COLORADO RIVER RECOVERY PROGRAM **RECOVERY PROGRAM**
FY 2008 ANNUAL PROJECT REPORT **PROJECT NUMBER: 123b**

I. Project Title: Nonnative fish control in the middle Green River

II. Principal Investigator(s):

Leisa Monroe/Trina Hedrick
Utah Division of Wildlife Resources
Northeast Region
152 East 100 North
Vernal, Utah 84078
Phone: (435) 781-9453 fax: (435) 789-8343
E-mail: leisamonroe@utah.gov
trinahedrick@utah.gov

III. Project Summary:

The Upper Colorado River Endangered Fish Recovery Program has determined that control of nonnative fish in the upper Colorado River basin is essential to the recovery of the four endangered fish species: Colorado pikeminnow, razorback sucker, humpback chub, and bonytail. This determination has been documented specifically for Colorado pikeminnow, razorback sucker, and bonytail in nursery habitats and in the mainstem middle Green River in Section 4.3.2 of each species' Recovery Goals (USFWS 2002) document.

Smallmouth bass abundance has dramatically increased in the Green River since 2000. This increase resulted in a recommendation from the December 2003 Nonnative Fish Control Workshop (Grand Junction, CO) to attempt control of this species in the Green River. Three years of removal, from 2004-2006 and annual Nonnative Fish Control Workshops have added to the knowledge base of the effort required to successfully remove smallmouth bass from the Green River. During the December 2006 workshop, participants discussed the importance of increasing this removal effort and discussed the need for a dramatic increase to be able to adequately suppress the middle Green River smallmouth bass population.

Northern pike are a significant predatory and competitive threat to the endangered fishes and were rated as one of the six nonnative species of greatest concern by experts on the Colorado River native fish assemblage (Hawkins and Nesler 1991). Northern pike became established in the Yampa River in the early 1980's. Originally introduced as game fish in Elkhead Reservoir in 1977, the species escaped and invaded the upper Yampa River and have expanded their number and range within the Yampa and Green rivers; in previous years, there has been evidence of successful spawning in Stewart Lake near Jensen, Utah and in Old Charlie Wash on the Ouray National Wildlife Refuge. A control program for northern pike in the Yampa River was initiated in 1999 and removal

of northern pike in the middle Green River was initiated in 2001. Based on trends in catch rates of subsequent years, removal efforts have been successful at significantly reducing the number of northern pike in the middle Green River. Control efforts since 2003 have resulted in the capture of less than 40 northern pike and as a result, total effort was reduced to only a maintenance level beginning in 2005. Effort in 2008 consisted of the minimal effort needed to keep their numbers under control. Northern pike populations will be monitored (and captured individuals removed) to locate ripe adults and to determine if this lower level of effort is sufficient to minimize threats to endangered and other native fishes.

The purpose of this project is to minimize the expansion of all predatory nonnative fishes, especially smallmouth bass, in the Green River. The objectives to meet this goal are 1) conduct one tagging pass and eleven removal passes for smallmouth bass in the middle Green River from Split Mountain boat ramp (RM 319.3) to the Duchesne River confluence (RM 247.9); 2) maintain low occurrence of adult northern pike in the middle Green River; 3) determine efficiency of smallmouth bass and northern pike removal efforts; 4) calculate an annual population estimate of smallmouth bass in the middle Green River; 5) identify the means and levels of smallmouth bass and northern pike control necessary to minimize the threat of predation/competition on endangered and other native fishes. Additional predatory nonnative fishes removed as bycatch include: green sunfish, black crappie, and walleye. White sucker, which hybridize with native suckers, was also removed during these efforts.

IV. Study Schedule: Initial year - FY - 2008 Final year - FY 2008

V. Relationship to RIPRAP:

GENERAL RECOVERY PROGRAM SUPPORT ACTION PLAN

III. Reduce negative impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).
III.A. Reduce negative interactions between nonnative and endangered fishes.
III.A.2. Identify and implement viable active control measures.
III.A.2.c. Implement and evaluate the effectiveness of viable active control measures.

GREEN RIVER ACTION PLAN: MAINSTEM

III. Reduce impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).
III.A. Reduce negative impacts to endangered fishes from sportfish management activities.
III.A.4. Develop and implement control programs for nonnative fishes in river reaches occupied by the endangered fishes to identify

required levels of control. Each control activity will be evaluated for effectiveness, and then continued as needed.

III.A.4.a. Northern pike in the middle Green River.

VI. Accomplishment of FY 2008 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Task 1. Capture and remove northern pike (UDWR – Vernal; March – April 2008).

Crews spent 44 fyke net nights and 1.9 electrofishing hours sampling for northern pike between 25 March and 15 April 2008. This sampling occurred entirely in Stewart Lake drain, Ashley Creek, Walker Hollow, and a backwater above the Red Wash boat ramp this year. Flows through the sampling period were quite low (around 2000 cfs), which limited the crews' ability to sample in other localities (such as Brush Creek). Crews removed five northern pike during this effort. One pike had a blue Floy tag (tag # 2749). This pike was originally tagged by John Hawkins of Colorado State University at Yampa RM 103.4 (Morgan Gulch) on 15 May 2003. It was 528 mm total length (TL) and 900 g at the time of tagging and 725 mm TL and 2377 g at the time of removal. Another pike had a PIT tag (#53120C6919). This fish was originally captured on 22 April 2004 at Yampa River mile 183.3 by Sam Finney of the U.S. Fish and Wildlife Service. It was 563 mm TL and 1310 g at the time of tagging and 743 mm TL and 2623 g at the time of removal four years later. Most white suckers were removed from Ashley Creek this year and were captured using fyke nets. In contrast, in 2007, most white suckers were captured via electrofishing and were removed from the Stewart Lake drain. Flannelmouth sucker were the only native species encountered during this effort. Fish species captured and the numbers of each are included in Table 1.

Table 1. Fish encountered during early spring fyke netting and electrofishing efforts. Species removed include black crappie, green sunfish, northern pike, and white sucker. All natives and the remaining nonnatives (listed below this table) were returned to the water alive.

	Fyke-netting				Electrofishing/Trammel netting			
	Number	Average Length (mm)	Range (mm)	Effort (#/fyke-net night)	Number	Average Length (mm)	Range (mm)	Effort (#/hour)
Black crappie	2	-	-	0.045	-	-	-	-
Creek chub	2	-	-	0.045	-	-	-	-
Flannelmouth sucker	26	-	-	0.59	-	-	-	-
Green sunfish	1	-	-	0.022	1	-	-	
Northern pike	3	722.67	700 - 743	0.068	2	587.5	535 - 640	1.05
White sucker	329	-	-	7.48	3	-	-	

Other species observed include brown trout, numerous channel catfish, common carp, and black bullhead.

In addition, crews spent 124.97 hours electrofishing for the Colorado pikeminnow abundance estimates in 2008. The first pass of the pikeminnow population estimate began

on 21 April 2008; the last pass for this project ended on 21 May 2008. Nonnatives captured and removed during this project, their average lengths, and their length ranges are included in Table 2. One of the northern pike captured and removed was originally tagged in 2003 in Lake Catamount by Billy Atkinson of the Colorado Division of Wildlife. The fish was 478 mm TL and 710 g when it was tagged and 665 mm and 1618 g when removed from the Split Mountain (RM 319.3) to Red Wash (RM 298.1) reach of the middle Green River.

Table 2. Nonnative fish removed during the Colorado pikeminnow abundance estimates in 2008.

	Number	Average Length (mm)	Range (mm)	Effort (# fish/hour)
Black crappie	2	166.5	163 – 170	0.016
Brown trout	12	238.75	135 – 446	0.096
Green sunfish	12	109.58	70 – 139	0.096
Northern pike	5	576.8	512 – 665	0.040
Rainbow trout	1	185	185	0.008
Smallmouth bass	105	246.88	85 – 590	0.840
Walleye	19	523.73	440 – 680	0.152
White sucker	70	235.33	146 – 430	0.560

Crews spent 50.04 hours electrofishing for the three species tagging pass on the middle Green River. This pass began on 2 June and ended on 21 June 2007. This pass was an effort to tag many of the bluehead and flannelmouth suckers in the middle Green River since there is no other project that does this. Nonnatives removed during this project, their average lengths, and the ranges of their lengths are included below in Table 3.

Table 3. Nonnative fish removed during the three species tagging pass in 2008.

	Number	Average Length (mm)	Range (mm)	Effort (# fish/hour)
Brown trout	1	320	320	0.020
Green sunfish	1	75	75	0.020
Walleye	6	510.5	453-625	0.120
White sucker	14	327.5	280-456	0.280

Task 2. Eleven smallmouth bass collecting passes from Split Mountain boat ramp to Duchesne River (UDWR – Vernal; June – October 2008).

Electrofishing was the primary gear type used to collect smallmouth bass for the mark recapture abundance estimate. Twelve complete shoreline electrofishing passes were completed. On the first electrofishing pass, smallmouth bass were marked with red Floy® tags and the left pectoral fin was clipped for a tag retention study. On the remaining eleven passes, smallmouth bass were examined for tags and marks and removed from the river.

Crews spent 420 hours electrofishing for smallmouth bass between 2 June and 24 October 2008. Nonnative numbers excluding bass, average lengths for each species, and effort expended to collect these species are included in Table 4.

Table 4. Nonnative fish removed during the SMB removal project 2008.

	Number	Average Length (mm)	Range (mm)	Effort (#fish/hour)
Black crappie	21	189.6	75-260	.05
Bluegill	3	143.3	90-209	.007
Brown trout	25	170.4	101-457	.06
Creek chub	1	125	125	.002
Gizzard shad	6	428.2	413-448	.01
Green sunfish	364	75.6	32-187	.87
Northern pike	15	669	370-1016	.04
Rainbow trout	6	385.8	95-535	.01
Walleye	15	498.7	455-538	.04
White sucker	112	196.8	50-465	.27

An initial population estimate for both juvenile and adult bass was obtained by calculating a two-pass Lincoln-Peterson estimate (Table 5). A total of 91 smallmouth bass were tagged using red Floy® tags on the first electrofishing pass. A total of 508 smallmouth bass were captured on the second pass and examined for marks, five of these were recaptures.

Table 5. Original population estimate for juvenile and adult SMB 2008.

Juvenile Bass (<200 mm)			**Adult Bass (≥ 200 mm)**
M=	**37**		**54**
C=	**382**		**126**
R=	**2**		**3**
N=	**4723.667**		**1778**
95% upper	**9428.797**		**3343.047**
95% lower	**18.53585**		**212.9528**
Standard Error	**2352.565**		**782.5236**
CV	**49.8038**		**44.01145**
Variance V(N)=	5534564		612343.2
+/-2*(SE)	4705.131		1565.047

A population estimate corrected for fish recruiting into the adult size class is included in Table 6. A growth rate of 4mm every 10 days was used to account for this recruitment.

Table 6. Corrected population estimate for juvenile and adult SMB 2008.

Juvenile Bass (<200 mm)			**Adult Bass (≥ 200 mm)**
M=	**37**		**54**
C=	**387**		**121**
R=	**2**		**3**
N=	**4915**		**1678**
95% upper	**9810.296**		**3153.1**
95% lower	**19.03687**		**201.9001**
Standard Error	**2447.815**		**737.7999**
CV	**49.80633**		**43.98211**
Variance V(N)=	5991798		544348.8
+/-2*(SE)	4895.63		1475.6

The original and corrected exploitation rates were calculated for 2008. Table 7 includes the original population estimate and exploitation rates not corrected for recruitment and in Table 8, the population estimate and exploitation rates have been corrected for the 4mm of growth every 10 days.

Table 7. Original exploitation rates 2008.

PASS	**Juvenile Bass (<200mm) Pop Est = 4723**		**Adult Bass (≥200mm) Pop Est = 1778**	
	# Tagged/Removed	**% of Estimate**	**# Tagged/Removed**	**% of Estimate**
1	**40**	**.85%**	**54**	**3.04%**
2	**382**	**8.1%**	**126**	**7.1%**
3	**283**	**6.0%**	**62**	**3.5%**
4	**160**	**3.4%**	**57**	**3.2%**
5	**199**	**4.2%**	**69**	**3.9%**
6	**364**	**7.7%**	**76**	**4.3%**
7	**308**	**6.5%**	**100**	**5.6%**
8	**335**	**7.1%**	**186**	**10.5%**
9	**234**	**5.0%**	**96**	**5.4%**
10	**91**	**1.9%**	**62**	**3.5%**
11	**133**	**2.8%**	**80**	**4.5%**
12	**45**	**.95%**	**55**	**3.1%**
Total	**2574**	**54.50%**	**1023**	**57.64%**

Table 8. Corrected exploitation rates 2008.

PASS	Juvenile Bass (<200mm) Pop Est = 4915		Adult Bass (≥200mm) Pop Est = 1678	
	# Tagged/Removed	% of Estimate	# Tagged/Removed	% of Estimate
1	40	.81%	54	3.2%
2	387	7.9%	121	7.2%
3	291	5.9%	54	3.2%
4	163	3.3%	54	3.2%
5	210	4.3%	58	3.5%
6	382	7.8%	58	3.5%
7	329	6.7%	79	4.7%
8	440	9.0%	81	4.8%
9	287	5.8%	43	2.6%
10	124	2.5%	29	1.7%
11	170	3.5%	43	2.6%
12	71	1.4%	29	1.7%
Total	2894	58.91%	703	41.9%

A population estimate was calculated in 2007 for the smallmouth bass removal effort. This effort consisted of 9 passes from Split Mountain boat ramp to the mouth of the Duchesne River (Table 9).

Table 9. Population estimate for juvenile and adult SMB 2007.

Juvenile Bass (< 200 mm)			Adult Bass (≥ 200 mm)
M=	68		54
C=	583		151
R=	1		4
N=	20,148		1,672
95% upper	43,373		3,014
95% lower	3,077		329
Standard Error	11612.518		671.27044
CV	57.64%		40.15%
Variance V(N)=	134,850.564		450,604
+/- 2*(SE)	23225.035		1342.5409

The original and corrected exploitation rates for 2007 are shown in Table 10 and 11, respectively. A growth rate of 5mm every 11 days was used to account for the recruitment in 2007. Compared with 2007, 2008 saw an increase in the exploitation of juvenile smallmouth bass.

Table 10. Original exploitation rates 2007.

PASS	Juvenile Bass (< 200mm) Pop Est = 20,148		Adult Bass (≥ 200mm) Pop Est = 1672	
	# Tagged/Removed	% of Estimate	# Tagged/Removed	% of Estimate
1	68	.34%	54	3.22%
2	583	2.89%	151	9.03%
3	409	2.03%	94	5.62%
4	804	3.99%	110	6.6%
5	1089	5.40%	230	13.8%
6	881	4.37%	177	10.6%
7	1010	5.01%	114	6.81%
8	881	4.37%	78	4.67%
9	17	0.08%	12	0.72%
Total	5742	28.14%	1020	57.85%

Table 11. Corrected exploitation rates 2007.

PASS	Juvenile Bass (< 200mm) Pop Est = 20,873		Adult Bass (≥ 200mm) Pop Est = 1411	
	# Tagged/Removed	% of Estimate	# Tagged/Removed	% of Estimate
1	68	.33%	54	3.8%
2	604	2.9%	130	9.2%
3	427	2.0%	76	5.4%
4	833	4.0%	81	5.7%
5	1179	5.6%	140	9.9%
6	961	4.6%	97	6.9%
7	1080	5.2%	44	3.1%
8	926	4.4%	33	2.3%
9	22	.10%	7	.50%
Total	6100	29.13%	662	46.80%

A population estimate was calculated in 2004 for the smallmouth bass removal effort. This effort consisted of 4 passes from Split Mountain boat ramp to the Sandwash boat ramp (Table 12).

Table 12. Population estimate for juvenile and adult SMB 2004.

Juvenile Bass (< 200 mm)			**Adult Bass (≥ 200 mm)**
M=	**114**		**181**
C=	**241**		**215**
R=	**2**		**3**
N=	**9277**		**9828**
95% upper	**18495**		**18536**
95% lower	**57**		**1119**
Standard Error	**4609.494**		**4354.329**
CV	**49.69%**		**44.31%**
Variance V(N)=	21247432		18960178
+/- 2*(SE)	9218.987		8708.657

No population estimates were calculated in 2005 or 2006 due to a lack of recaptures.

Based on the original population estimates for 2004, 2007 and 2008, the number of individuals per river mile was calculated. In 2004, 130 juvenile smallmouth bass and 138 adult smallmouth bass per river mile was estimated. In 2007, 282.2 juvenile smallmouth bass per river mile and 23.4 adult smallmouth bass per river mile were estimated and in 2008, 66 juvenile smallmouth bass and 25 adult smallmouth bass per river mile were estimated**.**

Catch rates for the entire reach, all passes combined, were calculated for 2004-2008 smallmouth bass removal effort (Table 13). Years 04-06 include 4 passes from Split Mountain boat ramp to the Sandwash boat ramp, year 07 includes 9 passes from Split Mountain boat ramp to the Duchesne River and year 08 includes 12 passes from Split Mountain boat ramp to the Duchesne River.

Table 13. Catch rates for SMB.

Year	04	05	06	07	08
CPUE (fish/hour)	9.33	4.02	4.71	26.04	6.13

Catch rates during each pass along with the number of smallmouth bass caught during each pass and the total caught for all passes for 2008 are shown in Table 14.

Table 14. Catch rates for SMB during each pass for 2008.

	Effort (hours)	Captures	CPUE (fish/hour)
Pass	08	08	08
1	42.8	94	2.19
2	42.9	508	11.8
3	42.4	345	8.14
4	37.4	217	5.80
5	32.8	268	8.17
6	32.2	440	13.7
7	46.8	408	11.8
8	30.1	521	17.3
9	33	330	10
10	26.4	153	5.8
11	27.3	213	7.8
12	25.3	100	4.0
Total	420	3597	

The number of marked and recaptured smallmouth bass for each pass for 04-08 is shown in Table 15. In the tag retention study in 2007, 6 out of the 22 recaptured smallmouth bass had a pit tag but no Floy® tag, demonstrating some issues with tag retention. In 2008, no smallmouth bass were captured that had a fin clip but no Floy® tag.

Table 15. Number of tagged and recaptured SMB per pass 2004-2008.

	Number tagged					Recaptures				
Pass	04	05	06	07	08	04	05	06	07	08
1	295	315	98	122	91	0	0	0	0	0
2	-	-	-	-	-	5	0	1	5	5
3	-	-	-	-	-	23	0	0	1	4
4	-	-	-	-	-	19	0	0	0	1
5				-	-				9	1
6				-	-				3	2
7				-	-				2	0
8				-	-				2	0
9				-	-				0	2
10					-					1
11					-					0
12					-					0
Total	295	315	98	122	91	47	0	1	22	16

Movement of marked smallmouth bass was seen both upstream and downstream from the Ouray section. In 2004, 2 marked bass from the Ouray reach were found in the Desolation stretch of the Green River and in 2005, 3 marked bass from the Yampa River were caught in the Ouray section. In 2006, three marked bass from the Ouray reach were found in the Yampa River and in 2008, 3 smallmouth bass from the Echo Park area were recaptured in the Ouray reach.

Length frequency distribution shows the presence of multiple year classes including young–of-the-year throughout the study reach. A larger proportion of juvenile smallmouth bass were collected during 2007 than any other year of the removal project. (Figure 1).

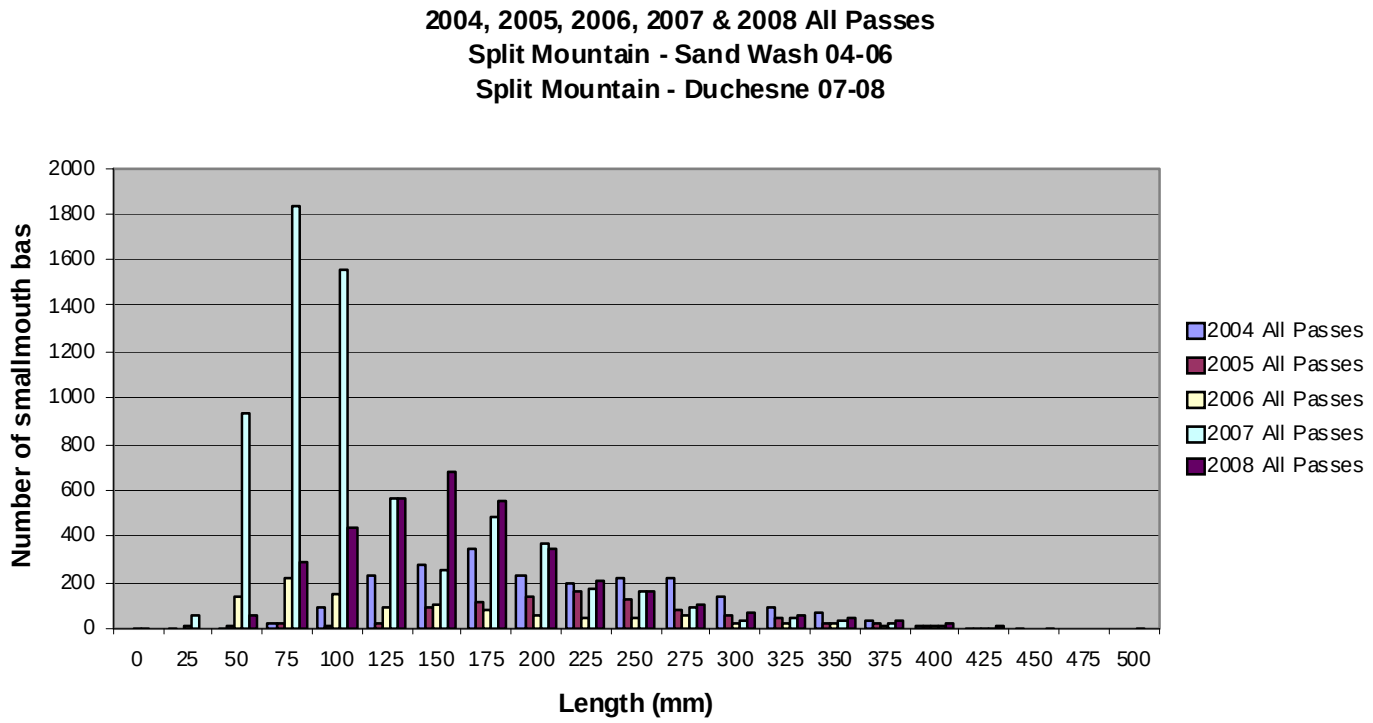

Figure 1. Length frequency distribution of smallmouth bass collected on all passes in the middle Green River: 2004, 2005, 2006, 2007 & 2008.

Concentration areas were determined by plotting the GPS coordinates of where each smallmouth bass was captured (Figure 2). Smallmouth bass were distributed throughout the study reach in 2008.

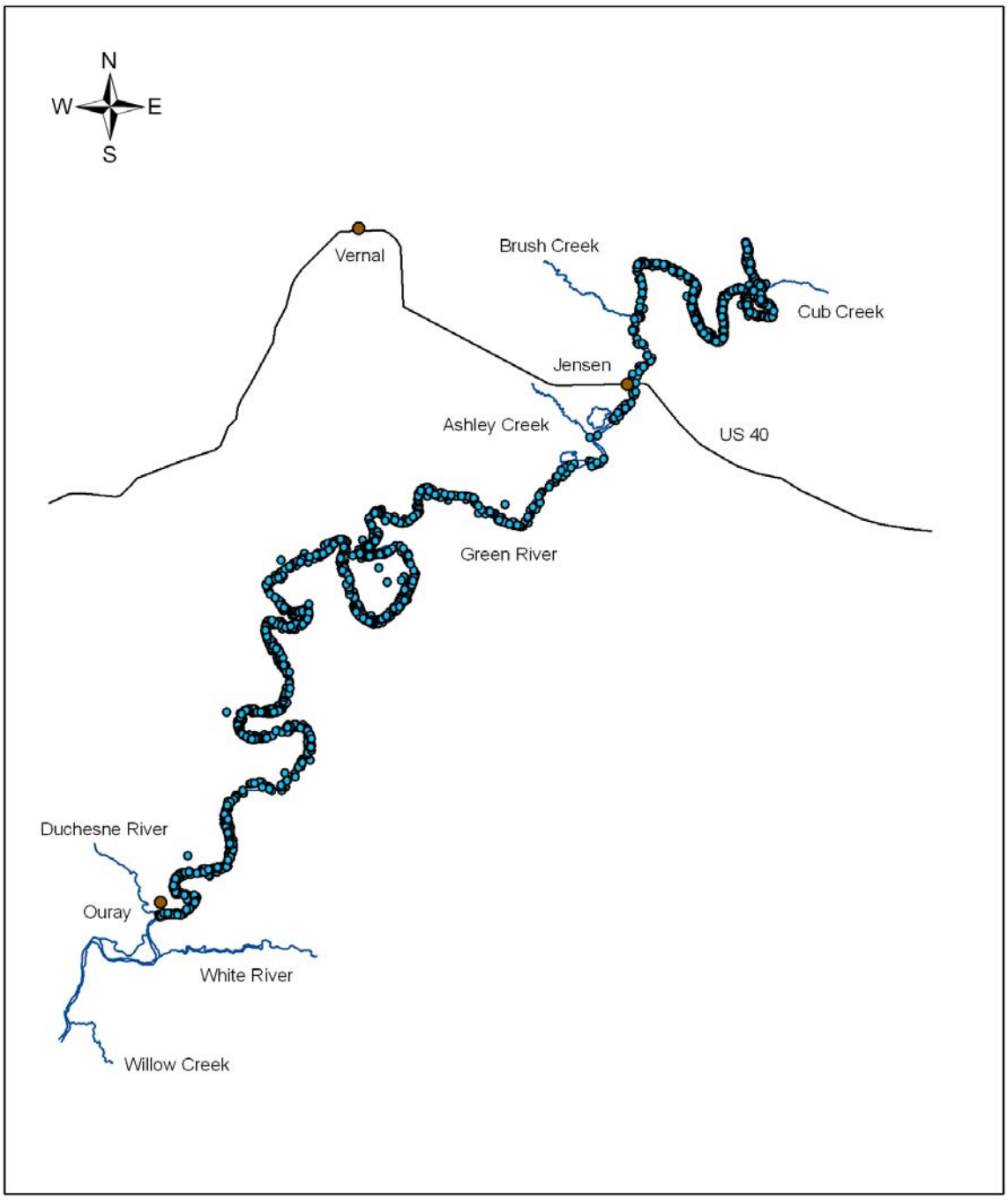

Figure 2. Concentration areas of smallmouth bass 2008.

Task 3: Data Management, Analysis, and Reporting

Annual RIP Report (Nov 2008)

VII. Recommendations:

- Focus effort on concentration areas

VIII. Project Status:

Ongoing

IX. FY 2008 Budget Status

A. Funds Provided: $119,755
B. Funds Expended: $119,755
C. Difference: $0
D. Percent of the FY 2008 work completed, and projected costs to complete: 100%
E. Recovery Program funds spent for publication charges: $0

XI. Signed: _____
Principal Investigator Date

XII. Literature Cited

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U.S. Fish and Wildlife Service. 2002. Colorado pikeminnow (*Ptychocheilus lucius*) recovery goals: amendment and supplement to the humpback chub recovery plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

U.S. Fish and Wildlife Service. 2002. Razorback sucker (*Xyrauchen texanus*) recovery goals: amendment and supplement to the humpback chub recovery plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

U.S. Fish and Wildlife Service. 2002. Bonytail (*Gila elegans*) recovery goals: amendment and supplement to the humpback chub recovery plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.