

I. Project Title: **Evaluation of smallmouth bass and northern pike management in the middle Yampa River.**

II. Bureau of Reclamation Agreement Number(s): R14AP00001
Performance Progress Reports (PPR) attached for CSU and FWS.

Project/Grant Period: Start date: 10/01/2008
End date: 09/30/2018
Reporting period end date: 09/30/2014
Is this the final report? Yes _____ No x

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IV. Abstract: This study was an evaluation of whether smallmouth bass *Micropterus dolomieu* numbers can be controlled through active removal from critical habitat for Colorado pikeminnow *Ptychocheilus lucius* in the Yampa River. The study area included 87 miles of the middle Yampa River from South Beach boat launch (river mile; RM 134.2) near Craig, Colorado to just upstream of Dinosaur National Monument (RM 47.5) and was divided into seven reaches. Boat electrofishing occurred on three to nine occasions (passes) from April through July using two electrofishing boats that sampled both shorelines. We estimated the number of sub-adult (100–199-mm) and adult (≥ 200 -mm) smallmouth bass in Little Yampa Canyon using capture-recapture methods. Smallmouth bass ≥ 100 mm were marked and released on one occasion in one reach (Little Yampa Canyon) to estimate their abundance, to evaluate how the population responds to removal, and to monitor fish movement and growth. We also removed all northern pike from the middle Yampa River study area. Data for northern pike were provided to Colorado Division of Wildlife (CPW) biologists and those results are reported in Project # 98a. In addition to electrofishing work, we removed small, primarily Age-0 smallmouth bass using an electric seine from August through October, in the lower 12-mile portion of Little Yampa Canyon. A final task was to remove adult northern pike from the area between Steamboat Springs and Hayden, identify spawning areas, and capture and remove young pike to confirm reproduction.

V. Study Schedule: *Initial year-2003 Final year- on going.*

VI. Relationship to RIPRAP:¹ Version: *April 22, 2014*

¹ See RIPRAP at

Green River Action Plan: Yampa and Little Snake rivers

- III Reduce negative impacts of nonnative fishes and sport fish management activities (nonnative and sport fish management).
- III.B Implement CPW Yampa Basin aquatic wildlife management plan and the Recovery Program's Yampa River Nonnative Fish Control Strategy. Each control activity will be evaluated for effectiveness and then continued as needed. See also III.A.2.c.1&2 under General Recovery program Support Action Plan.
 - III.B.1 Prevent nonnative fish introduction; reduce invasion and recruitment.
 - III.B.1.c Remove northern pike and smallmouth bass above Craig, CO (YS C-3).
 - III.B.1.D. Target spawning areas (YS C-4)
 - III.B.1.D.1 Northern pike
 - III.B.1.D.2 Smallmouth bass
 - III.B.2. Control nonnative fishes via mechanical removal.
 - III.B.2.a. Estimate nonnative abundance, status, trends & distribution (YS I-3).
 - III.B.2.c. Identify and evaluate gear types and methods to control nonnative fishes(YS I-5)
 - III.B.2.d. Remove and translocate northern pike from the Yampa River. See Hawkins et al 2005. (YS J-1).
 - III.B.2.d. Remove (*formerly* "and translocate") northern pike from the Yampa River. See Hawkins *et al.* 2005. (YS J-1).
 - III.B.2.e. Remove (*formerly* "and translocate") smallmouth bass. (YS J-1).

VII. Accomplishment of FY 2014 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Initial findings and preliminary results for 2014 are provided in the attached report, but are subject to change as data are further analyzed. For comparison with previous results see Hawkins *et al.* 2008; 2009a; 2009b; 2010; 2011; 2012; 2013 and Wright 2009.

VIII. Additional noteworthy observations: See attached report of preliminary results.

IX. Recommendations:

- Continue adult smallmouth bass removal during runoff.
- Continue intensive smallmouth bass nest disruption (The Surge) focusing on major production areas, especially in Little Yampa Canyon, South Beach, Lower Juniper, and Upper Maybell.
- Continue use of electric seine during the base flow period of the Surge to remove schools of bass that are feeding and concentrated in small backwater habitats.
- Find additional volunteers to help with electric seine sampling during the Surge.
- Expand intensive Surge efforts to include more removal passes in Lower Juniper, Upper Maybell, and Craig reaches, especially focusing on reaches with complex, braided channels that provide spawning habitat.
- Continue use and evaluate use of fyke nets and other gear in potential spawning backwaters during Surge.

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R14AP00001

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: FR-125

Project Title: **Evaluation of smallmouth bass and northern pike management in the middle Yampa River.**

Principal Investigator: John Hawkins.

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Project/Grant Period: Start date (Mo/Day/Yr): 1 Oct. 2008
 End date: (Mo/Day/Yr): 30 Sept. 2014
 Reporting period end date: 30 Sept. 2014
 Is this the final report? Yes _____ No X

Performance: The Larval Fish Laboratory completed all tasks and objectives of the smallmouth bass portion of this work including: We obtained an estimate of the number of smallmouth bass in Little Yampa Canyon. We coordinated mark-recapture and Surge sampling with CDOW and USFWS. We conducted one marking pass in Little Yampa Canyon and multiple removal passes in Little Yampa Canyon and Lily Park study reaches. We removed large numbers of invasive nonnative predators from Critical Habitat on multiple occasions from April through November. Due to high water flows we only completed part of Task 3.1b. (Conduct one marking pass and two removal passes for northern pike between Steamboat and Highway 40 Bridge) and part of Task 3.1c.(Sample for YOY pike to confirm spawning locations). We produced an annual report on activities and will prepare presentations based on data at workshops and meetings in December 2014 and January 2015.

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R13PG40020

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 125

Project Title: Middle Yampa smallmouth bass and northern pike removal

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Project/Grant Period: Start date (Mo/Day/Yr): 10/01/2013
 End date: (Mo/Day/Yr): 9/30/2015
 Reporting period end date (Mo/Day/Yr): 09/30/2014
 Is this the final report? Yes _____ No X

Performance: USFWS completed its portion of task 4, “conduct smallmouth bass removal and spawning disruption during the spawning period.” We performed two weeks of electrofishing in order to remove smallmouth bass adults in spawning habitats. Data has been submitted to the project lead at CSU, who will be responsible for data analysis and reporting.

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R10PG40095

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 125

Project Title: **Evaluation of Smallmouth Bass and Northern Pike Management in the Middle Yampa River (Surge)**

Principal Investigator: Travis Francis, Fish Biologist
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Project/Grant Period: Start date (Mo/Day/Yr): 5/6/2010
End date: (Mo/Day/Yr): 9/30/2015
Reporting period end date (Mo/Day/Yr): 9/30/2014
Is this the final report? Yes _____ No X

Performance:

We were tasked with providing a 3-person field crew for 8 days (total of 24 man days) with administrative support to assist crews from the CSU – Larval Fish Laboratory sometime from mid-June to mid-July. The 2014 smallmouth bass “Surge” effort was targeted to remove smallmouth bass as the Yampa River neared base flows. From July 7-11, we provided two jet-powered, hard-bottomed, electrofishing boats and a 3-person crew for 5 days (15 man days). Then from July 13-16, we provided two jet-powered, hard-bottomed, electrofishing boats and a 3-person crew for 4 days (12 man days).

Attachment:

Preliminary results of smallmouth bass removal in the middle Yampa River, 2014.

Overview: This report provides a preliminary summary of data that was collected in 2014 and therefore contains minimal analysis and discussion. Findings will be presented and discussed in greater detail at the nonnative workshop in December.

Methods-Middle Yampa SMB removal

The study area was primarily within an 87-mile reach of the middle Yampa River, between the South Beach boat ramp near Craig, Colorado (river mile; RM 134.2) and Dinosaur National Monument boundary (RM 47.5) and consisted of seven reaches totaling 79.6 miles of sampled waters. These reaches were sampled by Colorado Parks and Wildlife (CPW) and Colorado State University-Larval Fish Laboratory (CSU). Smallmouth bass data collected by both agencies is summarized in this report. Additional sampling was conducted in the Hayden-Craig reach by USFWS-Vernal (see table below).

Table-Location of study reaches in the middle Yama River

Reach	Agency	River miles	Length (miles)
Lily Park	CSU	47.5 -- 55.5	8.0
Sunbeam	CPW	60.6 -- 71.0	10.4
Lower Maybell	CPW	71.0 -- 79.2	8.2
Upper Maybell	CPW	79.2 – 88.7	9.5
Lower Juniper	CPW	91.0 – 100.0	9.0
Little Yampa Canyon	CSU	100.0 – 124.0	24.0
South Beach	CPW	124.0 – 134.2	10.5
Hayden-Craig	FWS	171-134.5	36.5

Fish sampling occurred with boat electrofishing on three to twelve occasions (passes) at each reach during runoff from April through July, typically using two electrofishing boats sampling both shorelines continuously downstream. Reaches with higher catch rates received greater effort. Passes 4, 8, 9, and 10 in Little Yampa Canyon had lower effort than other passes in that reach because they were either done with only one boat or some short sections of river were not sampled because they did not contain high quality habitat or spawning habitat. Starting in 2013, smallmouth bass were captured, marked and released only in Little Yampa Canyon, primarily to track abundance, but also to monitor movement and growth. Smallmouth bass >100-mm total length were marked with a numbered Floy tag and released on the first sampling pass in April and May. On all subsequent passes in Little Yampa Canyon and on all passes in the other reaches smallmouth bass were removed and euthanized upon capture.

Smallmouth bass were grouped into life stages based on their length: juvenile (< 100 mm), sub-adult (100–199 mm), and adult (>200-mm). We also reported the number of smallmouth bass ≥ 325 -mm TL for each reach. Smallmouth bass ≥ 325 mm are considered a higher threat to prey than smaller sizes. We also captured and euthanized northern pike and those data are reported primarily by CPW though the Project # 98a annual report. This is the first year that northern pike were not transported to State Parks Headquarters pond near Hayden.

In Little Yampa Canyon and Lily Park, we captured and measured all species of fish on all sample occasions to describe the fish community structure and composition. In addition, white

sucker, white sucker hybrids, and common carp were removed from all reaches except a 12-mile control reach in the upper 12 miles of Little Yampa Canyon where those species were measured and released.

Spawning disruption (The Surge)

In 2014, we completed the fifth year of an intensive removal program during smallmouth bass spawning with the goal of increasing our catch of adult bass and disrupting reproduction (The Surge). Increased effort during the Surge was obtained by assembling field crews and equipment from CSU, CPW, and FWS (Vernal and Grand Junction field stations) to assist with removal. As flows declined towards base flow, we optimized our catch rates by shifting effort away from sections of river that had low complexity and low catch rates (e.g. very-shallow, inner bends with little structure or cover) and increasing effort in sections of river with high complexity and high catch rates. Targeted areas typically were outer bends having complex structure, such as rubble or boulder substrate, or braided sections that create side channels or backwaters with decreasing flows. Water temperatures of 16°C initiate smallmouth bass spawning and defined the start of Surge removal. We observed maximum daily temperatures of 16°C at the Maybell Gage on June 21st, 18 days later than the year before, and initiated the Surge on that date. FWS crews sampling the Hayden-Craig reach initiated and completed their sampling a few days prior to this date due to other commitments. This year's discharge contained higher flows in April and May than in the past 3 years and overall moderately high water year (Figure 5).

We shifted from larger Jon boats during runoff to electrofishing rafts as flows declined to levels too low for safe Jon boat navigation (approximately <1000 cfs) during the Surge. We effectively disrupted nest building, spawning, and nest guarding between June 21st through July 24th, focusing our efforts in Craig, South Beach, Little Yampa Canyon, and Lower Juniper reaches. The additional resources of boats and people allowed us to intensively sample known spawning concentrations of smallmouth bass by repeatedly sampling those reaches. Fish were removed from nests in target reaches every 2-5 days at the peak of spawning and some sites were visited more than five times during the spawn.

Age-0 smallmouth bass removal

After bass spawning ended, we removed Age-0 and Age-1 smallmouth bass with an electric seine in the lower 12-miles of Little Yampa Canyon from August through October. Removal did not occur in other reaches. Bass were not removed from the upper 12 miles of LYC because it is a Control reach for Project 140 ("Evaluating the effects of nonnative predator fish removal on the native fishes in the Yampa River"). In addition, we sampled the small-bodied fish community with seines and backpack electrofisher every 5-miles from upstream of Craig to Dinosaur National Monument (RM 145--45) to determine the extent of smallmouth bass spawning and examine the small-bodied fish community.

Methods-Upper Yampa NP removal

Northern pike occupy the entire Yampa River and are currently being removed from the river downstream of Highway 40 bridge to the confluence with the Green River under Recovery Program projects 98a, 98b, 110, and 125. Pike are also currently removed by CPW in Catamount Reservoir and in the river from Catamount to Steamboat Springs. However, prior to 2014, no removal occurred in the reach between Steamboat and Hayden. In 2014, the Recovery Program recommended that this study remove northern pike between Tree Haus Bridge in

Steamboat Springs and Highway 40 Bridge at the Hayden Power Plant water intake (RM 194.1-170.6) in order to complete a full Yampa River removal effort.

The current study plan was to mark and remove northern pike from the 24-mile reach using raft electrofishing. Additional sampling was to occur later in the year to try and capture young-of-year northern pike to verify spawning. Expected results of the study include reducing the population of pike and identifying potential riverine spawning areas. Pike were to be marked and released on the first pass to obtain an abundance estimate for comparison with data from 2004 and 2005.

Almost all of this reach is located within private property and much of the access requires landowner permission. Although much of the work can occur on the water without touching land, gaining access to launch or take-out boats, or process fish, requires landowner permission. CPW took the lead in contacting and obtaining landowner permission for bank access for those activities. CPW provided electrofishing rafts for CSU use in April. The exact targeted area between Steamboat Springs and Highway 40 Bridge for electrofishing removal of northern pike was coordinated through CPW. The plan was to sample the targeted area of the Yampa River on at least three occasions, most likely in April, with timing depending on proper access and flow conditions, preferably occurring just prior to, or during, pike spawning. We were to mark northern pike on the first sample pass with Floy tags and remove them on the subsequent two passes.

Results-Middle Yampa SMB removal

Smallmouth bass abundance and exploitation

Using a Lincoln-Petersen model, we estimated there were 2,254 adult smallmouth bass (976—5,599, 95% CI; CV=37%) in the Little Yampa Canyon reach, slightly more than in 2013 (Table 1; Figure 1). Density of adult smallmouth bass in Little Yampa Canyon was 94 adult bass per mile. We estimated that there were 3,422 sub-adult smallmouth bass (1,081—11,798, 95% CI; CV=83%) in Little Yampa Canyon in 2014, fewer than the number observed in 2013 (Table 1). Density was 143 sub-adult smallmouth bass per mile. Abundance estimates for both life stages were likely imprecise based on high CVs caused by low capture probability on the recapture pass (resulting in few recaptures of tagged fish). Of 92 adult smallmouth bass marked and released only four were recaptured on the next pass and of 116 sub-adult smallmouth bass marked and released only two were recaptured.

Exploitation Rates

We divided the number of fish removed by boat electrofishing on all passes after the marking pass with the abundance estimate to obtain the exploitation rate of smallmouth bass in Little Yampa Canyon. We removed 83% (n=2845) of the sub-adults and 37% (n=826) of the adults from Little Yampa Canyon in 2014 (Table 1).

Fish removal effort

In 2014, we sampled a total of 679 hours with boat electrofishing and 1.2 hours with electric seine during large fish sampling in the spring (Table 2). We also sampled by fyke nets for 40 hours and trammel nets for 5 hours. In August and September we angled for smallmouth bass on 5 days between 2-3 hours per day with five anglers for a total of 60 angler hours. Total effort in 2014 was similar to that in 2013. Effort at the CSU Lily Park reach was reduced in 2014 and

2013 compared to prior years because our launch site shifted from easy-to-use private access to more challenging access from Dinosaur National Monument Deerlodge Boat Ramp. The public boat launch is only usable at higher flows because we cannot navigate the shallow, sandy reach between the Little Snake River and Deerlodge boat ramp at low flow periods that occur at the start and end of our spring sampling season.

Smallmouth bass captures by gear type

We handled 11,812 smallmouth bass during the spring large-fish sampling period from April-July, including 218 marked and released in Little Yampa Canyon for abundance estimates (Table 3). We caught 11,710 smallmouth bass by electrofishing boats or rafts, 87 by electric seine, 10 by fyke nets, five by trammel net during large-bodied fish sampling in the spring. We marked and released less than 2% (n=218) of all smallmouth bass handled. Those fish were marked to obtain information about abundance, movement, and growth. We captured 196 smallmouth bass that were considered large piscivores (≥ 325 mm TL) including the following in each reach: South Beach: 48, LYC: 75, Lower Juniper: 16, Upper Maybell: 23, Lower Maybell: 4, Sunbeam: 4, and Lily Park: 26. The number of large piscivorous smallmouth bass captured in each reach in 2014 was very similar to the number captured in each reach in 2013. In August and September, we captured 226 smallmouth bass by angling, including 128 sub-adult and 98 adult fish. From August through October, during YOY sampling in the lower 12-mile Treatment reach of LYC, we E-seined for 26 hours and captured an additional 5,122 smallmouth bass, including 1,208 juveniles, 144 sub-adults, 11 adults, and 3759 not measured but presumed juveniles. Gross CPUE for all smallmouth bass captured by E-seine was 197 fish/hour.

We continue to observe that high discharge events are often associated with high capture rates and suggest that we take advantage of those opportunities to sample during increasing flows when large numbers of bass become highly vulnerable to electrofishing. During the Surge we increased our effort significantly within a short period of time in known spawning reaches (Craig, South Beach, Little Yampa Canyon, and Lower Juniper). Surge sampling was highly effective because during spawning smallmouth bass are very territorial and typically remain near their nests in shallower water where they are highly susceptible to the electrofishing gear. By removing spawning fish from active spawning sites we open up habitat to new spawners who are then vulnerable to our next pass. When possible we allowed 2-5 days between removal passes for these areas to refill with new fish and then resampled them to remove another wave of new spawners. Removal during spawning was an effective method of obtaining higher catch rates of adult bass and disrupting the production of new bass.

We observed large numbers of smaller adult and sub-adult smallmouth bass using small, deep backwaters as flows dropped during the Surge. These fish were apparently moving into these habitats to feed on abundant small fishes and were highly vulnerable to capture by electrofishing because they were easily confined and captured. They were caught primarily with raft electrofishing but in 2014 we successfully used an electric seine for their capture. We recommend adding additional effort with an electric seine crew that targets these habitats during low flow, coinciding with the Surge. This technique has the advantage of using additional crews with minimal training, as compared to boat electrofishing.

Catch Rates

Smallmouth bass live in all reaches of the middle Yampa River, but were most abundant in reaches with the best habitat. Low catch rates in Lower Maybell and Sunbeam reflected that few smallmouth bass occupied these alluvial floodplain reaches where habitat contained minimal

diversity, structure, and cover. Catch rates for all life stages (juveniles, sub-adult, and adults) captured on all occasions were highest at Lily Park, followed by Lower Juniper, and Little Yampa Canyon (Figure 3). Of significance was the increase in catch rates of juveniles and sub-adults in Lower Juniper. Juveniles were almost three times more abundant in Lower Juniper in 2014 than in 2013. In 2014, on passes 6 and 7, Lower Juniper had the highest catch rates at 41 and 42 fish/ hour, respectively of any other reach or pass (Table 2).

Spawning observations

Spawning started in late June and continued into late July based on adequate habitat, water temperatures, capture of ripe males in spawning habitat, and ripe females. Nesting type habitat was observed at all Surge reaches.

Movement

This data is still being compiled and will be reported at the Nonnative Workshop in December.

Fish Community Sampling

Nonnative fish still dominate the fish community, comprising 99% of all fish collected in 1-mile reaches in Little Yampa Canyon, slightly more than in 2013 (Table 4). Smallmouth bass and white suckers were the most abundant fishes collected, although the percent of white suckers captured in our 1-mile study site in Little Yampa Canyon decreased from 70% in 2013 to 53% in 2014.

At Lily Park, native fish have typically outnumbered nonnative numbers prior to 2013. In 2012, native fish comprised 85% of the fish collected during 1-mile community sampling, in 2013, native fish comprised only 25% of the fish community, and in 2014 they comprised 37%. The slight increase was due to an increase catch of flannelmouth suckers. In 2014, flannelmouth suckers comprised 31% compared to 15% of the catch in the 1-mile reach in 2013. The percent of bass and white sucker captured in the Lily Park 1-mile reach decreased slightly from 2013 to 2014.

In addition to the 1-mile community sampling, we also collected and measured all fish species on all sampling occasions in Little Yampa Canyon and Lily Park. At Little Yampa Canyon we captured eight native species and 19 nonnative species (Table 5). As in 2013, only one Colorado pikeminnow was captured in Little Yampa Canyon. At Lily Park, we handled seven native species and ten nonnative species, including only one Colorado pikeminnow (Table 6).

Results-Upper Yampa NP removal

CPW staff assembled aerial maps with property boundaries for the Yampa River corridor between Steamboat Springs and Hayden, Colorado. Almost all of the property along this corridor is private and access points are limited. CPW assembled a list of over 60 landowners along this corridor from public records. Via phone, letter, or email, CPW contacted most of the landowners to inform them of our activities and request permission for us to access their land along the river for processing fish. Almost all landowners contacted agreed to allow access and were in favor of removing northern pike, primarily because they saw great value in protecting the fishery for trout and Mountain whitefish in that corridor.

We obtained electrofishing rafts from CPW on April 9th and met with CPW Biologist Billy Atkinson and AWM Jim Haskins the week of April 14th to discuss access logistics and scout the

river, bridges, and access points. We ran a scout trip using non electrofishing rafts with no railings on April 22nd from Steamboat Springs to Milner (RM 180.5) and determined that the water level was too high to safely pass an electrofishing raft under the many bridges through and immediately downstream of Steamboat Springs. On April 23rd, we electrofished the 11-mile long lower reach between Milner and Hayden (RM 180.5-170.6). We captured, tagged, and released three adult northern pike and observed one other northern pike that was not captured.

Table-Northern pike captured and tagged between Steamboat Springs and Hayden, 2014.

Date	Rivermile	TL (mm)	Wt. (g)	Recap?	Floy tag	Tagcolor	Habitat
4/23/2014	177.5	657	2300	No	18401	Yellow	Backwater
4/23/2014	175.1	595	1400	No	18402	Yellow	Backwater
4/23/2014	177.8	734	2900	No	18426	Yellow	Embayment

We modified the rafts so that safety railing could be removed and allow for lower clearances but rising flows precluded safe sampling. We were therefore unable to complete our marking or removal passes. Runoff flows in 2014 came early and rose quickly in the study reach. All electrofishing passes in 2004 and 2005 was conducted at flows less than 1000 cfs and in 2014 flows approaching 1000 cfs in Steamboat Springs (USGS Gage 09239500) occurred on April 10th and did not decline to a runnable level until July. Early runoff flows in 2014 were a little earlier and higher than those in 2011 an extremely high water year (see Figure below). Consultation with CPW staff led to the conclusion to discontinue sampling for the remainder of the year to avoid potential harm to trout due to higher water temperatures.

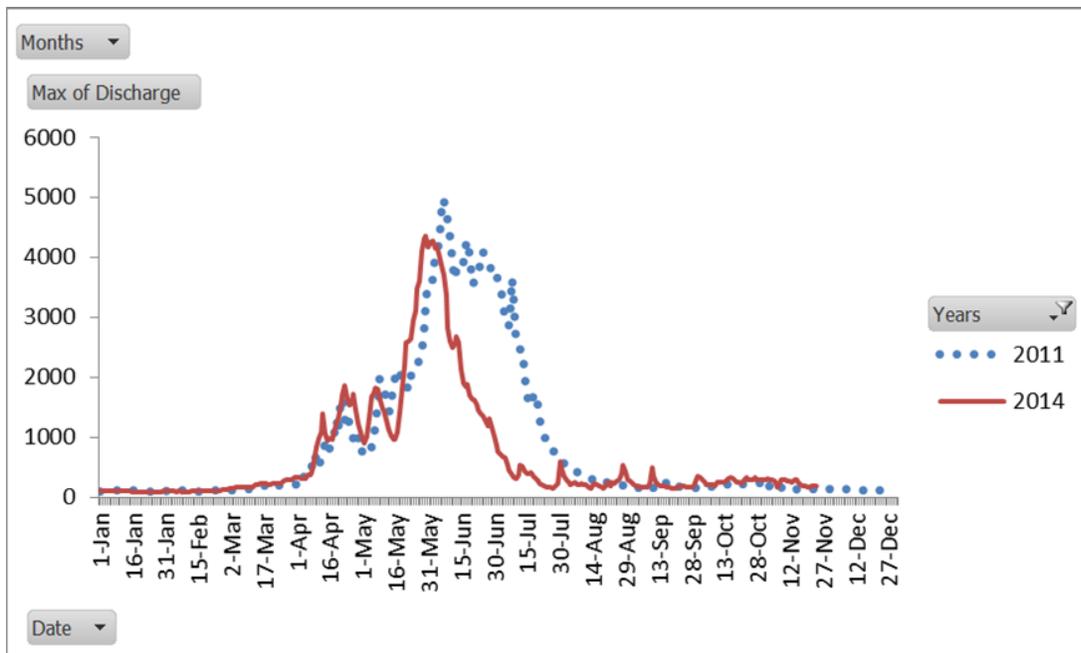


Figure- Comparison of 2014 flows to 2011 (a high flow year) at the Steamboat gage (USGS# 09239500).

In 2015, we plan to start sampling in late March if flows are adequate and complete adult northern pike removal by mid April.

A second objective of this study was to sample for YOY northern pike to confirm reproduction using electric seine, standard seines, or backpack electrofisher. Due to access issues we only sampled for YOY at one backwater in our study site; that was at KOA backwater (RM 189.1). In lieu of sampling our reach, we assisted CPW with sampling known spawning locations upstream of Steamboat Springs at Walton Creek and Chuck Lewis State Wildlife Area. We also assisted in sampling for YOY at four sites downstream of our study site in Craig and in Elkhead Reservoir.

We sampled on July 29-30 and captured 71 northern pike ranging from 80 to 690 mm TL. We captured five in Elkhead Reservoir, eight in Steamboat Springs, eight in our study site, and 50 in Craig. Higher numbers in Craig were due to the high quality of habitat for young northern pike and increased effort in that reach. Most YOY northern pike captured were between 100 and 200 mm TL in all three reaches but a large number of smaller, YOY pike (80-100 mm TL) were captured only in the Craig (See figure below).

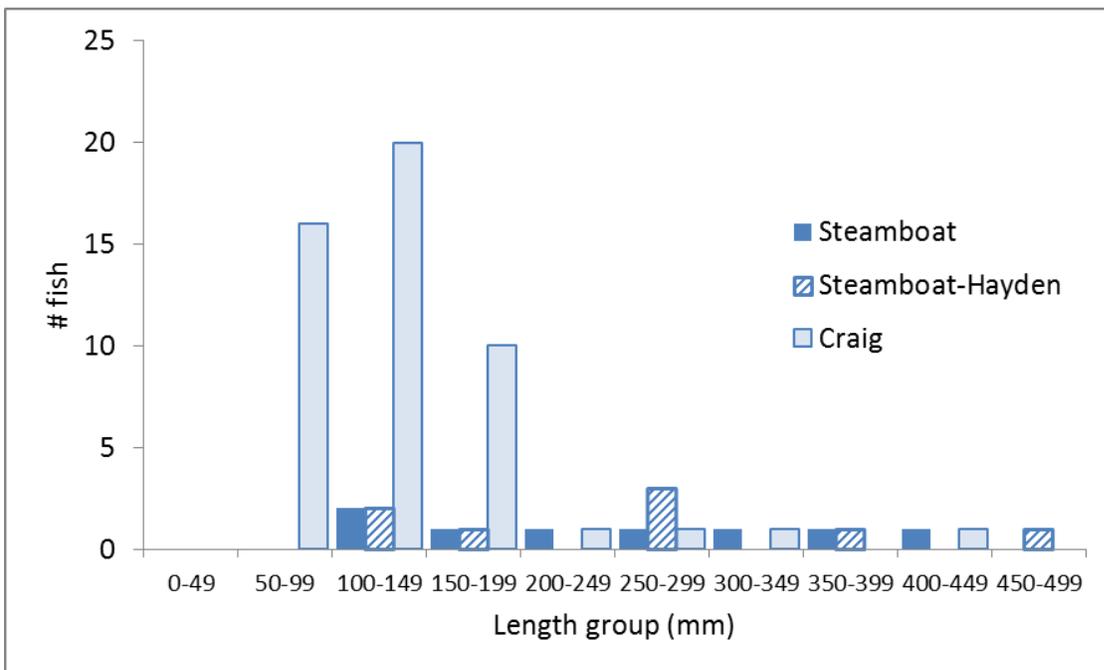


Figure- Length frequency of northern pike captured by electric seine or seine in July, 2014.

Most of the smaller northern pike were preserved and we plan to obtain daily ages from their otoliths to estimate their hatch and spawn dates. This information will be compared with estimated spawning dates obtained from gonad conditions of adults captured by CPW in these backwaters in the spring. Identifying the spawning period and the associated environmental conditions in a given year will help us define the precise timing and location of spawning and therefore increase our efficiency in catching northern pike. Precision will increase catch rates and disruption of spawning.

Conclusions

- Smallmouth bass numbers in Lily Park and Little Yampa Canyon over the duration of this project have declined, although their numbers increased in 2013 and 2014.

- There was a strong year class of smallmouth bass produced in 2012 that were present as juveniles and sub-adults in 2013 and 2014.
- Removal during spawning was highly productive at removing large numbers of adults and disrupting the spawning event within the focused area.

Recommendations

- Continue adult smallmouth bass removal during runoff.
- Continue intensive smallmouth bass nest disruption (The Surge) focusing on major production areas, especially in Little Yampa Canyon, South Beach, Lower Juniper, and Upper Maybell.
- Continue use of electric seine during the base flow period of the Surge to remove schools of bass that are feeding and concentrated in small backwater habitats.
- Find additional volunteers to help with electric seine sampling during the Surge.
- Expand intensive Surge efforts to include more removal passes in Lower Juniper, Upper Maybell, and Craig reaches, especially focusing on reaches with complex, braided channels that provide spawning habitat.
- Continue use and evaluate use of fyke nets and other gear in potential spawning backwaters during Surge.
- Develop a decision tree to identify bass vulnerabilities and identify opportunities for higher exploitation.
- Discontinue releasing white suckers and common carp in the 12-mile control reach in Little Yampa Canyon

References

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Wright, B. 2009. Middle Yampa River northern pike removal and evaluation: smallmouth bass evaluation and limited removal. Project 98a. 2008 Annual Report to the Colorado River Endangered Fish Recovery Program, U. S. Fish and Wildlife Service.

Table 1--- Abundance estimates for sub-adult (100-199 mm) and adult (≥ 200 mm) smallmouth bass in Little Yampa Canyon, Yampa River, 2014. Abundance was estimated using a Lincoln-Petersen estimator. SE = Standard Error. CV= Coefficient of Variation. Exploitation rate is based on the number of smallmouth bass removed by electrofishing after the marking passes were completed.

Life Stage	Abundance	lower – upper 95% CI	SE	CV %	Capture probability	Density #fish/mile	Exploitation rate	
							# fish removed	Percent removed
Little Yampa Canyon (24 miles)								
Sub-adult	3422	1081— 11798	2357.8	69	1%	143	2845	83%
Adult	2254	976—5599	1079.5	48	4%	94	826	37%

Table 2—CPUE (Catch per unit effort) for smallmouth bass captured by boat electrofishing in the middle Yampa River, 2014. Life stages were based on length: juvenile (<100 mm), sub-adult (100-199 mm), and adult (≥200 mm).

Hayden-Craig				Number of fish				CPUE (# fish/hr)			
Pass	Sampling Period	Agency	Effort (Hrs)	Juv	Sub-adult	Adult	All sizes	Juv	Sub-adult	Adult	All sizes
1-Surge	Jun 17	FWS	4.8			2	2			0.01	0.01
2-Surge	Jun 18	FWS	10.0			1	1			0.01	0.01
3-Surge	Jun 19	FWS	10.6			1	1			0.01	0.01
4-Surge	Jun 20	FWS	4.2			2	2			0.01	0.01
Total			29.6			6	6			0.2	0.2
South Beach				Number of fish				CPUE (# fish/hr)			
Pass	Sampling Period	Agency	Effort (Hrs)	Juv	Sub-adult	Adult	All sizes	Juv	Sub-adult	Adult	All sizes
1	Apr 21	CPW	10.6	12	4	23	39	1.1	0.4	2.2	3.7
2	Apr 24	CPW	11.2	2	3	13	18	0.2	0.3	1.2	1.6
3	Apr 29	CPW	9.9	1	2		3	0.1	0.2	0.0	0.3
4	May 6	CPW	9.2	1	4	6	11	0.1	0.4	0.7	1.2
5	May 8	CPW	11.6	13	8	6	27	1.1	0.7	0.5	2.3
6	May 20	CPW	12.1	21	18	19	58	1.7	1.5	1.6	4.8
7	May 22	CPW	11.7	8	17	12	37	0.7	1.5	1.0	3.2
8	May 29	CPW	12.0	27	25	9	61	2.3	2.1	0.8	5.1
9-Surge	Jun 21	CSU	6.2	50	10	4	64	8.1	1.6	0.6	10.4
10-Surge	Jul8-10	CSU	13.3	28	31	35	94	2.1	2.3	2.6	7.1
11-Surge	Jul11-12	CSU	8.6	101	145	52	298	11.7	16.8	6.0	34.5
12-Surge	Jul13-15	CSU	6.4	95	93	30	218	14.9	14.6	4.7	34.2
Total			122.9	359	360	209	928	2.9	2.9	1.7	7.6
Little Yampa Canyon				Number of fish				CPUE (# fish/hr)			
Pass	Sampling Period	Agency	Effort (Hrs)	Juv	Sub-adult	Adult	All sizes	Juv	Sub-adult	Adult	All sizes
1-Mark	Apr22-May7	CSU	34.6	180	117	100	397	5.2	3.4	2.9	11.5
2	May8-13	CSU	28.9	70	59	98	227	2.4	2.0	3.4	7.9
3	May20-24	CSU	40.8	165	246	142	553	4.0	6.0	3.5	13.5
4	May25-27	CSU	22.8	140	237	80	457	6.1	10.4	3.5	20.0
5	Jun5-8	CSU	29.5	161	134	44	339	5.5	4.5	1.5	11.5
6-Surge	Jun17-20	CSU	33.9	176	47	20	243	5.2	1.4	0.6	7.2
7-Surge	Jul8-10	CSU	34.0	122	333	139	594	3.6	9.8	4.1	17.5
8-Surge	Jul11-13	CSU	16.4	294	421	74	789	17.9	25.6	4.5	48.0
9-Surge	Jul14-15	CSU	23.7	389	830	95	1314	16.4	35.0	4.0	55.5
10-Surge	Jul 22-24	CSU	13.7	193	421	34	648	14.1	30.8	2.5	47.4
Total			278.2	1890	2845	826	5561	6.8	10.2	3.0	20.0

Table 2--cont.

Lower Juniper				Number of fish				CPUE (# fish/hr)			
Pass	Sampling Period	Agency	Effort (Hrs)	Juv	Sub-adult	Adult	All sizes	Juv	Sub-adult	Adult	All sizes
1	Apr 30	CPW	9.1	6	1	3	10	0.7	0.1	0.3	1.1
2	Jun 13	CPW	10.6	19	20	14	53	1.8	1.9	1.3	5.0
3-Surge	Jun 22	CSU	4.7	9	2	5	16	1.9	0.4	1.1	3.4
4-Surge	Jul 8	CSU	6.3	15	44	12	71	2.4	7.0	1.9	11.2
5-Surge	Jul10-11	CSU	7.2	44	79	31	154	6.1	11.0	4.3	21.4
6-Surge	Jul 15	CSU/CPW	8.1	188	334	40	562	23.2	41.2	4.9	69.4
7-Surge	Jul 16	CPW	7.8	199	330	67	596	25.4	42.1	8.6	76.1
8-Surge	Jul 23	CSU	2.7	23	75	20	118	8.5	27.6	7.4	43.5
Total			56.6	503	885	192	1580	8.9	15.6	3.4	27.9

Upper Maybell				Number of fish				CPUE (# fish/hr)			
Pass	Sampling Period	Agency	Effort (Hrs)	Juv	Sub-adult	Adult	All sizes	Juv	Sub-adult	Adult	All sizes
1	Apr 22	CPW	9.5	5	10	14	29	0.5	1.0	1.5	3.0
2	Apr 25	CPW	7.5	6	18	14	38	0.8	2.4	1.9	5.0
3	May 1	CPW	11.0	13	6	3	22	1.2	0.5	0.3	2.0
4	May 7	CPW	8.6	9	34	25	68	1.0	4.0	2.9	7.9
5	May 12	CPW	10.9	2	9	14	25	0.2	0.8	1.3	2.3
6	May 19	CPW	11.7	57	84	52	193	4.9	7.2	4.5	16.5
7	May 30	CPW	8.9	16	45	15	76	1.8	5.0	1.7	8.5
8	Jun 4	CPW	10.3	25	57	18	100	2.4	5.5	1.7	9.7
Total			78.4	133	263	155	551	1.7	3.4	2.0	7.0

Lower Maybell				Number of fish				CPUE (# fish/hr)			
Pass	Sampling Period	Agency	Effort (Hrs)	Juv	Sub-adult	Adult	All sizes	Juv	Sub-adult	Adult	All sizes
	Apr 23	CPW	10.0	3	6	2	11	0.3	0.6	0.2	1.1
	May 21	CPW	11.9	13	22	14	49	1.1	1.8	1.2	4.1
	Jun 12	CPW	9.1	15	14	11	40	1.6	1.5	1.2	4.4
Total			31.0	31	42	27	100	1.0	1.4	0.9	3.2

Sunbeam				Number of fish				CPUE (# fish/hr)			
Pass	Sampling Period	Agency	Effort (Hrs)	Juv	Sub-adult	Adult	All sizes	Juv	Sub-adult	Adult	All sizes
1	May 13	CPW	10.5	13	4	8	25	1.2	0.4	0.8	2.4
2	Jun 3	CPW	10.5	8	3		11	0.8	0.3		1.0
3	Jun 26	CPW	3.3	1	2	2	5	0.3	0.6	0.6	1.5
Total			24.3	22	9	10	41	0.9	0.4	0.4	1.7

Table 2--cont.

Lily Park				Number of fish				CPUE (# fish/hr)			
Pass	Sampling Period	Agency	Effort (Hrs)	Juv	Sub-adult	Adult	All sizes	Juv	Sub-adult	Adult	All sizes
1	Jun3-4	CSU	17.0	67	692	137	896	3.9	40.6	8.0	52.6
2	Jun9-10	CSU	16.6	124	726	122	972	7.5	43.7	7.3	58.5
3	Jun23-24	CSU	10.3	156	255	49	460	15.1	24.8	4.8	44.7
4	Jul 1	CSU	7.6	168	187	58	413	22.0	24.5	7.6	54.1
5	Jul 2	CSU	6.5	70	104	28	202	10.7	16.0	4.3	31.0
Total		CSU	58.1	585	1964	394	2943	10.1	33.8	6.8	50.7
Grand Total			679	3523	6368	1819	11710	5	9	3	17

Table 3— Number of smallmouth bass captured by each gear during large-bodied fish sampling in the middle Yampa River, Spring, 2014. Includes 208 fish marked and released in Little Yampa Canyon for abundance estimation.

Reach	Electrofishing boat	E-seine- during surge	Fyke net	Trammel net	Total
Craig	6				6
South Beach	928		6	5	939
Little Yampa Canyon	5561	87	4		5652
Lower Juniper	1580				1580
Upper Maybell	551				551
Lower Maybell	100				100
Sunbeam	41				41
Lily Park	2943				2943
Total	11710	87	10	5	11812

Table 4---Relative abundance of fish collected with boat electrofishing in the 1-mile fish community sample sites of the Yampa River, 2014. Little Yampa Canyon contained four, 1-mile sites and Lily Park contained one site.

	Little Yampa Canyon	Lily Park
<i>nonnative species</i>		
smallmouth bass	38.9	39.8
northern pike	1.4	1.0
white sucker	53.1	20.5
white x flannelmouth sucker	0.7	-
white x bluehead sucker	0.2	-
creek chub	2.3	-
green sunfish	0.7	-
black crappie	0.05	-
channel catfish	0.4	1.5
fathead minnow	0.05	-
brown trout	0.2	0.1
rainbow trout	0.5	0.1
rainbow x cutthroat trout	0.05	-
black bullhead	0.2	-
common carp	0.05	0.1
<i>native species</i>		
roundtail chub	0.5	0.5
bluehead sucker	0.1	5.1
flannelmouth sucker	0.2	30.8
flannelmouth x bluehead	0.05	-
mottled sculpin	-	0.1
speckled dace	0.4	0.4
mountain whitefish	0.05	-
Total number of fish	1938	800
% nonnative fish	98.8	63.1
% native fish	1.2	36.9

Table 5---Number of fish captured by boat electrofishing in Lily Park in the Yampa River, 2014.

	Removed	Released	Total
<i>nonnative species</i>			
smallmouth bass	2943	-	2943
northern pike	26	-	26
white sucker	1380	3	1383
white x bluehead sucker	1	-	1
channel catfish	-	105	105
common carp	30	-	30
black bullhead	1	-	1
creek chub	1	-	1
rainbow trout	-	2	2
brown trout	-	1	1
<i>native species</i>			
flannelmouth sucker	2*	1217	1219
bluehead sucker	-	173	173
flannelmouth x bluehead	-	1	1
roundtail chub	1	67	68
Colorado pikeminnow	-	1	1
mottled sculpin	-	1	1
speckled dace	-	6	6
Total number of fish	4385	1577	5962

*Native fish were removed and euthanized only when they were severely injured.

Table 6---Number of fish captured by boat electrofishing in Little Yampa Canyon in the Yampa River, 2014.

	Removed	Released	Total
<i>nonnative species</i>			
smallmouth bass	5343	218*	5561
northern pike	143	-	143
white sucker	4042	1699	5741
white x flannelmouth sucker	26	51	77
white x bluehead sucker	7	7	14
white x flannelmouth x creek chub	1	-	1
green sunfish	317	-	317
black crappie	88	-	88
black bullhead	1	-	1
brown trout	6	-	6
rainbow trout	-	38	38
rainbow x cutthroat trout	1	53	54
channel catfish	-	2	2
common carp	-	41	41
fathead minnow	3	3	6
brook stickleback	2	3	5
redside shiner	1	-	1
Iowa darter	-	1	1
	-	2	2
<i>native species</i>			
roundtail chub	1**	70	71
bluehead sucker	-	36	36
flannelmouth sucker	-	27	27
flannelmouth x bluehead	-	1	1
Colorado pikeminnow	-	1	1
mottled sculpin	-	12	12
speckled dace	2	115	115
mountain whitefish	-	5	5
Total number of fish	9984	2385	12369

*includes one smallmouth bass that was accidentally released during the mark pass.

**Native fish were removed and euthanized only when they were severely injured.

Little Yampa Canyon

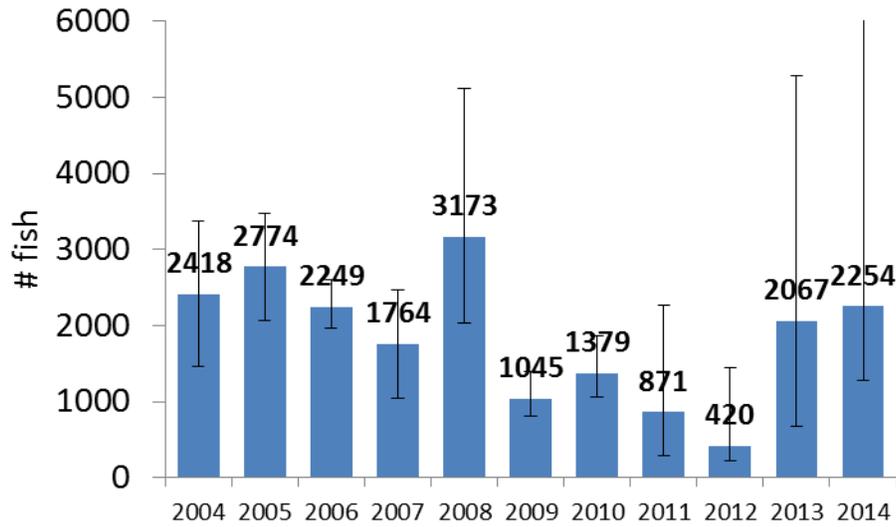


Figure 1---Estimated abundance of adult smallmouth bass(≥ 200 mm) in Little Yampa Canyon in the Yampa River, 2004—2014. Abundance estimated with a modified Lincoln-Peterson estimator.

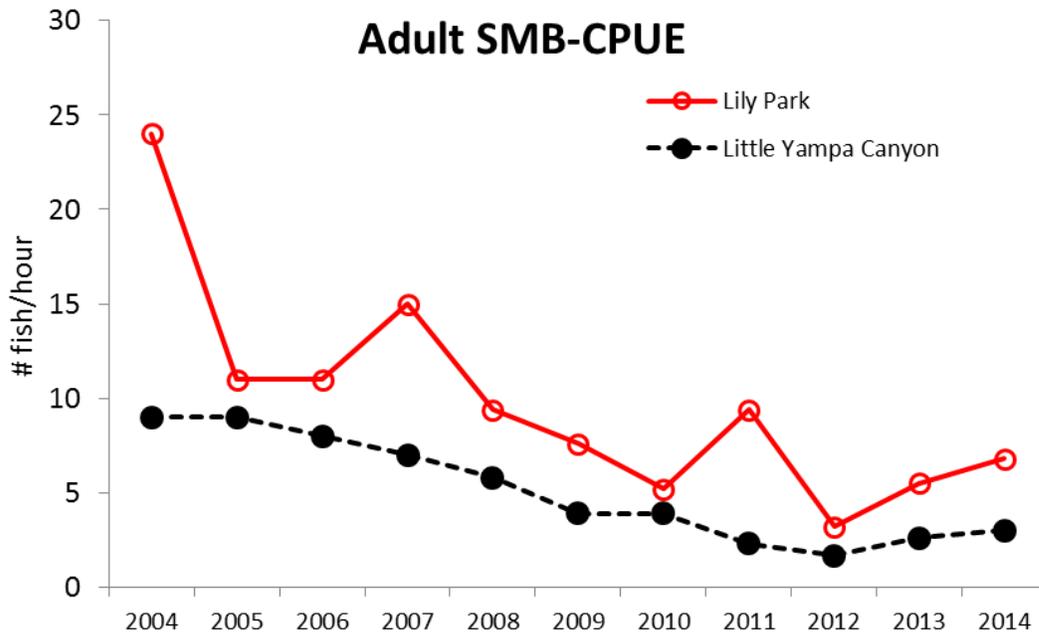


Figure 2—Number of adult (≥ 200 mm) smallmouth bass captured per hour of boat electrofishing in two reaches of the Yampa River, 2004-2014.

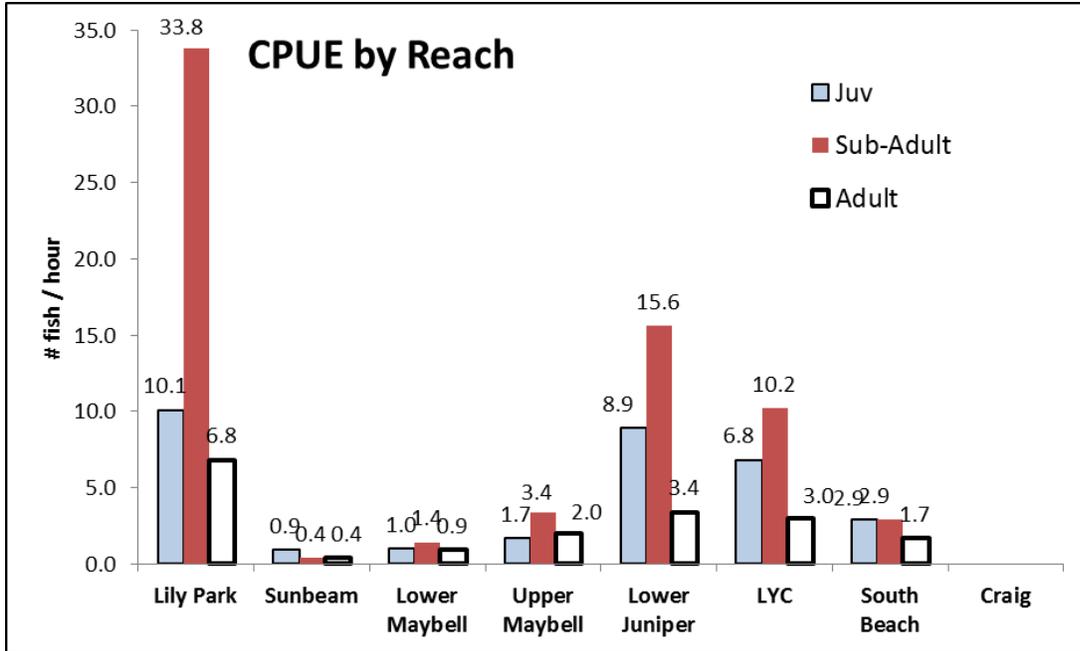


Figure 3—Catch per unit effort along a longitudinal gradient of the middle Yampa River, 2014.

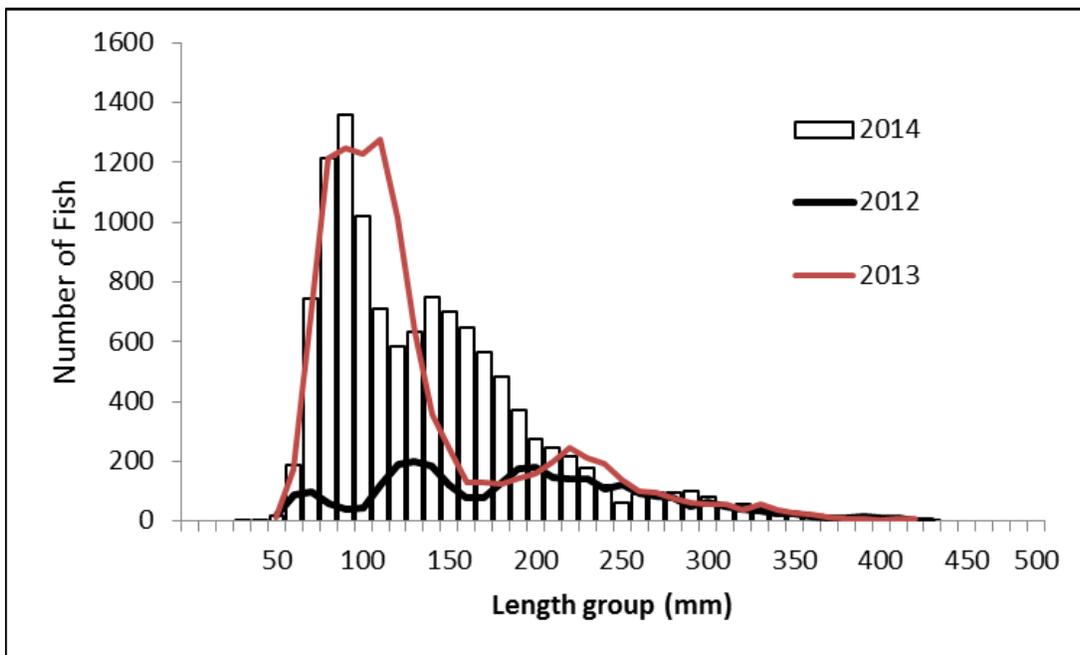


Figure 4---Length frequency of smallmouth bass captured by boat electrofishing, trammel nets, and fyke nets in all reaches of the middle Yampa River, 2011--2014.

Yampa River discharge, 2011-2014

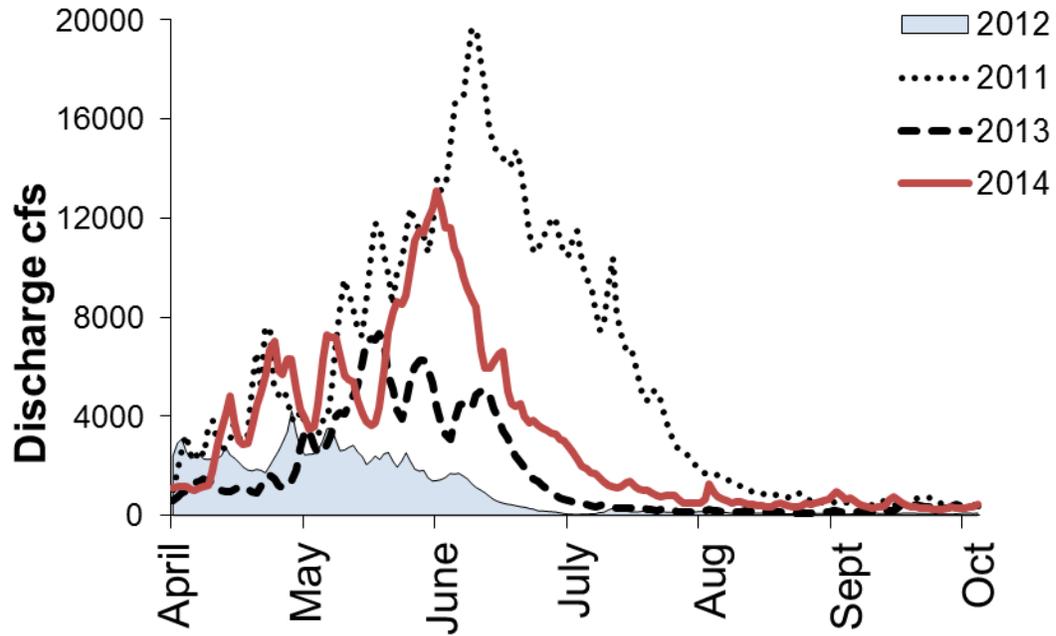


Figure 5-- Comparison of flow discharge at the Maybell USGS gage on the Yampa River, 2011-2014.

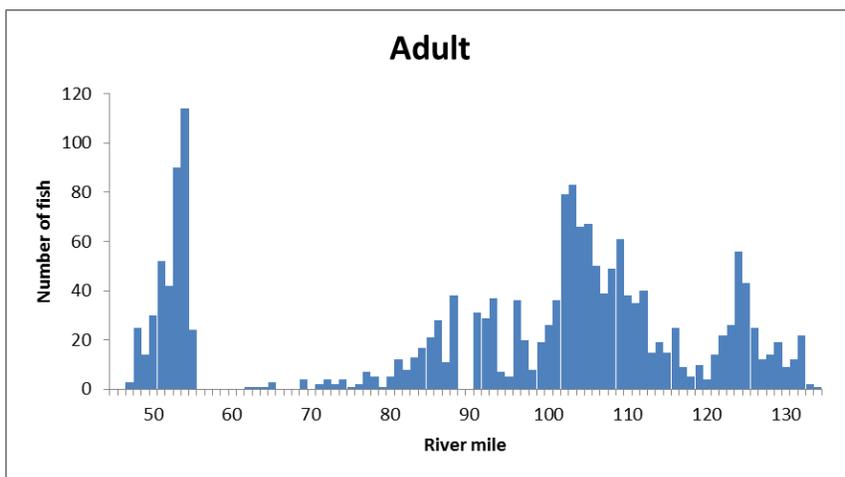
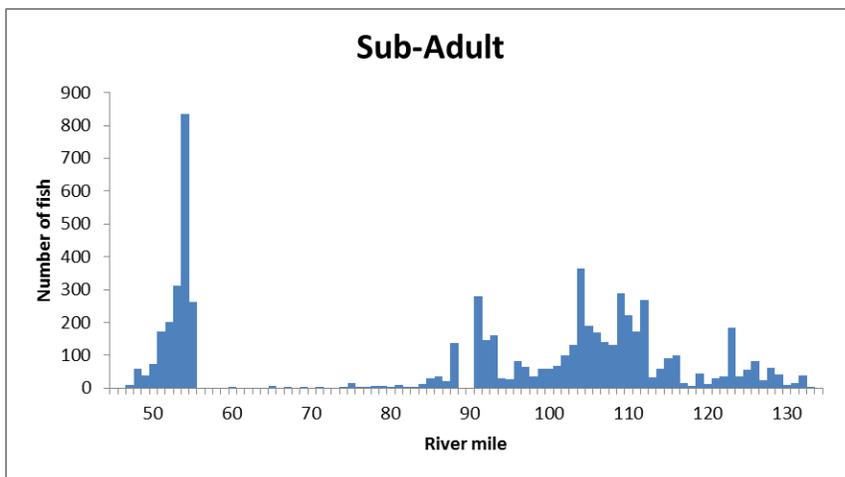
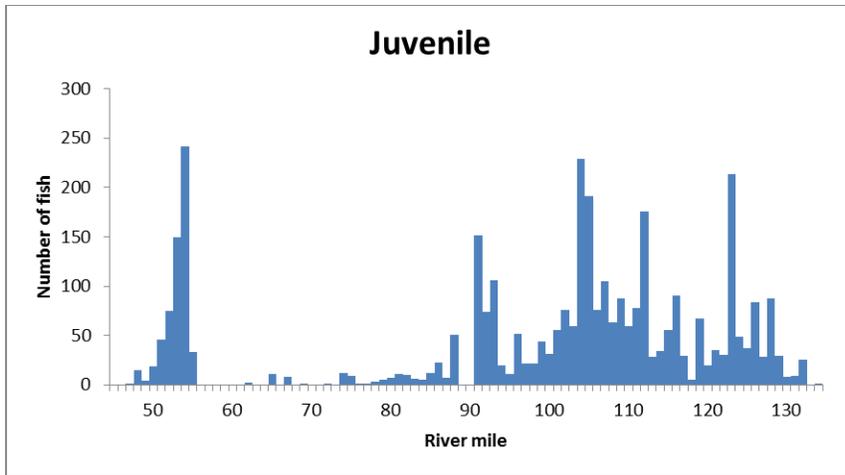


Figure 6—Number of smallmouth bass captured per mile in the middle Yampa River, 2014.