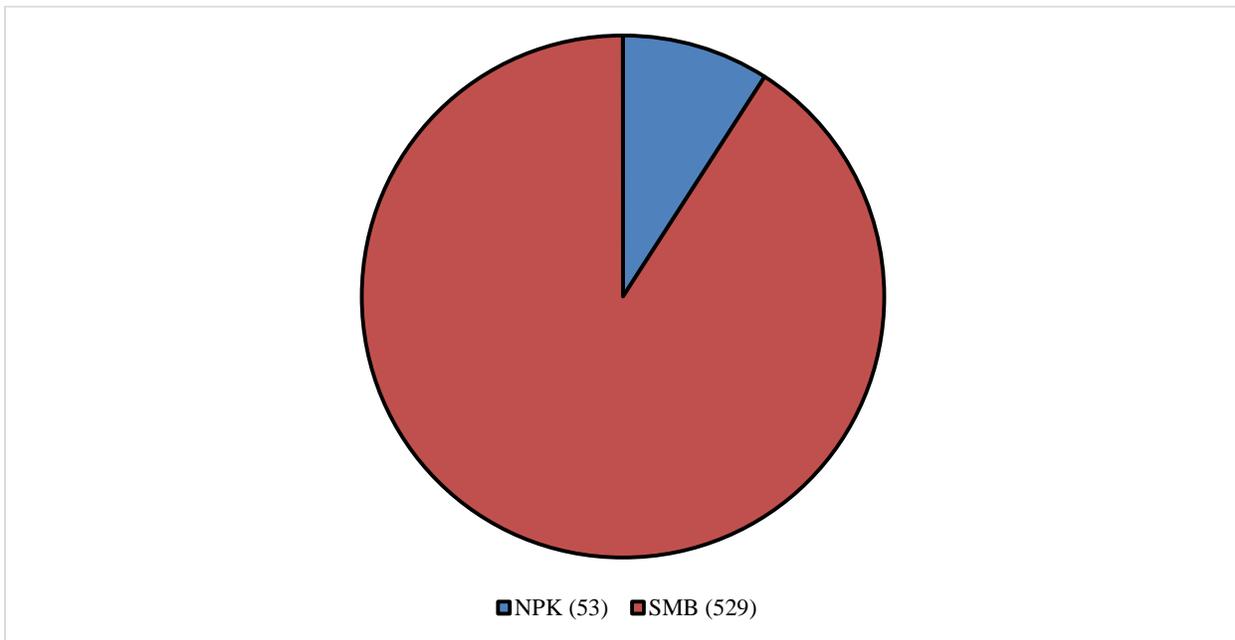


Figure 17. Species composition of fish lethally removed during the Elkhead Reservoir fishing tournament in 2016.

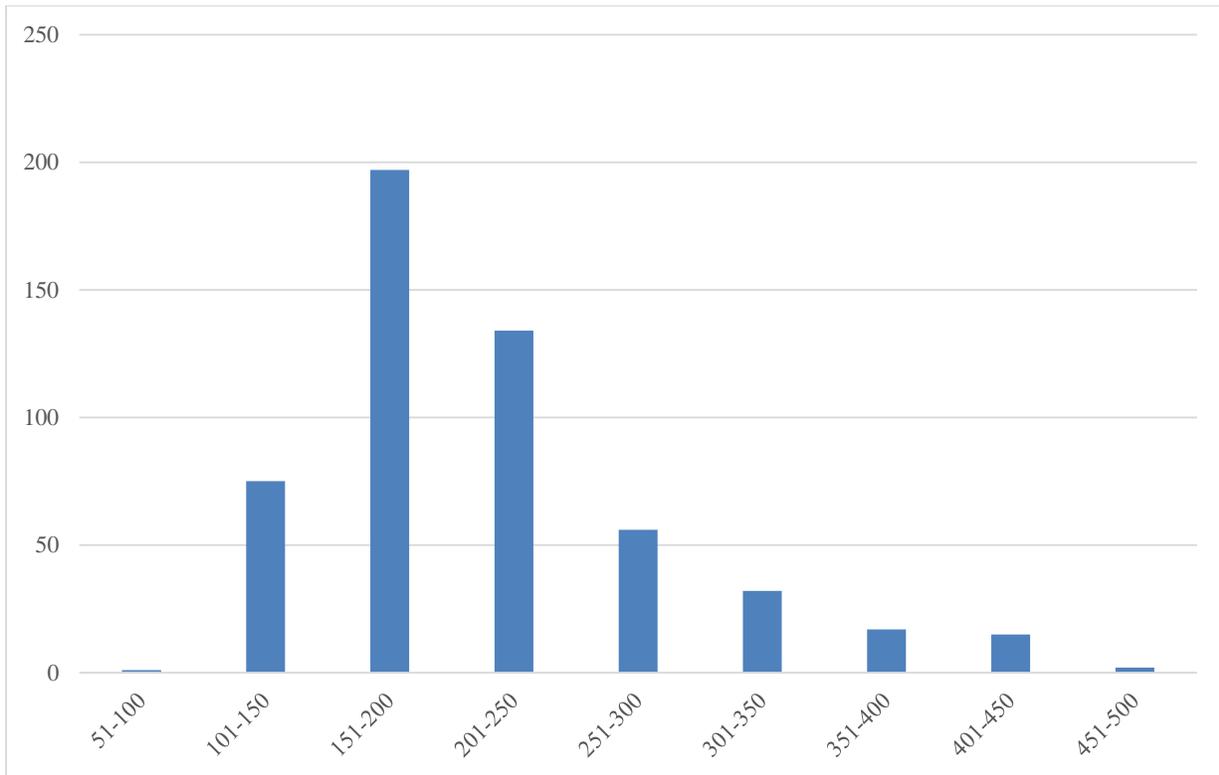


Figure 18. Length frequency for smallmouth bass removed during the harvest tournament at Elkhead Reservoir in 2016

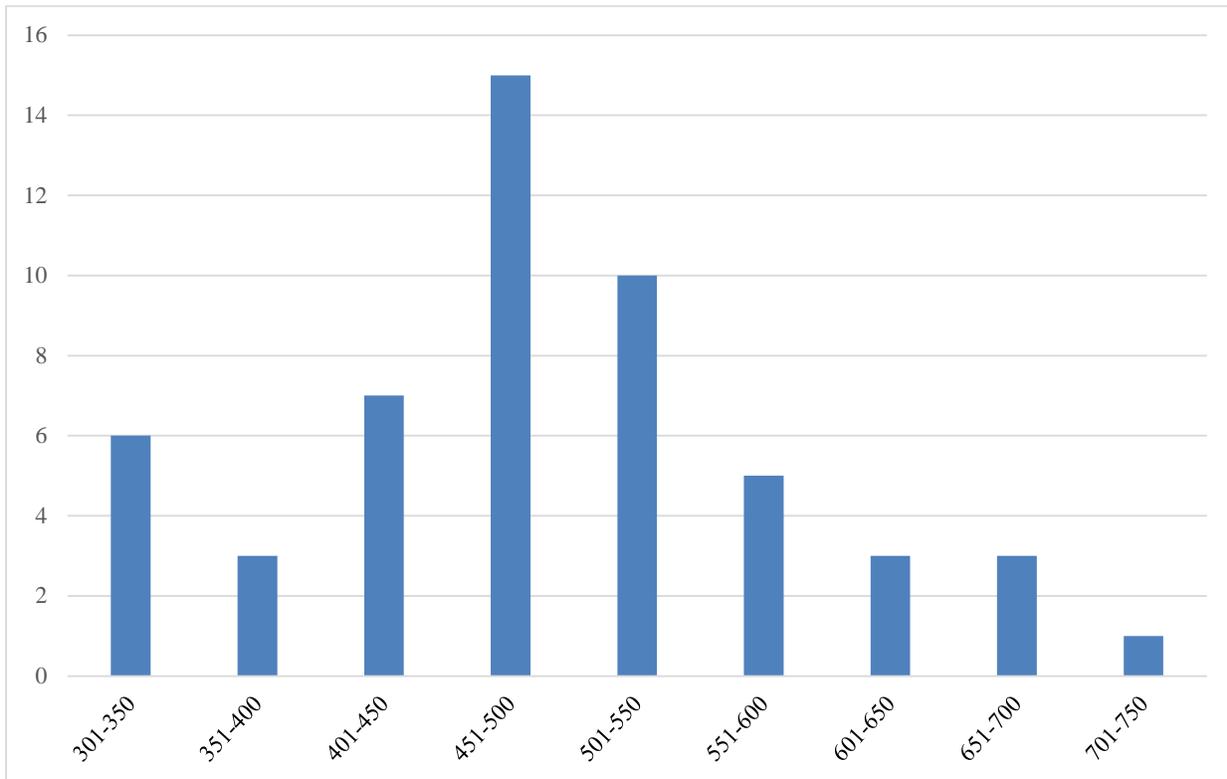


Figure 19. Length frequency for northern pike removed during the harvest tournament at Elkhead Reservoir in 2016.