

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

II. Principal Investigator(s):

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III. Project Summary:

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. Fish sampling occurred on four to seven occasions (passes) from April through August using two electrofishing boats sampling both shorelines. Smallmouth bass ≥ 100 mm were marked and released on one occasion in each reach to estimate their abundance and monitor movement and growth. Smallmouth bass were removed from the river on all other passes. To evaluate removal success we estimated the number of sub-adult (100–199-mm) and adult (≥ 200 -mm) smallmouth bass at each study site using capture-recapture methods. From August through October, we removed small, primarily Age-0 smallmouth bass from the lower 12-mile portion of Little Yampa Canyon using an electric seine. All smallmouth bass removed from the river were euthanized. 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.

IV. Study Schedule: Initial Year: 2003
Final Year: ongoing

V. Relationship to RIPRAP : March 25, 2011 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).

See *RIPRAP* at

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

VI. Accomplishment of FY 2012 Tasks and Deliverables, Discussion of Initial Findings a and Shortcomings:

Preliminary results for 2012 are provided in the attached report and 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, and Wright 2009.

Smallmouth bass

The goal is to reduce the number of smallmouth bass and reduce their spawning success 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, Lily Park, and if possible river-wide using a mark-recapture abundance estimator. Coordinate mark-recapture sampling with CDOW and USFWS to obtain the estimate of smallmouth bass, upstream of Yampa Canyon.
2. Conduct one marking pass 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 each study area based on initial population size.
5. Remove large numbers of age-0 and age-1 smallmouth bass from a 12-mile treatment reach (RM100-112) 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. Coordinate 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:

Conduct one marking pass and eight 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, 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.

VII. 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.
- Expand intensive Surge efforts to include more removal passes in Lower Juniper, Upper Maybell, and Craig reaches.
- Reduce or prevent escapement of smallmouth bass from Elkhead Reservoir.

VIII. Project Status: On going and on track

IX. FY 2012 Budget Status

- A. Funds Provided: \$321,458
 - a. \$300,692 to CSU,
 - b. \$12,606 to FWS-Grand Junction
 - c. \$8,160 to FWS-Vernal
- B. Funds Expended: \$321,458
- C. Difference: 0
- D. Percent of the FY 2012 work completed, and projected costs to complete: 100%
- E. Recovery Program funds spent for publication charges: \$0

- X. Status of Data Submission (Where applicable): Endangered fish capture data will be submitted by year's end and all other data is currently being formatted for consistency and submission to the database administrator.

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.

XI.Signed: John Hawkins 11/14/12
Principal Investigator Date

Submitted electronically.

Date submitted: 11-14-12

Revised: 11-28-12 Editorial changes by P. Martinez & J. Hawkins

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

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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:

Obtaining an estimate of the number of smallmouth bass in reaches with adequate data. We coordinated mark-recapture and Surge sampling with CDOW and USFWS. We conducted one marking pass and multiple removal passes in Little Yampa Canyon and Lily Park study reaches. We removed large numbers invasive nonnative predators from Critical Habitat on multiple occasions from April through November..

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

Principal Investigator: Aaron Webber
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Project/Grant Period: Start date (Mo/Day/Yr): 05/06/2010
End date: (Mo/Day/Yr): 09/30/2015
Reporting period end date (Mo/Day/Yr): 9/30/2012
Is this the final report? Yes X No

Performance: USFWS completed assigned portions of task 4. FWS employees provided equipment and assisted with nonnative fish removal during 2 weeks of sampling during the weeks of 11 June and 18 June.

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:
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Project/Grant Period: Start date: 5/6/2010
 End date: 9/30/2015
 Reporting period start/end date: 10/1/2011 to 9/30/2012
 Is this the final report? Yes _____ No X

Performance:

We were tasked to provide a three-person field crew for **eight days** with administrative support sometime from mid-June to mid-July; provide either jet-powered electrofishing hard-bottom craft or row-powered electrofishing inflatables. Runoff for 2012 provided for low base flows; accordingly, CSU requested our help at the beginning of June and requested we provide two electrofishing rafts (inflatables). For FY 2012, we provided a three person field crew for **twelve days** (6/10/2012-6/15/2012; 6/17/2012-6/22/2012).

Preliminary Results of smallmouth bass removal in the middle Yampa River, 2012

Overview: This report provides a preliminary summary of data that was collected in 2012 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 on four to eight occasions (passes) at each reach from April through June using two electrofishing boats sampling both shorelines continuously downstream. Two agencies (CSU and CPW) sampled concurrently in their respective reaches. Agencies coordinated the marking pass to occur May 2-11 and the recapture pass May 14-19. 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. In previous years, smallmouth bass 250 mm and larger were translocated to Elkhead Reservoir but translocation was stopped in 2011 due to excessive escapement of some of those fish from the reservoir.

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 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 some young-of-year (YOY) pike were euthanized and preserved for aging and diet studies.

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.

When flows declined too low for safe Jon boat navigation (approximately <1000 cfs), we shifted to rafts and smaller Jon boats. After bass spawning was finished we shifted to canoes and removed smallmouth bass YOY with an electric seine in the lower 12-miles of Little Yampa Canyon. No electric seine removal occurred in Lily Park in 2012. In addition, in August and September, 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.

Intensive removal during spawning (The Surge)

In 2012, we completed the third 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 their 2012 production. Water temperatures of 16°C initiate smallmouth bass spawning and Surge removal started on May 30 soon after maximum daily water temperatures exceeded 16°C on May 29. 2012 was an extremely dry year and resulted in a low peak flow and a short runoff (Figure 5). This low and short runoff resulted in extremely early spawning which started approximately 50 days earlier than in 2011 and approximately 30 days earlier than in 2010.

We shifted from larger Jon boats during runoff to electrofishing rafts and smaller electrofishing Jon boats during the Surge. We effectively disrupted nest building, spawning, and nest guarding between May 30 and June 19 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.

Results

Smallmouth bass abundance and exploitation

In 2012, we estimated abundance of smallmouth bass for each reach using a Lincoln-Petersen model when data were adequate. Low flows and a low-magnitude runoff resulted in low catch rates during the mark and recapture passes. In most reaches fewer fish were marked than in previous years, but more importantly even fewer fish were recaptured. In several reaches we recaptured between zero and one recaptures (Table 2). At best, we recaptured only four tagged adults in Little Yampa Canyon. We did not estimate abundance for reaches with only one recapture. We estimated abundance for three reaches that had more than one recapture but low recapture probabilities resulted in poor estimates with high standard errors.

We estimated there were 735 adults (254-2506, 95% CI) in the South Beach reach, almost double the number in 2011 (N=418), but similar to the number in 2010 (N=816). Our ability to detect a change in this reach is poor because confidence intervals overlapped and coefficient of variation was extremely high in all years (range 67-96%). Adult density in South Beach was 74 fish/mile which is one of the highest densities of all reaches (Table 1).

We estimated there were 420 adults (203-1020, 95% CI) in Little Yampa Canyon in 2012 which is the fewest observed since 2004 (Table 1; Figure 1). Density of adults in Little Yampa Canyon was 18 adult bass per mile which is one of the lowest measured in any reach of the middle Yampa River.

There were 435 sub-adults (157-1464, 95% CI) in Lily Park in 2012, similar to that observed in 2011. Density was 54 sub-adults/mile, similar to 2011, but much lower than the 491 fish/mile in 2010 and the 612 fish/mile in 2009.

Exploitation Rates

To obtain an estimate of the number of fish living in a reach prior to any sampling, we added the abundance estimate to the number of adults that were removed on the first pass prior to the mark pass. We divided the number of fish removed by boat electrofishing on all passes with the estimated number of fish at the start of the season to obtain the exploitation rate. We removed 23% of the adults (n=184) from South Beach and 74% of the adults (n=320) from Little Yampa Canyon in 2012 (Table 1). We removed 10% of the sub-adults (n=43) from Lily Park in 2012 (Tables 1). There was no adjustment made to calculate exploitation in Lily Park because no fish were removed before the mark pass (Table 3). We may be underestimating exploitation because our abundance estimates were derived from a Lincoln Petersen estimator and that estimator may underestimate the number of animals living in a reach because it treats all fish equally and does not account for the effects of fish length, sample occasion, or reach.

Fish removal effort

In 2012, we sampled a total of 556 hours with boat electrofishing and 41 hours with electric seine (Table 3). We also sampled by angling 52 man-hours. Total effort in 2012 was less than that in 2011 primarily due to the shorter boating season. Extreme low water conditions reduced our sampling period to a 63 day window in 2012 (April 17-June 19), less than half of the 134 day window sampled in 2011 (April 10-Aug 22). Generally, effort in 2012 was similar to effort in 2011 at all CPW reaches of South Beach, Lower Juniper, Upper Maybell, Lower Maybell, and Sunbeam. Effort at the CSU Lily Park reach was reduced compared to prior years because the effort was redirected to upstream spawning reaches, especially at Little Yampa Canyon and South Beach.

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

We handled 3,043 smallmouth bass and removed 2,757 of them using boat electrofishing (Table 4). We caught and removed an additional 36 fish by angling. We marked and released 9% (n=286) of all smallmouth bass handled. Those fish were marked to obtain information about abundance, movement, and growth.

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 effort accounted for between 31 and 58% of all electrofishing effort but resulted in catching between 53 and 93% of all fish captured in those reaches (see table below).

Effort and number of smallmouth bass removed from the Yampa River during the Surge compared to all other sampling in 2012.

	Electrofishing Hours			# fish removed		
	All passes	Surge passes	Surge proportion	All passes	Surge passes	Surge Proportion
South Beach	85.5	39.7	46%	352	185	53%
Little Yampa Canyon	212.1	122.3	58%	778	726	93%
Lower Juniper	70.8	37.1	52%	634	558	88%
Upper Maybell	60.0	18.4	31%	647	519	80%
Total all Surge reaches	428.4	217.5	51%	2411	1988	83%

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.

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 adult and sub-adult smallmouth bass were highest in Upper Maybell and Lower Juniper, followed by Lily Park and South Beach (Figure 3). Sub-adult catch rates in Lily Park were dramatically lower in 2012 (2.6 fish/hr) than they were in 2011 (16 fish/hr) and 2010 (20 fish/hr). Adult catch rates also declined in Lily Park from 9 fish/hr in 2011 to 3 fish/hr in 2012. CPUE of adult smallmouth bass has declined since 2004 in both Lily Park and Little Yampa Canyon, two reaches with the longest record. Little Yampa Canyon has declined from just under 10 adults/hour to 2 fish/hour and Lily Park from 25 adults/hour to about 3 adults/hour (Figure 2).

Spawning observations

Spawning started in early June and likely continued through the month based on adequate water temperatures, capture of ripe males building nests, and ripe females. Reproduction began earlier than previous years due to low runoff flows that allowed water temperatures to warm to 16°C and this temperature was reached on May 29. Nests were observed at all Surge reaches including the Craig reach where FWS crews observed and removed bass from nests at the confluence with Elkhead Creek. They returned 7 days later and found newly emerged young bass around the abandoned nests.

Young of Year (YOY) sampling with electric seine

In the lower 12-mile Treatment area of Little Yampa Canyon, electric seine CPUE was about three times higher in 2012 (180 Juveniles/hr) compared to 2011 (60 Juveniles/hr; Table 3). Juveniles are comprised of mostly young of year and high numbers reflect high production in 2012. Supplemental flows were released from Elkhead Reservoir in 2012 for endangered

fishes in Critical Habitat of the Yampa River. These flows improved water quality and habitat conditions for native fishes and enhanced our ability to capture smallmouth bass YOY.

Movement

We recaptured six smallmouth bass that moved upstream from Yampa Canyon into our study reaches. Four were tagged in 2010 and two in 2011. They moved short distances into Lily Park and as far upstream as Little Yampa Canyon, over 50 miles away. They were between 198-264 mm when tagged and were between 260-325 mm when recaptured. Additional information regarding movement of recaptured bass will be provided at the nonnative workshop.

Elkhead escapees

In 2012, we recaptured 20 smallmouth bass that had escaped from Elkhead Reservoir after translocation in previous years. One was translocated to the reservoir in 2007, three in 2008, three in 2009, and 13 in 2010. We captured an additional 12 smallmouth bass that were possible Elkhead escapees because they had left-pelvic fin clips and no Floy tag. In some earlier years, all translocated bass were double tagged with a Floy tag and a left pelvic fin clip so that we could identify translocated fish if they lost their Floy tag.

Fish Community Sampling

Nonnative fish still dominate the fish community, comprising 84% of all fish collected during 1-mile sampling in Little Yampa Canyon, slightly less than in 2011 (Table 5). Smallmouth bass and white suckers were the most abundant fishes collected, although smallmouth bass numbers in Little Yampa Canyon declined from 34% of the community in 2011 to 16% in 2012 (Table 5). White suckers increased during that same time from 38% to 53%. The composition of most native species remained similar to 2011, except there were fewer roundtail chub and more mountain whitefish in 2012. At Lily Park, 85% of the fish collected in 1-mile samples were native species, mostly flannelmouth and bluehead suckers. Bass comprised a relatively small 5% of the fish community in 2012; in 2011 they comprised 30% of 1-mile samples in Lily Park.

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 18 nonnative species including a 392-mm splake, the first occurrence of the species in this reach (Table 7). Only one Colorado pikeminnow was captured in Little Yampa Canyon. At Lily Park, we handled seven native species and eight nonnative species, including three walleye between 485-500 mm long (Table 6). Only three Colorado pikeminnow were captured in Lily Park.

Conclusions

- Smallmouth bass numbers in Lily Park and Little Yampa Canyon appear to be in decline while numbers in South Beach, Lower Juniper, and Upper Maybell appear to be on the increase.
- Smallmouth bass spawning in 2012 was much earlier than normal and a long period of warm water temperatures allowed YOY bass to grow rapidly.
- Declining abundance and CPUE provided evidence of declining populations of adult smallmouth bass in Little Yampa Canyon and Lily Park.
- Increasing abundance and CPUE in South Beach, Lower Juniper, and Upper Maybell suggests increasing population trends in those reaches.
- Removal during spawning was highly productive at removing large numbers of adults and disrupting the spawning event within the focused area.
- Escapement of translocated smallmouth bass from Elkhead Reservoir was documented in 2012.

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.

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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) or adult (≥ 200 mm) smallmouth bass at three reaches in the middle Yampa River, 2012. Abundance was estimated using a Lincoln-Petersen estimator. SE = Standard Error. CV= Coefficient of Variation.

Life Stage	Abundance	lower – upper 95% CI	SE	CV	Capture probability	Density (#fish/mile)	Exploitation rate	
							# of fish removed	% of population removed
South Beach (10 miles)								
Adult	735	254--2506	492.5	67%	5%	74	184	23% *
Little Yampa Canyon (24 miles)								
Adult	420	203--1020	189.2	43%	8%	18	320	74% **
Lily Park (8 miles)								
Sub-adult	432	157—1464	284.6	66%	6%	54	43	10%

* Exploitation based on 802 fish in the reach at the start of sampling (735 + 67 removed on Pass 1).

** Exploitation based on 431 fish in the reach at the start of sampling (420 + 11 removed on Pass 1).

Table 2 --- Number of smallmouth bass handled during mark and recapture occasions in the middle Yampa River, 2012.

	Life Stage	Number of mark passes	Number of fish		
			marked	handled at recapture	recaptured
South Beach (10 miles)	Sub-adult	1	10	9	0
	Adult	1	42	35	2
Little Yampa Canyon (24 miles)	Sub-adult	1	17	1	0
	Adult	1	48	35	4
Lower Juniper (10 miles)	Sub-adult	1	7	21	0
	Adult	1	23	24	1
Upper Maybell (10 miles)	Sub-adult	1	3	9	0
	Adult	1	33	23	1
Lower Maybell (10 miles)	Sub-adult	1	5	15	0
	Adult	1	13	12	1
Sunbeam (10 miles)	Sub-adult	1	2	10	0
	Adult	1	6	5	0
Lily Park (8 miles)	Sub-adult	1	32	27	2
	Adult	1	40	24	1
Totals all reaches	Sub-adult		76	92	2
	Adult		205	158	10

Table 3— CPUE (catch per unit effort) for smallmouth bass captured by boat and electric seine electrofishing in the middle Yampa River, 2012. 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
1	June-2	Removal-Surge	5.3		2	12	14	0.0	0.4	2.3	2.6
2	June-11-12	Removal-Surge	16.2	1	42	41	84	0.1	2.6	2.5	5.2
3	June-18-19	Removal-Surge	17.2	6	18	8	32	0.3	1.0	0.5	1.9
Total			38.7	7	62	61	130	0.2	1.6	1.6	3.4

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
1	April 30	Removal	10.1		10	67	77	0.0	1.0	6.6	7.6
2	May 9	Mark	11.8		26	44	70	0.0	2.2	3.7	5.9
3	May 17	Recapture	12.0	4	9	35	48	0.3	0.8	2.9	4.0
4	May 23	Removal	11.9	6	18	18	42	0.5	1.5	1.5	3.5
5	May 31-June 2	Removal-Surge	9.7		4	17	21	0.0	0.4	1.8	2.2
6	June-4-6	Removal-Surge	12.1	2	20	39	61	0.2	1.7	3.2	5.0
7	June 13-16	Removal-Surge	17.9	29	66	8	103	1.6	3.7	0.4	5.8
Total			85.5	41	153	228	422	0.5	1.8	2.7	4.9

Table 3----cont.

Little Yampa Canyon 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
1	April 17-19	Removal	24.3	3	1	11	15	0.1	0.0	0.5	0.6
2	May 2-6	Mark	37.8	3	17	50	70	0.1	0.4	1.3	1.9
3	May 15-19	Recapture	27.7	1	1	35	37	0.0	0.0	1.3	1.3
4	May 30-June 6	Removal-Surge	36.9	9	73	140	222	0.2	2.0	3.8	6.0
5	June 12-13	Removal-Surge	31.8	31	117	68	216	1.0	3.7	2.1	6.8
6	June 14-15	Removal-Surge	36.6	36	109	45	190	1.0	3.0	1.2	5.2
7	June 16-19	Removal-Surge	17.0	12	65	21	98	0.7	3.8	1.2	5.8
Total			212.1	95	383	370	848	0.4	1.8	1.7	4.0
1	Jul-10-16	Removal-E-Seine	3.1	114	22	8	144	37	7	3	47
2	Jul 25-30	Removal-E-Seine	5.9	534	27	12	573	90	5	2	96
3	Aug 8-13	Removal-E-Seine	5.1	871	25	6	902	171	5	1	178
4	Aug 22-29	Removal-E-Seine	5.9	1267	205	11	1483	214	35	2	251
5	Sep 5-12	Removal-E-Seine	6.9	1288	141	9	1438	188	21	1	209
6	Sep 19-25	Removal-E-Seine	8.4	2204	70	2	2276	262	8	0.2	271
7	Oct 5	Removal-E-Seine	0.7	398	6	1	405	569	9	1	579
8	Oct 29-Nov2	Removal-E-Seine	4.8	664	43	--	707	138	9	--	147
Total			40.8	7340	539	49	7928	180	13	1	194

Table 3----cont.

Lower Juniper 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
1	May 2	Removal	10.3	1	2	25	28	0.1	0.2	2.4	2.7
2	May-11	Mark	11.3	2	13	23	38	0.2	1.2	2.0	3.4
3	May -16	Recapture	12.1	3	21	24	48	0.2	1.7	2.0	4.0
4	June-1	Removal-Surge	10.1		36	81	117	0.0	3.6	8.0	11.5
5	June-5-6	Removal-Surge	12.4	41	76	104	221	3.3	6.1	8.4	17.9
6	June-12-15	Removal-Surge	14.6	53	96	71	220	3.6	6.6	4.9	15.1
Total			70.8	100	244	328	672	1.4	3.4	4.6	9.5

Upper 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
1	April 18, May 1	Removal	11.9		16	20	36	0.0	1.3	1.7	3.0
2	May-10	Mark	9.9	1	11	33	45	0.1	1.1	3.3	4.5
3	May-14	Recapture	9.3	2	9	23	34	0.2	1.0	2.5	3.6
4	May-22	Removal	10.4	3	19	36	58	0.3	1.8	3.5	5.6
5	June-5	Removal-Surge	9.7	16	96	96	208	1.6	9.9	9.9	21.4
6	June-7	Removal-Surge	8.7	35	162	114	311	4.0	18.5	13.0	35.6
Total			60.0	57	313	322	692	1.0	5.2	5.4	11.5

Table 3---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
1	May-3	Removal	9.1	1	7	3	11	0.1	0.8	0.3	1.2
2	May-7	Mark	9.9		16	14	30	0.0	1.6	1.4	3.0
3	May-15	Recapture	9.2		15	12	27	0.0	1.6	1.3	2.9
Total			28.1	1	38	29	68	0.0	1.4	1.0	2.4

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
1	May-8	Mark	10.8		16	6	22	0.0	1.5	0.6	2.0
2	May-18	Recapture	10.5	1	10	5	16	0.1	1.0	0.5	1.5
3	May-24	Removal	10.8		4	2	6	0.0	0.4	0.2	0.6
Total			32.1	1	30	13	44	0.0	0.9	0.4	1.4

Lily Park 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
1	May-7	Mark	10.7	1	32	41	74	0.1	3.0	3.8	6.9
2	May-17-18	Recapture	8.2	1	27	24	52	0.1	3.3	2.9	6.3
3	May-21-22	Removal	9.5		16	25	41	0.0	1.7	2.6	4.3
Total			28.4	2	75	90	167	0.1	2.6	3.2	5.9

Table 4— Disposition of smallmouth bass captured primarily by boat electrofishing in the middle Yampa River, 2012. 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	130		130
South Beach	422	53	369
LYC	848	67	781
Lower Juniper	672	30	642
Upper Maybell	692	36	656
Lower Maybell	68	19	49
Sunbeam	44	8	36
Lily Park	167	73	94
Grand Total	3043	286	2757

Table 5---Relative abundance of fish collected with boat electrofishing in the 1-mile fish community sample sites of the Yampa River, 2012. Little Yampa Canyon contained four, 1-mile sites and Lily Park contained one site.

	Little Yampa Canyon	Lily Park
<u>nonnative species</u>		
smallmouth bass	16.1	4.9
northern pike	4.1	0.9
white sucker	53.3	1.9
white x flannelmouth sucker	2.3	0.2
white x bluehead sucker	0.2	-
white x flannelmouth x bluehead	0.1	-
creek chub	6.4	-
rainbow trout	0.8	-
common carp	0.1	1.5
bluegill	0.1	-
black crappie	0.1	-
green sunfish	0.2	-
brown trout	0.1	-
channel catfish	0.1	5.1
brook stickleback	0.1	-
walleye	-	0.2
<u>native species</u>		
flannelmouth sucker	1.6	65.7
roundtail chub	0.5	3.9
bluehead sucker	1.7	15.2
mountain whitefish	4.9	-
speckled dace	2	0.2
mottled sculpin	5	0.2
Total number of fish	858	467
% nonnative fish	84.3	14.8
% native fish	15.7	85.2

Table 6---Number of fish captured by boat electrofishing in Lily Park in the Yampa River, 2012.

	<u>Removed</u>	<u>Released</u>	<u>Total</u>
<u>nonnative species</u>			
smallmouth bass	94	73	167
northern pike	19	31	50
white sucker	78	2	80
white x flannelmouth sucker	1	1	2
channel catfish		105	105
common carp	48		48
red shiner		1	1
redside shiner		1	1
walleye	3		3
<u>native species</u>			
flannelmouth sucker		1577	1577
roundtail chub		138	138
bluehead sucker		258	258
mountain whitefish		2	2
speckled dace		1	1
Colorado pikeminnow		3	3
mottled sculpin		<u>3</u>	<u>3</u>
Total number of fish	243	2196	2439

Table 7---Number of fish captured by boat electrofishing in Little Yampa Canyon in the Yampa River, 2012.

	<u>Removed</u>	<u>Released</u>	<u>Total</u>
<u>nonnative species</u>			
smallmouth bass	781	67	848
northern pike	89	41	130
white sucker	1285	1166	2451
white x flannelmouth sucker	53	124	177
white x bluehead sucker	2	17	19
white x flannelmouth x bluehead		1	1
creek chub	195	2	197
black bullhead	9		9
rainbow trout		30	30
common carp	4		4
bluegill	2		2
fathead minnow		2	2
black crappie	2		2
green sunfish	12		12
brown trout		11	11
channel catfish		3	3
brook stickleback	7		7
cutthroat trout		19	19
redside shiner		1	1
Iowa darter		1	1
Splake		1	1
<u>native species</u>			
flannelmouth sucker		73	73
roundtail chub		22	22
bluehead sucker		99	99
mountain whitefish		390	390
speckled dace	1	103	104
Colorado pikeminnow		1	1
flannelmouth x bluehead sucker		1	1
mottled sculpin		108	108
Total number of fish	2442	2283	4725

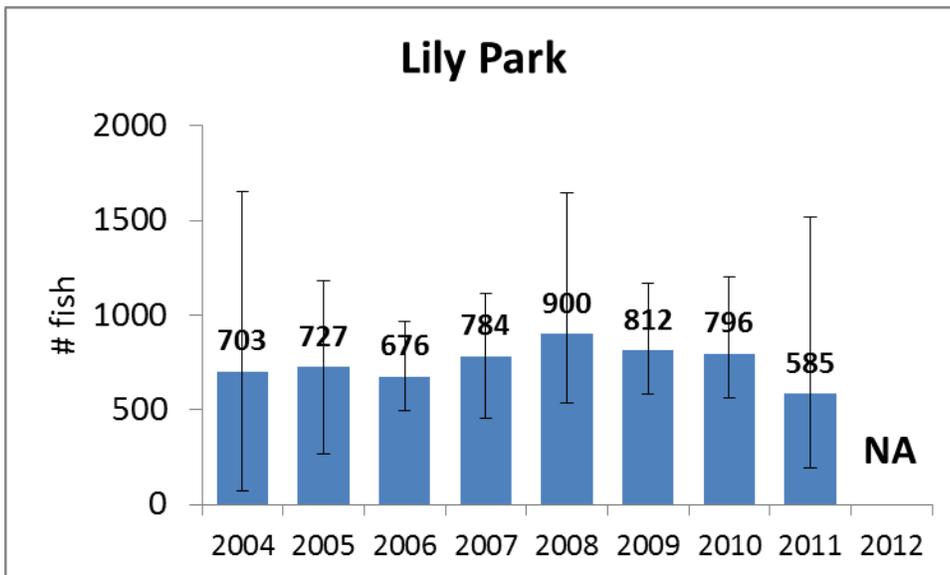
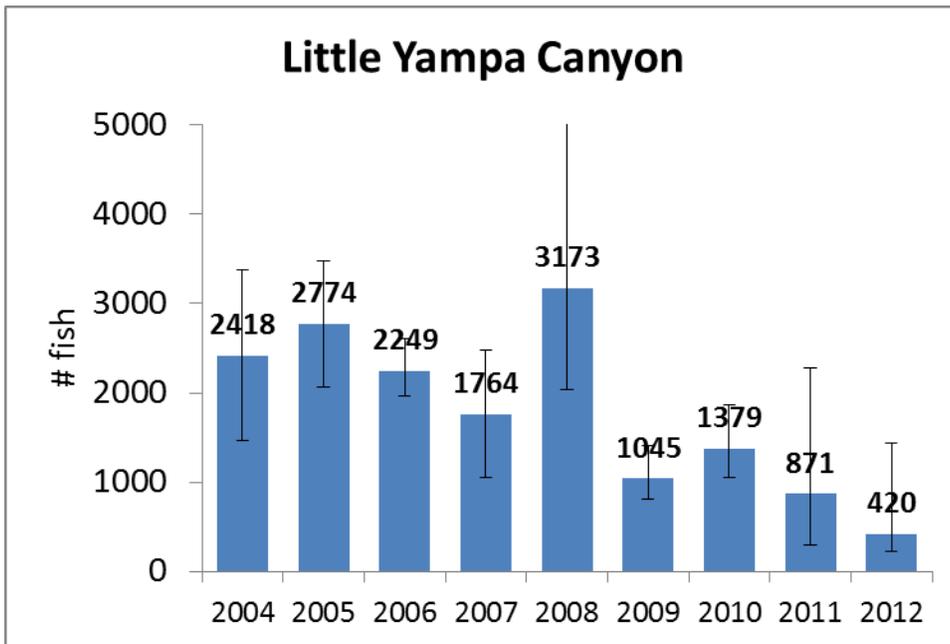


Figure 1---Estimated abundance of adult smallmouth bass (≥ 200 mm) in two reaches of the Yampa River, 2004--2012. NA= insufficient data.

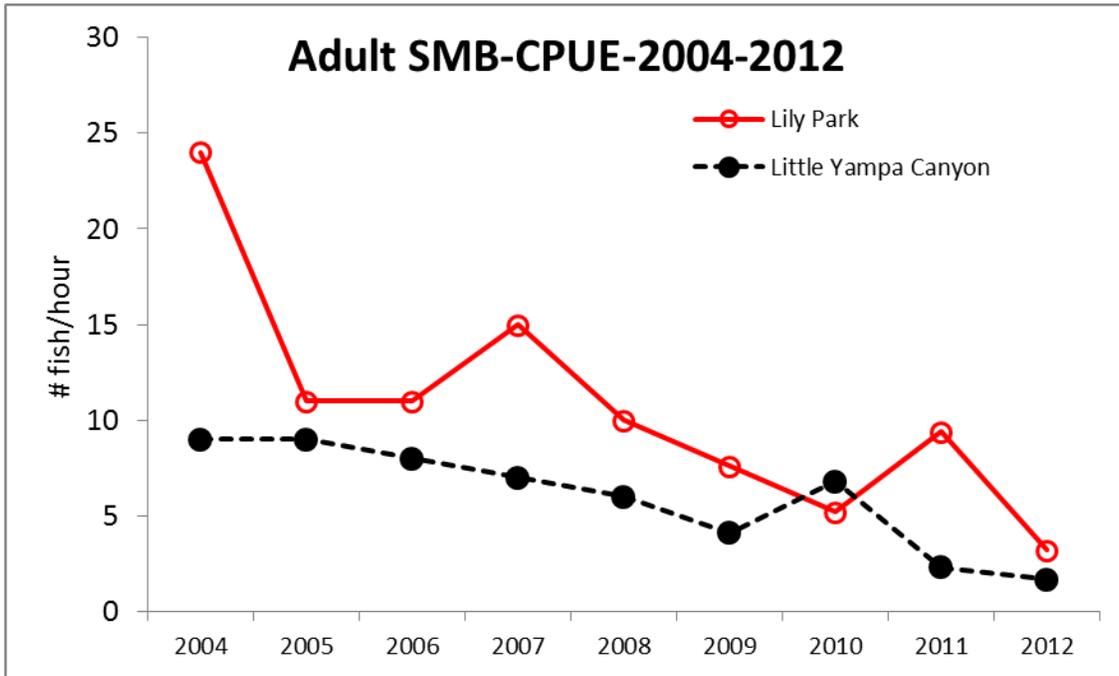


Figure 2—Number of adult (≥ 200 mm) smallmouth bass captured per hour of boat electrofishing in two reaches of the Yampa River, 2004-2012.

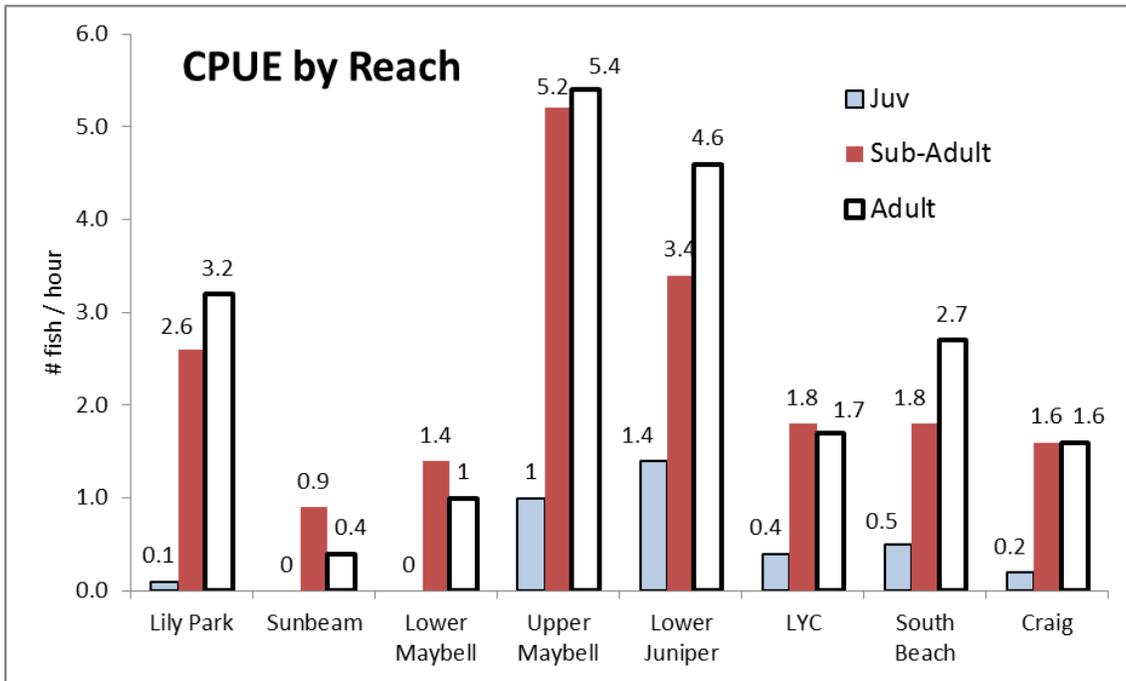


Figure 3—Catch per unit effort along a longitudinal gradient of the middle Yampa River, 2012.

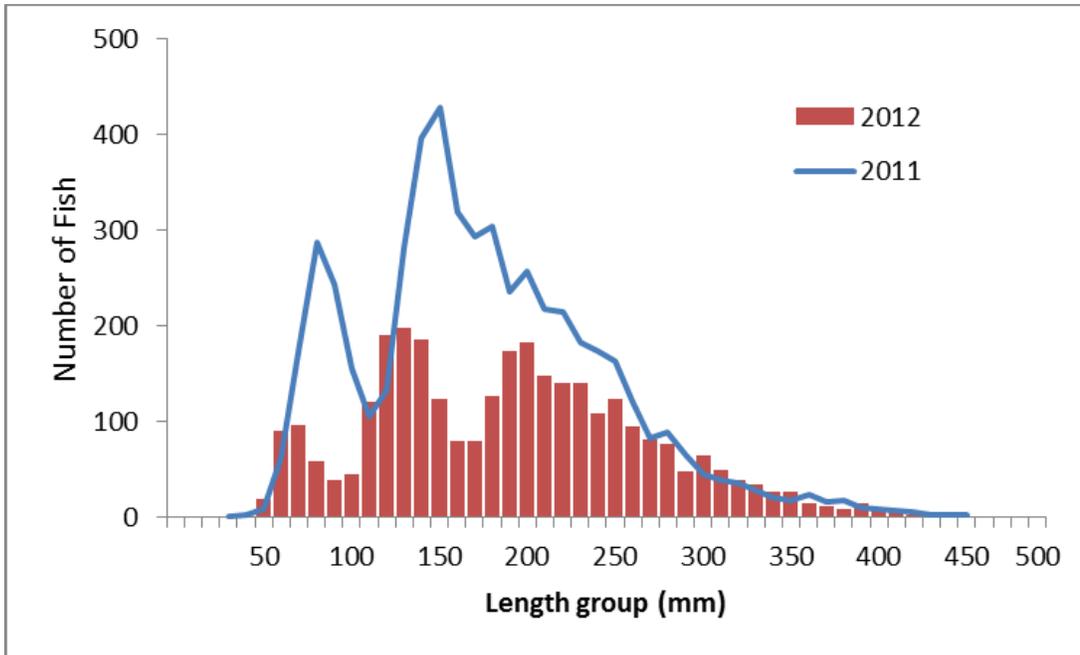


Figure 4---Length frequency of smallmouth bass captured in all reaches of the middle Yampa River, 2011 and 2012.

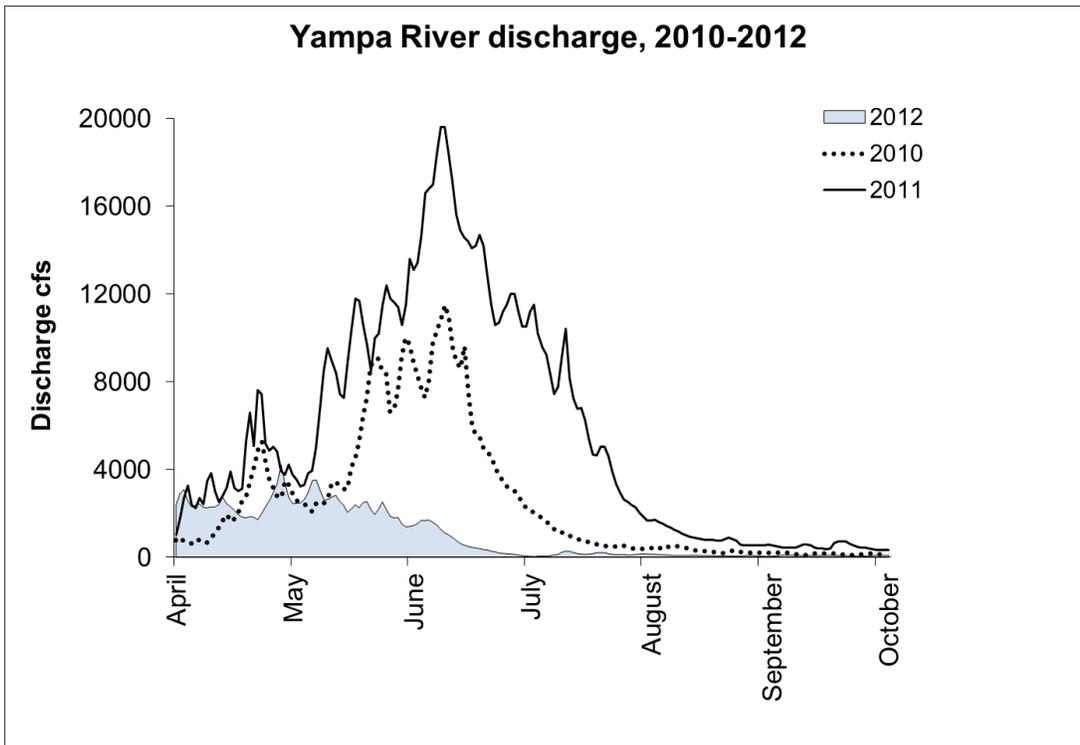


Figure 5-- Comparison of 2010-2012 discharge at the Maybell USGS gage on the Yampa River.

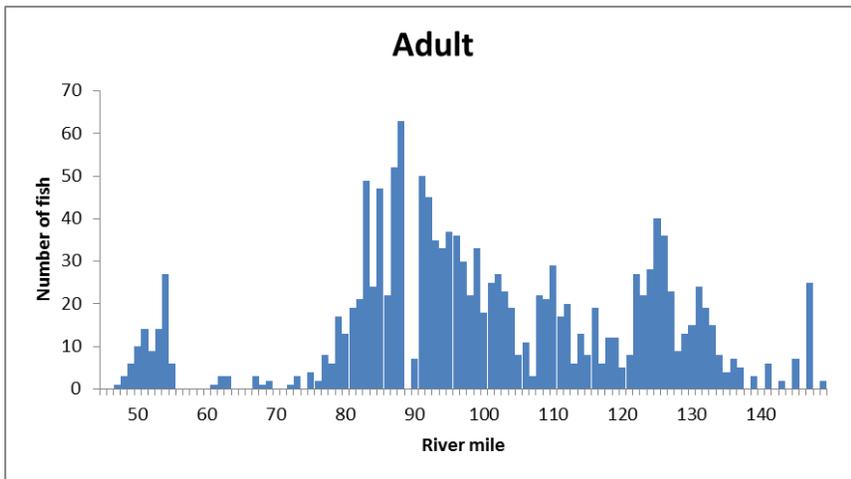
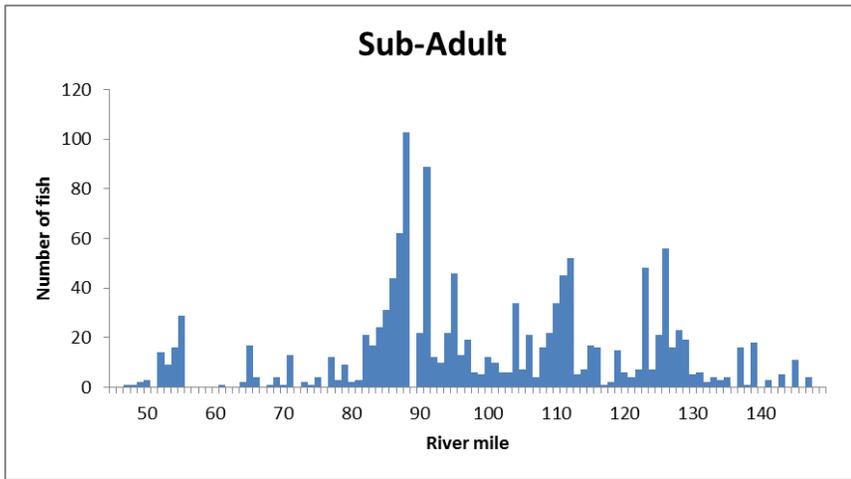
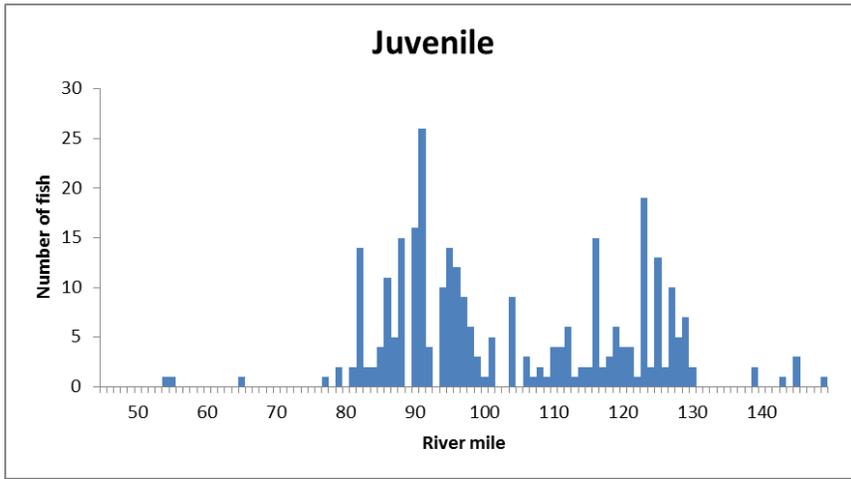


Figure 6—Number of smallmouth bass captured per mile in the middle Yampa River, 2012.