

COLORADO RIVER RECOVERY PROGRAM
FY 2013 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: 125

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

II. Bureau of Reclamation Agreement Number(s): R09AP40860 / 09FG402860
Performance Progress Reports (PPR) attached for CSU and FWS.

III. Principal Investigator(s):

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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. 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 estimated the number of sub-adult (100–199-mm) and adult (≥ 200 -mm) smallmouth bass in Little Yampa Canyon using capture-recapture methods. We also removed northern pike and transported those ≥ 500 mm to State Parks Headquarters pond near Hayden. Data for northern pike that we caught were provided to Colorado Division of Wildlife (CPW) biologists and those results are reported in Project # 98a. From August through October, in the lower 12-mile portion of Little Yampa Canyon we removed small, primarily Age-0 smallmouth bass using an electric seine.

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

VI. Relationship to RIPRAP¹: *March 25, 2011 RIPRAP version*
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 CDOW 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.B1. Prevent nonnative fish introduction; reduce invasion and recruitment.
- III.B.1(a). Evaluate nonnative fish escapement and control options at Elkhead Reservoir (during and after Elkhead expansion construction). See Miller et al. 2005.
- 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.e. Remove (formerly "and translocate") smallmouth bass. (YS J-1).

VII. Accomplishment of FY 2013 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Initial findings and preliminary results for 2013 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, Hawkins et al. 2009a, Hawkins et al. 2009b, Hawkins et al. 2010, Hawkins et al. 2011, Hawkins et al. 2012, and Wright 2009.

Smallmouth bass

The goal is to reduce both the number and the spawning success of smallmouth bass in two study sites in the Yampa River in order to benefit native fishes and assist in the recovery of endangered fishes.

Objectives:

1. Obtain an estimate of the number of smallmouth bass in Little Yampa Canyon using a mark-recapture abundance estimator.

¹ See RIPRAP at <http://www.coloradoriverrecovery.org/documents-publications/foundational-documents/recovery-action-plan.html>

2. Conduct one marking pass in Little Yampa Canyon and eight removal passes in Little Yampa Canyon and Lily Park study reaches.
3. Reduce the success of smallmouth bass spawning in the South Beach and Little Yampa Canyon reaches.
4. Calculate the proportion of juvenile and adult smallmouth bass removed from Little Yampa Canyon based on initial population size.
5. Remove large numbers of age-0 and age-1 smallmouth bass [with electric seine] from a 12-mile treatment reach (RM 100-112) in Little Yampa Canyon and in Lily Park in coordination with Recovery Program Project 140 (Native fish response evaluation).

Northern pike

The goal is to reduce the number of northern pike from two study sites in the Yampa River in order to benefit native fishes and assist in the recovery of endangered fishes. We also coordinated mark-recapture sampling with CPW and USFWS to obtain a river-wide estimate of northern pike upstream of Yampa Canyon (Primarily accomplished by CPW Project 98a and supplemented by this Project (#125)).

Objective:

1. Conduct nine removal passes for northern pike from the Little Yampa Canyon and Lily Park study reaches to support Project 98a.

Other species

The goal is to reduce the number of other nonnative species from two study sites in the Yampa River in order to benefit native fishes and assist in the recovery of endangered fishes.

Objectives:

1. Remove centrarchid species, black bullhead, [creek chub], and brook stickleback *Culaea inconstans* on all sample occasions in all areas of the two study sites on the Yampa River.
2. Remove white sucker, white sucker hybrids, and common carp in Lily Park and the lower 12-miles of Little Yampa Canyon to develop baseline data on the effort required to reduce their numbers.
3. Evaluate whether there is a change in relative abundance of common carp, white sucker and white sucker hybrids over time and between control and treatment reaches by comparing CPUE of the two species from 1-mile fish-community samples in treatment and control reaches.

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 and South Beach.
- Increase the 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.
- Use and evaluate use of fyke nets in potential spawning backwaters during Surge.
- Develop a decision tree to identify bass vulnerabilities and identify opportunities for higher exploitation.

X. Project Status: on-track and ongoing.

XI. FY 2013 Budget Status

Funds Provided: \$316,740
CSU: \$295,974,
FWS-Vernal: \$8,160
FWS-Grand Junction: \$12,606
Funds Expended:
CSU: \$270,447,
FWS-Vernal: \$8,160
FWS-Grand Junction: \$12,606
Difference: \$25,527 (CSU)

Percent of the FY 2013 work completed, and projected costs to complete: 92% completed, remaining monies (\$25,527) needed for boat repair and laboratory identification and verification of preserved fish collected in 2013.

Recovery Program funds spent for publication charges: none

XII. Status of Data Submission (Where applicable): Endangered fish capture data and other database records of field collections will be submitted by year's end. Any other data, including fish currently being identified or verified in the lab will be submitted in early 2014.

Reports Submitted for Program peer review:

Hawkins, J., C. Walford, and A. Hill. 2009. Smallmouth bass control in the middle Yampa River, 2003–2007. Contribution 154 of the Larval Fish Laboratory, Colorado State University. Final Report for the Upper Colorado River Endangered Fish Recovery Program, U. S. Fish and Wildlife Service.

XIII. Signed: John Hawkins 11/13/13
Principal Investigator Date

APPENDIX: Attached:
Annual Performance Progress Reports
Preliminary Results of smallmouth bass removal in the middle Yampa River,2013

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): 9/30/2013
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 2013 smallmouth bass “Surge” effort was targeted to remove smallmouth bass as the Yampa River neared base flows. From June 25-28, we provided two jet-powered, hard-bottomed, electrofishing boats and a 4-person crew for 4 days (16 man days). Then from July 9-12, we provided two oar-powered electrofishing rafts and a 4-person crew for 4 days (16 man days).

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R10PG40095

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 125

Project Title: Middle Yampa smallmouth bass and northern pike removal

Principal Investigator: Aaron Webber

U.S. Fish and Wildlife Service

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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): 09/30/2013
 Is this the final report? Yes _____ No X

Performance: USFWS completed task 4, removing smallmouth bass, northern pike, and white suckers under the direction of Colorado State University 24-28 June 2013.

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R09AP40860 / 09FG402860

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 125

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

Principal Investigator:

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Project/Grant Period:

Start date (Mo/Day/Yr): 10/01/2008

End date: (Mo/Day/Yr): 09/30/13

Reporting period end date (Mo/Day/Yr): 11/30/2012

Is this the final report? Yes _____ No X

Performance: CSU completed all tasks and objectives 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.

Attachment:

Preliminary Results of smallmouth bass removal in the middle Yampa River, 2013.

Overview: This report provides a preliminary summary of data that was collected in 2013 and therefore contains minimal analysis and discussion. Findings will be presented and discussed in greater detail at the nonnative workshop in December.

Methods

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). Additional sampling was conducted during spawning in the Craig reach by USFWS-Vernal (Table below).

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
Craig	FWS	151-134.5	16.5

Fish sampling occurred with boat electrofishing on three to nine occasions (passes) at each reach from April through July using two electrofishing boats sampling both shorelines continuously downstream. Two agencies (CSU and CPW) sampled concurrently in their respective reaches. Starting in 2013, abundance was estimated only in Little Yampa Canyon and the marking pass occurred between April 30 and May 6 with the recapture pass between May 16 and 19. Smallmouth bass >100-mm total length were marked with a numbered Floy tag and released on one sample occasion to estimate abundance and monitor movement and growth. Smallmouth bass were removed from the river on all other sample occasions and euthanized.

Smallmouth bass were grouped into life stages based on their total 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 tagged and removed northern pike in a similar manner and those data are reported primarily by CPW though Project # 98a. Pike ≥ 500 mm were transported to State Parks Headquarters pond near Hayden and those < 500 mm TL were euthanized.

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, we targeted

these two areas for removal of white sucker, white sucker hybrids, and common carp. Those species were removed from Lily Park and the lower 12 miles of Little Yampa Canyon (Treatment areas). In the upper 12 miles of Little Yampa Canyon (Control area) those species were measured and released.

Intensive removal during spawning (The Surge)

In 2013, we completed the fourth year of an intensive removal program (The Surge) which increased the range and intensity of smallmouth bass removal during their spawning period with the goal of increasing our catch of adult bass and disrupting reproduction. 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) and shifted effort to outer bends with complex substrate such as rubble. Water temperatures of 16°C initiate smallmouth bass spawning. We observed that temperature at the Maybell Gage on June 3rd and initiated Surge removal (FWS crews joining us on June 24th). This year's discharge was not as low as in 2012, which was an extremely dry year, and resulted in a low peak flow and a short runoff (Figure 5).

We shifted from larger Jon boats during runoff to electrofishing rafts and smaller electrofishing Jon boats 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 13 and July 15 in Craig, South Beach, Little Yampa Canyon, Lower Juniper, and Upper Maybell. 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 the removal. The additional resources of boats and people allowed us to intensively sample known spawning concentrations of smallmouth bass by repeatedly sampling known spawning 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 shifted to canoes and removed smallmouth bass YOY and age-1s with an electric seine in the lower 12-miles of Little Yampa Canyon. No electric seine removal occurred in Lily Park in 2012 or 2013 due to lack of access to the river via private property. In addition, in September and October, we sampled the small-bodied fish community with seines and backpack electrofisher every 5-miles from South Beach to Dinosaur National Monument (RM 134--46) to determine where smallmouth bass spawning occurred and to examine the small-bodied fish community.

Results

Smallmouth bass abundance and exploitation

In 2013, we estimated abundance of smallmouth bass only for the Little Yampa Canyon reach. Using a Lincoln-Petersen model, we estimated there were 2067 adults (1383-3211, 95% CI) in the Little Yampa Canyon reach, five times the number in 2012 (N=420) (Table 1; Figure 1).

Density of adults in Little Yampa Canyon was 86 adult bass per mile.

We estimated that there were 4843 sub-adults (3128—7706, 95% CI) in Little Yampa Canyon in 2013. Density was 201 sub-adults/mile. We did not have estimates of subadult numbers in 2012 due to lack of adequate numbers of tagged or recaptured fish.

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. We removed 55% (n=2646) of the sub-adults and 30% (n=623) of the adults from Little Yampa Canyon in 2013 (Table 1). We did not adjust the abundance estimate for the 8 sub-adults and 8 adult bass captured and removed on Pass 1, prior to our mark and release of bass on Pass 2 because the numbers were so few (Table 2).

Fish removal effort

In 2013, we sampled a total of 663.1 hours with boat electrofishing and 1.6 hours with electric seine during large fish sampling in the spring (Table 2). We also sampled by angling 92.8 man-hours. Total effort in 2013 was more than that in 2012 primarily due to the longer boating season in 2013. Effort at the CSU Lily Park reach was reduced compared to prior years because of difficulty accessing the river as flows dropped.

Fish captured with boat electrofishing and angling-including the Surge.

We handled 10,622 smallmouth bass and removed 10,267 of them using boat electrofishing (Table 3). We caught and removed an additional 275 fish by angling, 2 by fyke net, and 83 with electric seine during large boat sampling. We marked and released 3% (n=355) of all smallmouth bass handled. Those fish were marked to obtain information about abundance, movement, and growth. We captured 205 smallmouth bass that were considered large piscivores (≥ 325 mm TL) including the following in each reach: South Beach: 56, LYC: 76, Lower Juniper: 10, Upper Maybell: 23, Lower Maybell: 9, Sunbeam: 8, and Lily Park: 23.

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, Lower Juniper, and Upper Maybell). 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. We allowed 2-5 days for these areas to refill with new fish and then resampled them and removed another wave of spawners. Removal during spawning is an effective method of obtaining higher catch rates of

adult bass and disrupting the production of new bass.

We observed large numbers of 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 we see new opportunities to use 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 could use additional crews that require very little training.

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 Upper Maybell and Little Yampa Canyon (Figure 3). Compared to catch rates in 2012, the catch of juveniles and sub-adults increased dramatically in almost all reaches, but especially in Lily Park. This increase in juvenile smallmouth bass is most likely attributed to a very strong cohort produced in 2012, an extremely low flow year (Figure 5). The strong cohort of fish in Lily Park probably were produced in upstream reaches.

Spawning observations

Spawning started in early June and continued into early 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 including the Craig reach where FWS crews observed and removed bass from the confluence with Elkhead Creek.

Young of Year (YOY) sampling with electric seine

The number and CPUE of smallmouth bass captured with electric seine is reported in Table 2.

Movement

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

Fish Community Sampling

Nonnative fish still dominate the fish community, comprising 98% of all fish collected during 1-mile sampling in Little Yampa Canyon, slightly more than in 2012 (Table 4). Smallmouth bass and white suckers were the most abundant fishes collected, although the percent of white suckers increased from 53% in 2012 to 70% of the catch in our 1-mile study sites in Little Yampa

Canyon in 2013. White sucker numbers have increased each year over the last three years.

At Lily Park, native fish have typically outnumbered nonnative numbers until 2013. In 2013 native fish comprised only 25% of the fish captured in Lily Park, compared to 85% in 2012. This was most evident in flannelmouth suckers which declined from 66% of the catch in 2012 to only 15% of the catch in 2013. The percent of bass captured in Lily Park increased dramatically in 2013 rising from 5% in 2012 to 46% of all fish captured in 2013. Nonnative white suckers also increased, representing 27% of the fish community in 2013 while only representing 2% in 2012.

In addition to the 1-mile community sampling, we also collected and measured all fish species during all sampling occasions in Little Yampa Canyon and Lily Park. At Little Yampa Canyon we captured seven native species and 15 nonnative species (Table 5). Only one Colorado pikeminnow was captured in Little Yampa Canyon. At Lily Park, we handled six native species and ten nonnative species (Table 6). Only four Colorado pikeminnow were captured in Lily Park.

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

References

Hawkins, J. 2008. Evaluation of smallmouth bass and northern pike management in the middle Yampa River. Project 125. 2008 Annual Report to the Colorado River Endangered Fish Recovery Program, U. S. Fish and Wildlife Service.

Hawkins, J. C. Walford, and A. Hill. 2009a. Smallmouth bass control in the middle Yampa River, 2003-2007. Contribution 154 of the Larval Fish Laboratory, Colorado State University. Final Report for the Upper Colorado River Endangered Fish Recovery Program, U. S. Fish and Wildlife Service.

Hawkins, J., C. Walford, B. Wright., J. Logan, and A. Hill. 2009b. Evaluation of smallmouth bass and northern pike management in the middle Yampa River. Project 125. 2009 Annual Report to the Colorado River Endangered Fish Recovery Program, U. S. Fish and Wildlife Service.

Hawkins, J., C. Walford, and B. Wright. 2010 Evaluation of smallmouth bass and northern pike management in the middle Yampa River. Project 125. 2010 Annual Report to the Colorado River Endangered Fish Recovery Program, U. S. Fish and Wildlife Service.

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Hawkins, J., C. Walford, and K. Battigi. 2012 Evaluation of smallmouth bass and northern pike management in the middle Yampa River. Project 125. 2012 Annual Report to the Colorado River Endangered Fish Recovery Program, U. S. Fish and Wildlife Service

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, 2013. 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 and does not include a small number of fish removed prior to the marking pass (see Table 3).

Life Stage	Abundance	lower – upper 95% CI	SE	CV	Capture probability	Density (#fish/mile)	Exploitation rate	
							# of fish removed	% of population removed
Little Yampa Canyon (24 miles)								
Sub-adult	4843	3128--7706	1137.7	23%	7%	201	2646	55%
Adult	2067	1383--3211	454.1	21%	12%	86	623	30%

Table 2— CPUE (catch per unit effort) for smallmouth bass captured by boat and electric seine electrofishing in the middle Yampa River, 2013. Life stages were based on length: juvenile (<100 mm), sub-adult (100-199 mm), and adult (≥200 mm). E-Seine denotes removal targeting young-of-year fish captured by electric seine in the lower 12-miles of Little Yampa Canyon..

Craig Reach				<u>Number captured</u>				<u>CPUE (#fish/ hour electrofishing)</u>			
Pass	Dates sampled	Fish Disposition	Effort (hrs)	juvenile	sub-adult	adult	All sizes	juvenile	sub-adult	adult	All sizes
<u>Boat electrofishing</u>											
1	June24-26	Removal-Surge	24.3	22	33	16	71	0.9	1.4	0.7	2.9
2	June27-28	Removal-Surge	16.6	153	193	19	365	9.2	11.6	1.1	22.0
Total			40.9	175	226	35	436	4.3	5.5	0.9	10.7

South Beach Reach				<u>Number captured</u>				<u>CPUE (#fish/ hour electrofishing)</u>			
Pass	Dates sampled	Fish Disposition	Effort (hrs)	juvenile	sub-adult	adult	All sizes	juvenile	sub-adult	adult	All sizes
<u>Boat electrofishing</u>											
1	April 22	Removal	9.7	1	5	2	8	0.1	0.5	0.2	0.8
2	April 30	Removal	11.1	3	21	21	45	0.3	1.9	1.9	4.1
3	May 2	Removal	10.6	12	17	4	33	1.1	1.6	0.4	3.1
4	May 10	Removal	11.1	11	21	17	49	1.0	1.9	1.5	4.4
5	May 20	Removal	12.3	23	20	18	61	1.9	1.6	1.5	4.9
6	June-3	Removal	12.5	11	12	15	38	0.9	1.0	1.2	3.0
7	June 5	Removal	11.2	2	2	3	7	0.2	0.2	0.3	0.6
8	June17, 20	Removal-Surge	11.8	108	63	16	187	9.1	5.3	1.4	15.8
9	June25-26	Removal-Surge	10.1	76	83	31	190	7.5	8.2	3.1	18.8
Total			100.5	247	244	127	618	2.5	2.4	1.3	6.1

Table 2----cont.

Little Yampa Canyon Reach			Effort (hrs)	<u>Number captured</u>				<u>CPUE (#fish/ hour electrofishing)</u>			
Pass	Dates sampled	Fish Disposition		juvenile	sub- adult	adult	All sizes	juvenile	sub- adult	adult	All sizes
<u>Boat electrofishing</u>											
1	April 17-19	Removal	21.5	5	8	8	21	0.2	0.4	0.4	1.0
2	Apr30-May6	Mark	37.4	293	209	148	650	7.8	5.6	4.0	17.4
3	May 16-19	Recapture-Removal	38.0	205	376	244	825	5.4	9.9	6.4	21.7
4	May29-Jun3	Removal	34.3	50	66	42	158	1.5	1.9	1.2	4.6
5	June 13-18	Removal-Surge	28.8	216	129	51	396	7.5	4.5	1.8	13.7
6	June 25-27	Removal-Surge	40.2	127	370	169	666	3.2	9.2	4.2	16.6
7	June28-Jul2	Removal-Surge	33.7	224	467	58	749	6.7	13.9	1.7	22.2
8	Jul-19-10	Removal-Surge	35.2	71	688	41	800	2.0	19.5	1.2	22.7
9	Jul-11-15	Removal-Surge	27.5	54	550	18	622	2.0	20.0	0.7	22.6
Total			296.7	1245	2863	779	4887	4.2	9.7	2.6	16.5
<u>Electric Seine Electrofishing</u>											
1	Aug 8-13	Removal-E-Seine	7.9	1356	86	3	1445	171.6	10.9	0.4	182.9
2	Aug 20-26	Removal-E-Seine	7.2	916	62	9	987	127.2	8.6	1.3	137.1
3	Sep-10	Removal-E-Seine ¹	1.2	2			2	1.7			1.7
4	Sep-18	Removal-E-Seine ¹	0.7				0				0.0
5	Oct-2	Removal-E-Seine	2.4	603	6		609	251.3		0.0	253.8
6	Oct-13	Removal-E-Seine	1.4	99		1	100	70.7	0	0.7	71
Total			20.8	2976	154	13	3143	143.1	7.4	0.6	151.1

¹ E-Seine removal on Trips 3 and 4 were conducted only in Isolated Pools where few and no smallmouth bass were captured respectively..

Table 2---cont.

Lower Juniper Reach			Effort (hrs)	<u>Number captured</u>				<u>CPUE (#fish/ hour electrofishing)</u>			
Pass	Dates sampled	Fish Disposition		juvenile	sub- adult	adult	All sizes	juvenile	sub- adult	adult	All sizes
<u>Boat electrofishing</u>											
1	April-26	Removal	9.0	4	1	1	6	0.4	0.1	0.1	0.7
2	May-7	Removal	10.5	19	19	17	55	1.8	1.8	1.6	5.2
3	May-28	Removal	11.6	46	36	32	114	4.0	3.1	2.8	9.8
4	June-14-18	Removal-Surge	8.7	10	18	32	60	1.2	2.1	3.7	6.9
5	June -21	Removal-Surge	10.4	34	54	48	136	3.3	5.2	4.6	13.1
6	June-26-28	Removal-Surge	19.0	123	230	107	460	6.5	12.1	5.6	24.2
Total			69.2	237	408	240	885	3.4	5.9	3.5	12.8

Upper Maybell Reach			Effort (hrs)	<u>Number captured</u>				<u>CPUE (#fish/ hour electrofishing)</u>			
	Dates sampled	Fish Disposition		juvenile	sub- adult	adult	All sizes	juvenile	sub- adult	adult	All sizes
<u>Boat electrofishing</u>											
1	April-23	Removal	7.1	9	2	3	14	1.3	0.3	0.4	2.0
2	May-1	Removal	10.6	42	31	21	94	4.0	2.9	2.0	8.9
3	May-3	Removal	9.9	28	16	14	58	2.8	1.6	1.4	5.8
4	May-9	Removal	11.5	98	83	69	250	8.6	7.2	6.0	21.8
5	May-14	Removal	11.0	113	128	57	298	10.3	11.6	5.2	27.1
6	May-21	Removal	11.4	220	204	67	491	19.3	17.9	5.9	43.0
7	June-4	Removal	10.7	184	88	53	325	17.2	8.2	5.0	30.5
8	June-19	Removal-Surge	7.3	59	44	14	117	8.1	6.0	1.9	16.0
Total			79.5	753	596	298	1647	9.5	7.5	3.7	20.7

Table 2----cont.

Lower Maybell Reach				<u>Number captured</u>				<u>CPUE (#fish/ hour electrofishing)</u>			
	Dates sampled	Fish Disposition	Effort (hrs)	juvenile	sub- adult	adult	All sizes	juvenile	sub- adult	adult	All sizes
<u>Boat electrofishing</u>											
1	May-25	Removal	10.0	1		1	2	0.1	0.0	0.1	0.2
2	May-8	Removal	11.3	28	27	23	78	2.5	2.4	2.0	6.9
3	May-29	Removal	12.8	27	28	17	72	2.1	2.2	1.3	5.6
Total			34.1	56	55	41	152	1.6	1.6	1.2	4.5

Sunbeam Reach				<u>Number captured</u>				<u>CPUE (#fish/ hour electrofishing)</u>			
	Dates sampled	Fish Disposition	Effort (hrs)	juvenile	sub- adult	adult	All sizes	juvenile	sub- adult	adult	All sizes
<u>Boat electrofishing</u>											
1	May-24	Removal	10.1	3	3	3	9	0.3	0.3	0.3	0.9
2	June-6	Removal	10.5	9	4	7	20	0.9	0.4	0.7	1.9
3	June-27	Removal	12.1	19	11	7	37	1.6	0.9	0.6	3.1
Total			32.7	31	18	17	66	0.9	0.6	0.5	2.0

Table 2----cont.

Lily Park Reach			Effort (hrs)	<u>Number captured</u>				<u>CPUE (#fish/ hour electrofishing)</u>			
Pass	Dates sampled	Fish Disposition		juvenile	sub- adult	adult	All sizes	juvenile	sub- adult	adult	All sizes
<u>Boat electrofishing</u>											
1	May-14-15	Removal	9.8	61	83	88	232	6.2	8.4	8.9	23.6
2	May-20-21	Removal	12.5	116	201	72	389	9.3	16.1	5.8	31.2
3	June-1-2	Removal	11.5	201	211	59	471	17.5	18.4	5.1	41.0
4	June-4	Removal	8.1	169	212	31	412	20.8	26.1	3.8	50.8
5	June-12	Removal	8.6	214	187	26	427	24.9	21.8	3.0	49.7
Total			50.5	761	894	276	1931	15.1	17.7	5.5	38.2

Table 3— Disposition of smallmouth bass captured by boat electrofishing in the middle Yampa River, 2013. Marked fish were tagged and returned to the river for research on abundance, movement, and growth.

Reach	Total # of fish handled	# of fish marked & released	# of fish removed
Craig	436		436
South Beach	618		618
LYC	4532	355	4887
Lower Juniper	885		885
Upper Maybell	1647		1647
Lower Maybell	152		152
Sunbeam	66		66
Lily Park	1931		1931
Grand Total	10267	355	10622

Table 4---Relative abundance of fish collected with boat electrofishing in the 1-mile fish community sample sites of the Yampa River, 2013. 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	20.7	46.2
northern pike	0.6	0.6
white sucker	70.1	26.9
white x flannelmouth sucker	0.7	-
white x bluehead sucker	0.1	-
creek chub	5.0	0.2
green sunfish	0.2	-
bluegill	0.2	-
channel catfish	0.1	0.5
fathead minnow	0.1	-
brown trout	0.1	-
rainbow trout	0.1	-
black bullhead	0.04	-
brook stickleback	0.04	-
common carp	-	0.5
iowa darter	-	0.2
redu side shiner	-	0.2
<i>native species</i>		
roundtail chub	0.9	5.6
bluehead sucker	0.4	3.8
flannelmouth sucker	0.4	15.1
flannelmouth x bluehead sucker	0.04	0.2
mottled sculpin	0.1	0.2
speckled dace	0.1	-
Total number of fish	2682	628
% nonnative fish	98.1	75.2
% native fish	1.9	24.8

Table 5---Number of fish captured by boat electrofishing in Little Yampa Canyon in the Yampa River, 2013.

	Removed	Released	Total
<i>nonnative species</i>			
smallmouth bass	4532	355	4887
northern pike	106	0	106
white sucker	7052	2661	9713
white x flannelmouth sucker	58	70	128
white x bluehead sucker	12	16	28
white x flannelmouth x bluehead	2	2	4
creek chub	474	3	477
green sunfish	55	1	56
bluegill	6	-	6
black bullhead	5	-	5
brown trout	-	31	31
rainbow trout	1	10	11
splake	-	2	2
channel catfish	-	29	29
common carp	5	1	6
fathead minnow	1	9	10
brook stickleback	3	-	3
redside shiner	-	3	3
<i>native species</i>			
roundtail chub	-	108	108
bluehead sucker	-	82	82
flannelmouth sucker	-	43	43
flannelmouth x bluehead sucker	-	4	4
Colorado pikeminnow	-	1	1
mottled sculpin	-	46	46
speckled dace	-	30	30
mountain whitefish	-	1	1
Total number of fish	12312	3508	15820

Table 6---Number of fish captured by boat electrofishing in Lily Park in the Yampa River, 2013.

	Removed	Released	Total
<i>nonnative species</i>			
smallmouth bass	1931	-	1931
northern pike	46	-	46
white sucker	801	-	801
white x flannelmouth sucker	5	-	5
white x bluehead sucker	1	-	1
channel catfish	-	26	26
common carp	19	-	19
redside shiner	-	18	18
creek chub	2	-	2
brook stickleback	2	-	2
green sunfish	1	-	1
iowa darter	-	1	1
<i>native species</i>			
flannelmouth sucker	-	688	688
bluehead sucker	1	109	110
flannelmouth x bluehead sucker	-	3	3
roundtail chub	-	251	251
Colorado pikeminnow	-	4	4
mottled sculpin	-	3	3
speckled dace	-	1	1
Total number of fish	2809	1104	3913

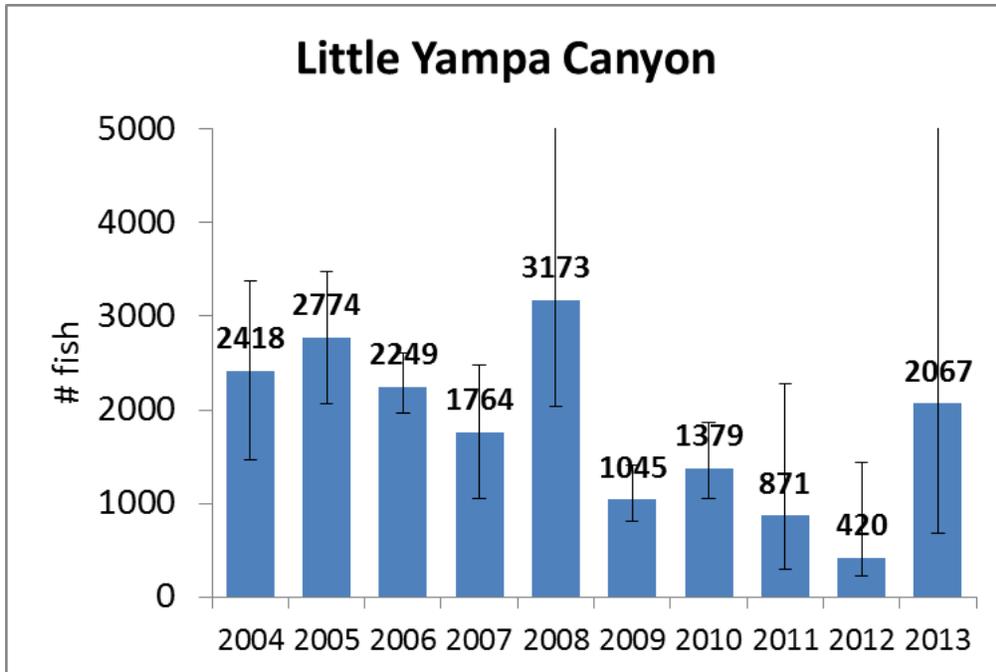


Figure 1---Estimated abundance of adult smallmouth bass(≥ 200 mm) in Little Yampa Canyon in the Yampa River, 2004—2013. Abundance estimated with a modified Lincoln-Peterson estimator.

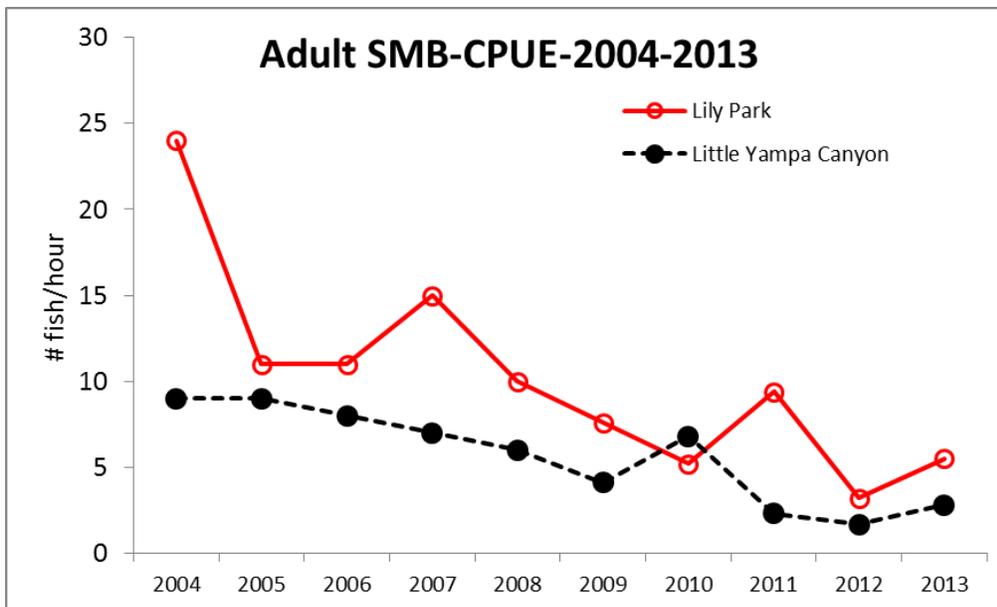


Figure 2—Number of adult (≥ 200 mm) smallmouth bass captured per hour of boat electrofishing in two reaches of the Yampa River, 2004-2013.

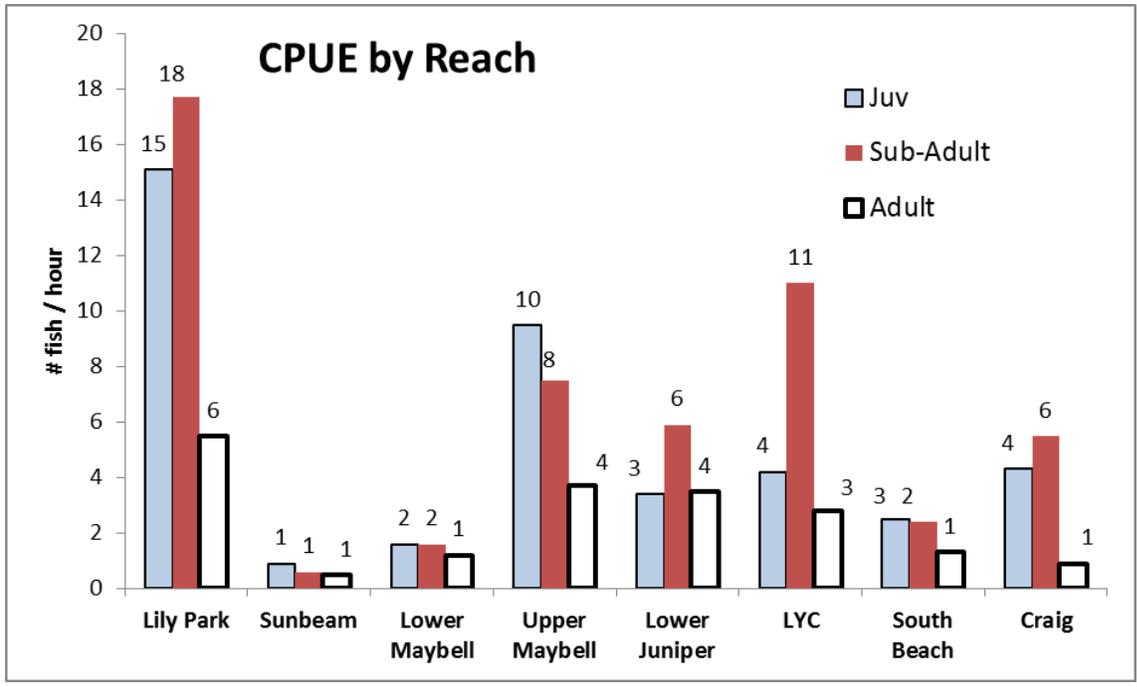


Figure 3—Catch per unit effort along a longitudinal gradient of the middle Yampa River, 2013.

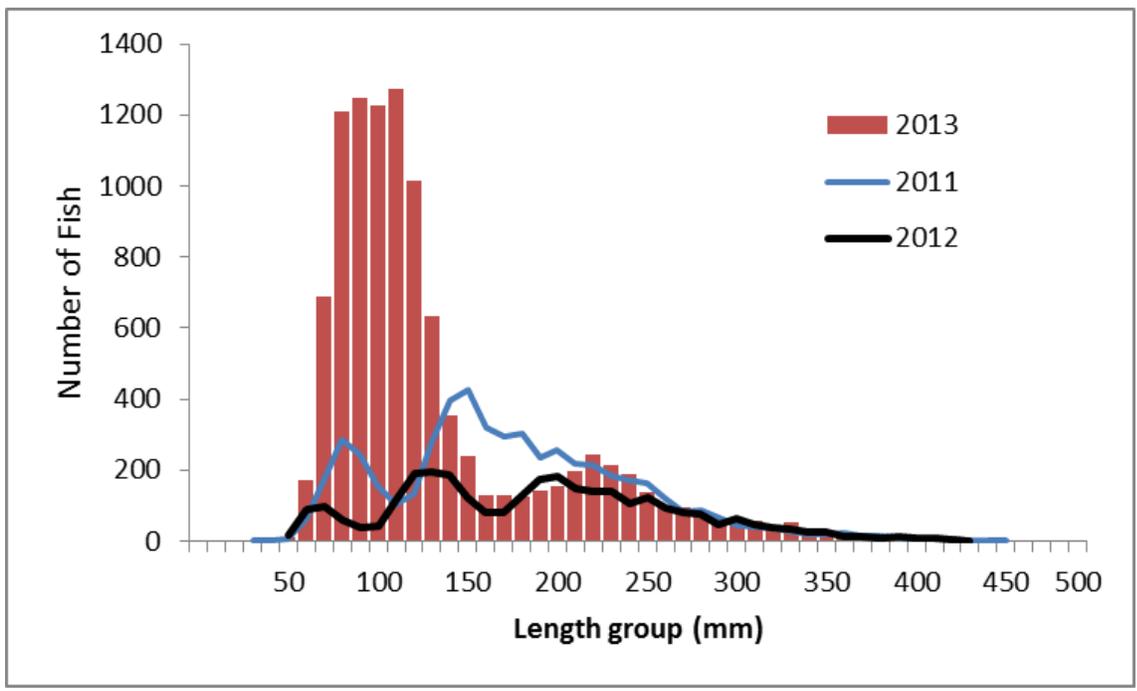


Figure 4—Length frequency of smallmouth bass captured in all reaches of the middle Yampa River, 2011--2013.

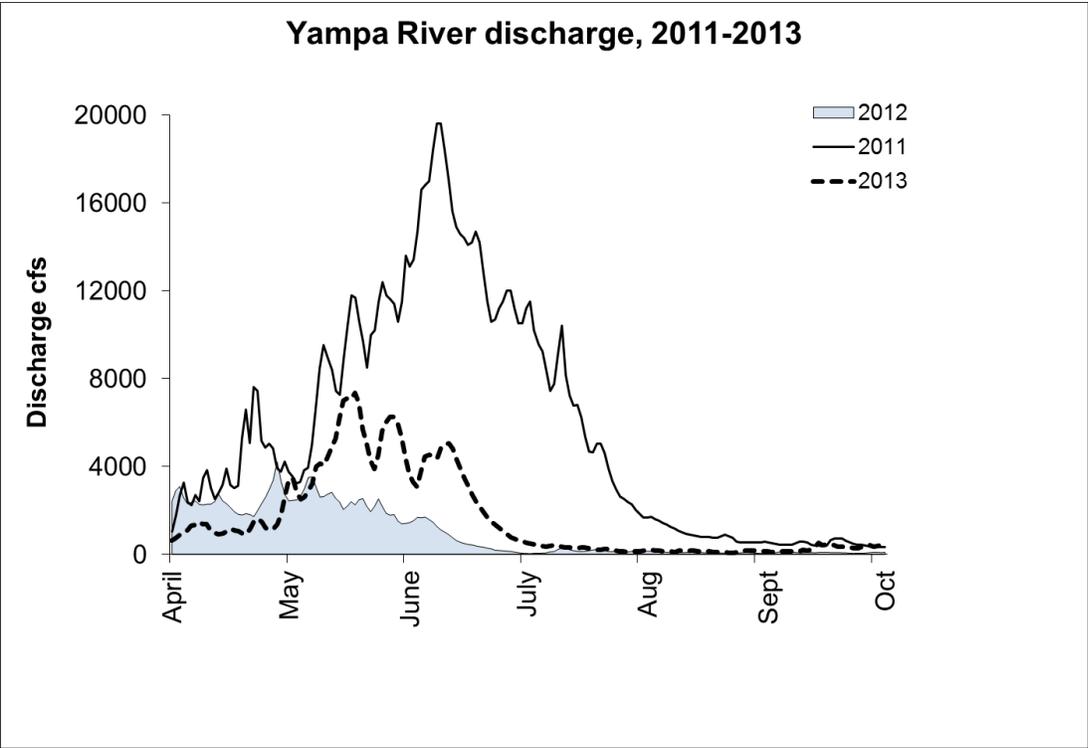


Figure 5-- Comparison of flow discharge at the Maybell USGS gage on the Yampa River, 2011-2013.

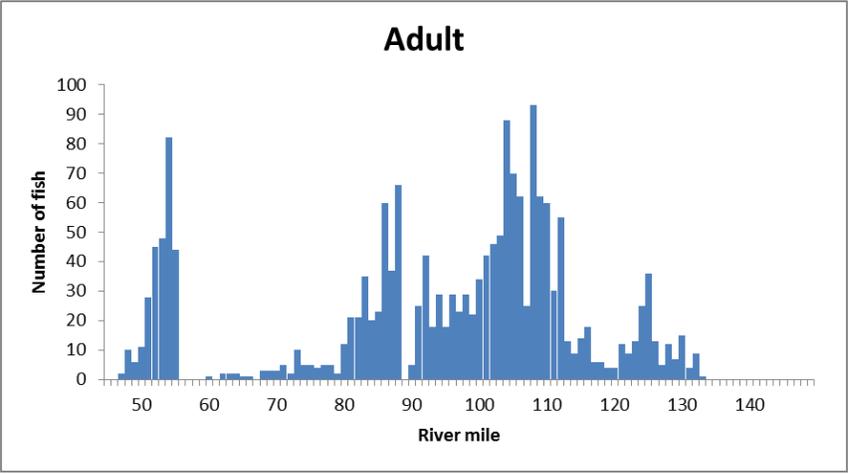
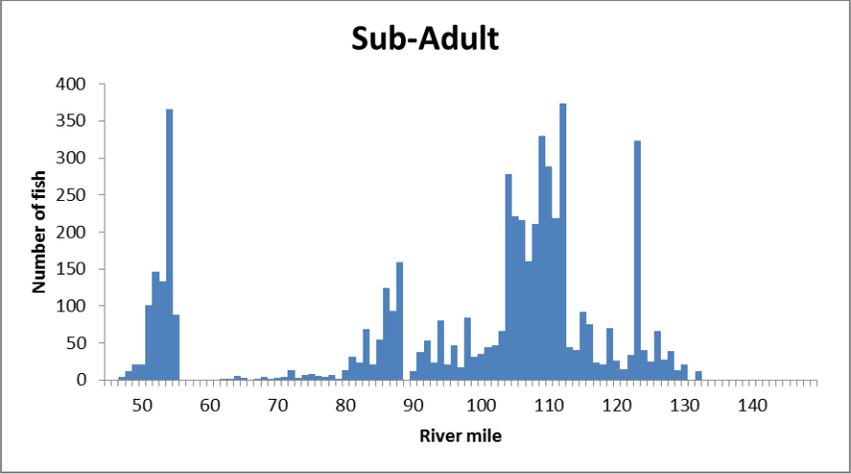
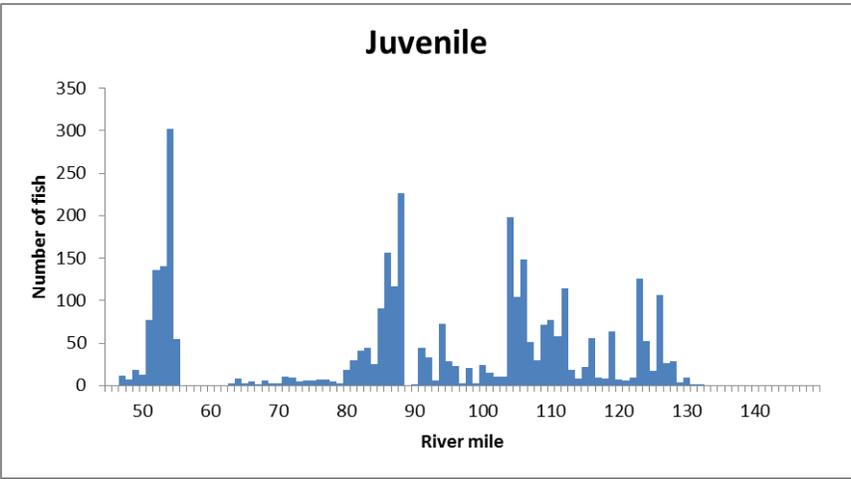


Figure 6—Number of smallmouth bass captured per mile in the middle Yampa River, 2013.