COLORADO RIVER RECOVERY PROGRAM
FY 2009 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: 144

I. Project Title:
Native fish response to nonnative fish control in the middle Green River, Utah.

II. Principal Investigator:

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III. Project Summary:

Control actions targeting nonnative gamefish species are being evaluated across the upper Colorado River Basin to determine the level of reduction necessary to minimize the threat to the recovery of the endangered Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*), and bonytail (*Gila elegans*). There are two key aspects to evaluating nonnative fish control: (1) can the abundance of target species be reduced to an acceptable level (i.e., for the persistence of native fishes) by the approaches employed, and (2) is there a measurable positive response by populations of endangered fish and other native species?

Given the preliminary stage of nonnative fish control evaluations and the confinement to select river reaches, the first observed positive response will likely be evident in early life-stages of the native fish community (Bestgen et al. 2007a), such as bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*), roundtail chub (*Gila robusta*), and speckled dace (*Rhinichthys osculus*). An adult response to nonnative removal may not be detectable initially for a number of reasons, one of which is the large home range of adults (UDWR 2006). Likewise, a positive response by adult endangered species may be more difficult to measure statistically without a longer observational period due to generation times of endangered fish populations (e.g., Bestgen et al. 2007b). Data necessary for these analyses will be generated by current and future young-of-year (YOY) sampling and population estimation projects for endangered species in conjunction with nonnative fish removal efforts.

This project will focus on determining the response of early life-stages of native and small-bodied fish to removal of nonnative predators, primarily smallmouth bass (*Micropterus dolomieu*) and northern pike (*Esox lucius*), which are being removed from the Green River between Island Park and the confluence with the Duchesne River.

Removal efforts for northern pike began in 2001 and have kept numbers of northern pike at low levels in this reach. This work was originally contained within project #109, but was subsumed under project #123b in 2007. Smallmouth bass removal began in 2004 with one marking pass and three removal passes. This effort (project #123b) continued through 2006, but was increased to include eight removal passes in 2007 and eleven removal passes in 2008 and 2009. Native and small-bodied fish will serve as indicators of the response that would be experienced by endangered fish species occupying the same habitats.

IV. Study Schedule: 2005 – 2010

V. Relationship to RIPRAP:

Green River Action Plan: Mainstem
III. Reduce negative impacts of nonnative fishes and sportfish management activities (Nonnative and sportfish management)

> III.A.2.c. Evaluate the effectiveness (e.g., nonnative and native fish response) and develop and implement an integrated, viable active control program.

VI. Accomplishment of FY 2009 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Objective 1: Estimate response of small-bodied native fish to removal of northern pike and smallmouth bass in the middle Green River.

Beginning this year, the field work for this project was subsumed under the YOY Colorado pikeminnow monitoring project. You can see specific information relating to the field studies by referring to annual report for project #138.

Table 1 includes abundance and catch-per-unit-effort (CPUE; fish/100m^2) for all native fish from 2005 to 2009. Table 2 has the same information, but for all nonnative fish captured during this effort. Information is included from all three backwaters sampled in each five-mile sub-reach. Fathead minnow (*Pimephales promelas*), red shiner (*Cyprinella lutrensis*), and sand shiner (*Notropis stramineus*) values include only numbers gathered during the first seine haul of each backwater. Catch rates for all YOY natives (except speckled dace) increased over the study period, largely due to results in 2009. Catch rates for most YOY nonnatives (except carp [*Cyprinus carpio*] and green sunfish [*Lepomis cyanellus*]) decreased over the study period, although there is high variation between years. Catch rates of the most plentiful nonnatives (fathead minnow, red shiner, sand shiner) were highest in 2006 and 2007, but were comparatively quite low in 2008 and 2009.

Table 1. Total numbers and (CPUE) (fish/100m^2), by species for native fish captured in backwater habitats of the middle Green River from 2005 to 2009 in fall sampling.

	Year				
Species	2005 29 Sept-18 Oct	2006 13 Sept-3 Oct3	2007 24 Sept-5 Oct	2008 22 Sept-2 Oct	2009 22 Sept-1 Oct
Bluehead sucker	6 (0.06)	2 (0.02)	29 (0.32)	15 (0.19)	57 (0.53)
Chub (*Gila* spp.)	29 (0.27)	-	-	3 (0.04)	5 (0.05)
YOY Colorado pikeminnow	55 (0.51)	5 (0.06)	9 (0.10)	20 (0.26)	641 (5.93)
Juvenile Colorado Pikeminnow	2 (0.02)	-	1 (0.01)	-	1 (0.01)
Flannelmouth sucker	25 (0.23)	18 (0.17)	35 (0.38)	21 (0.27)	103 (0.96)
Roundtail chub	-	-	4 (0.04)	-	37 (0.35)
Speckled dace	3 (0.03)	-	-	-	2 (0.02)

Table 2. Total number and (CPUE) (fish/100m^2) by species for small-bodied nonnative YOY fish caught in backwater habitats of the middle Green River from 2005-2009. In 2006, many shiners were too small to identify (n = 12,030 and were not included in this table).

	Year				
Species	2005	2006	2007	2008	2009
Black crappie	105 (0.97)	26 (0.29)	45 (0.49)	61 (0.79)	15 (0.14)
Black bullhead	1 (0.01)	9 (0.10)	24 (0.29)	21 (0.27)	3 (0.03)
Bluegill	-	3 (0.03)	1 (0.01)	-	-
Brown trout	-	21 (0.24)	-	-	-
Channel catfish	8 (0.07)	-	24 (0.26)	7 (0.09)	2 (0.02)
Carp	46 (0.42)	180 (2.03)	47 (0.51)	221 (2.86)	382 (3.56)
Fathead minnow	1849 (25.6)	4356 (77.18)	1089 (24.48)	603 (19.63)	875 (19.3)
Gizzard shad	-	51 (0.47)	159 (1.73)	27 (0.35)	29 (0.27)
Green sunfish	38 (0.35)	24 (0.27)	23 (0.25)	436 (5.63)	213 (1.99)
Plains killifish	-	-	-	1 (0.01)	-
Red shiner	38,705 (535.7)	84,937 (1504.9)	13,124 (295.0)	2787 (90.72)	6199 (136.7)
Sand shiner	12,113 (167.7)	7083 (125.5)	11,590 (260.57)	2058 (66.99)	892 (19.7)
Smallmouth bass	7 (0.06)	5 (0.05)	27 (0.29)	7 (0.09)	2 (0.02)
White sucker	48 (0.44)	11 (0.12)	50 (0.54)	56 (0.72)	22 (0.21)

Table 3 contains information on native fish captures both above and below the White River. By considering the reaches above and below the confluence separate, we can examine the relative contribution of native fish from the upper Green River versus those fish that originate in the White River. In order to address if larval flannelhead sucker, bluehead sucker, and roundtail chub drift down river and if there is a difference in the relative contribution from the upper Green River versus the White River, we sampled backwaters located on the Green River above and below the confluence with the White River. Because more backwaters are located above the confluence than below, we would expect to see 23% of all bluehead and flannelmouth sucker captures below the White River and 77% above the White River. We are hypothesizing that if we see a deviation from this proportion, we will be able to determine the relative contribution of the White River population relative to the Green River population. This should be especially obvious for the unlisted native species, not necessarily the Colorado pikeminnow (which has never been known to spawn in the White River). What we see is that over the course of the study, the Green River spawning population of *Gila* spp. (coming from Yampa Canyon or Whirlpool Canyon?) is much more important than any drift coming down from the White River. YOY roundtail chub were observed in the White River during separate surveys conducted by the Utah Division of Wildlife Resources in 2009. The presence of YOY in the White River may suggest that roundtail chub may spend more time in the White River, rather than drifting to the Green River. Future life-history studies should examine differences in larval drift distances between fish spawned in the Green River versus those spawned in the White River.

For flannelmouth and bluehead sucker, our hypothesis is that bluehead sucker are drifting down from both the White River and from upriver in the Green River. Over the period of study, bluehead sucker captures above the White River increased steadily relative to captures of suckers below the White River. The same may be true for flannelmouth sucker, although we did observe a decrease in 2008. Although we did find some evidence to support the hypothesis that flannelmouth and bluehead suckers drift downstream as larvae or YOY, further studies should address this question, and future research should then focus on the potential reasons for the difference in relative contribution from the upper Green River versus the White River (i.e., removal of smallmouth bass, habitat changes, flow changes?).

The trend for pikeminnow is somewhat interesting, even if results do not suggest the same mechanism. While one YOY Colorado pikeminnow (TL = 43 mm) was confirmed in the White River (RM 65.7) on 28 Sept 2009 by UDWR biologists, the White River YOY contribution is never likely a large component of the Green River YOY population. This is the first YOY pikeminnow ever observed in the White River, suggesting that spawning may occur in this river. It is more likely that habitat was better for pikeminnow below the White River in 2006-2008 and is only improving in 2009 for a currently unknown reason.

Table 3. Percentage of total number of each species captured above and below the White River confluence by year.

Species	Year	Percent of capture found below the White River	Percent of capture found above the White River	Total number captured	Percent of total effort below the White River	Percent of total effort above the White River
Bluehead sucker	2005	100%	0%	4	23%	77%
	2006	100%	0%	2		
	2007	56%	44%	27		
	2008	20%	80%	15		
	2009	8%	92%	57		
Gila Spp.	2005	10%	90%	4		
	2006	0%	0%	0		
	2007	33%	67%	3		
	2008	0%	100%	3		
	2009	5%	95%	42		
Colorado pikeminnow	2005	36%	64%	55		
	2006	100%	0%	5		
	2007	60%	40%	10		
	2008	90%	10%	20		
	2009	28%	72%	641		
Flannelmouth sucker	2005	48%	52%	25		
	2006	11%	89%	18		
	2007	10%	90%	40		
	2008	24%	76%	21		
	2009	6%	94%	103		

Figures 1-4 show length frequencies for all YOY native fish captured over the course of the study, except speckled dace. Not enough speckled dace were captured to warrant a figure. In addition, no juvenile pikeminnow are included. Length distributions are not extremely different across years, with the exception of 2007, the lowest flow year during the study. Bluehead sucker, flannelmouth sucker, and Colorado pikeminnow were overall larger during YOY studies in 2007.

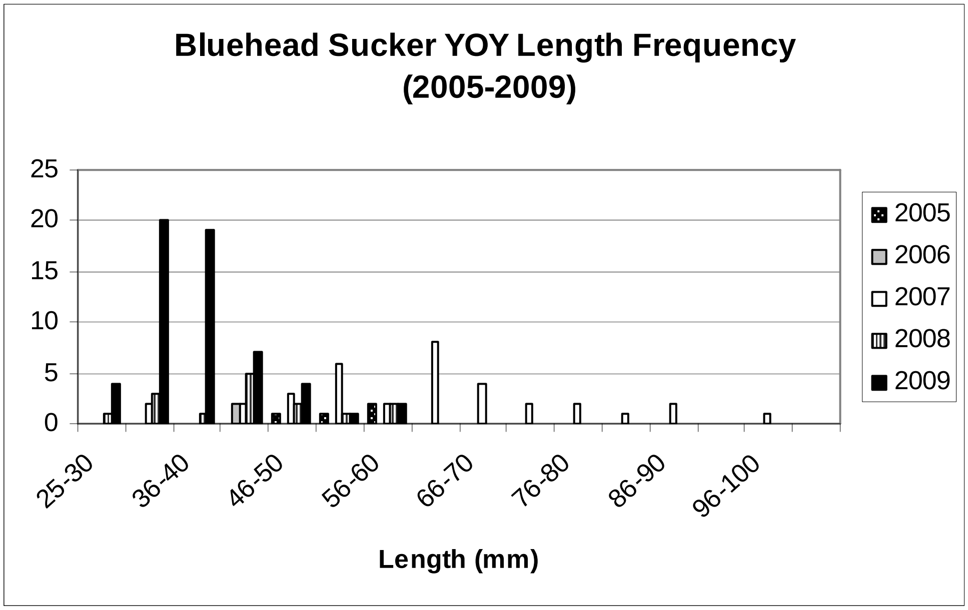

Figure 1. Length frequencies for all bluehead suckers captured during the 2005-2009 Young-of-Year (YOY)/Native Fish Response sampling effort.

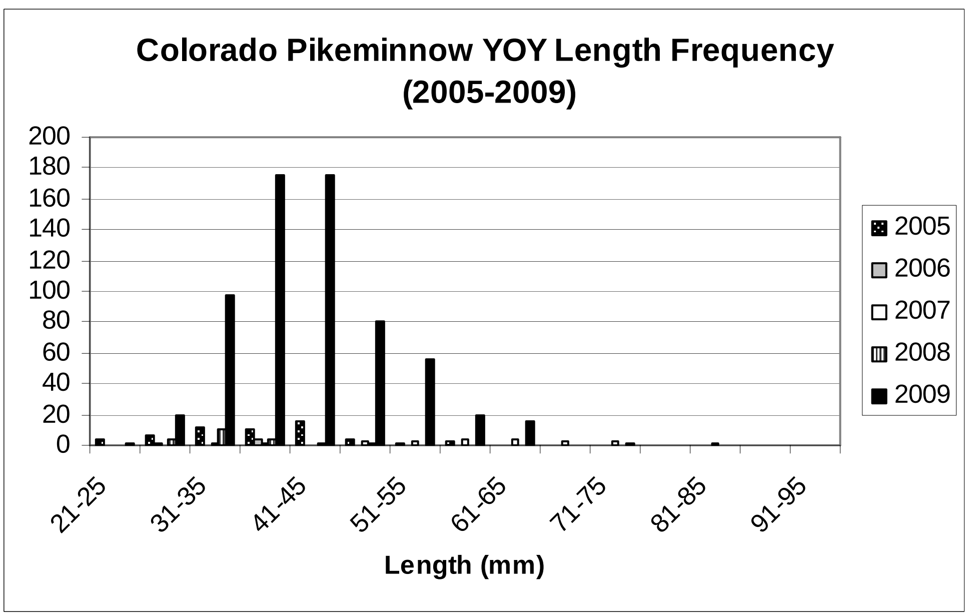

Figure 2. Length frequencies for all Colorado pikeminnow captured during the 2005-2009 YOY/Native Fish Response sampling effort.

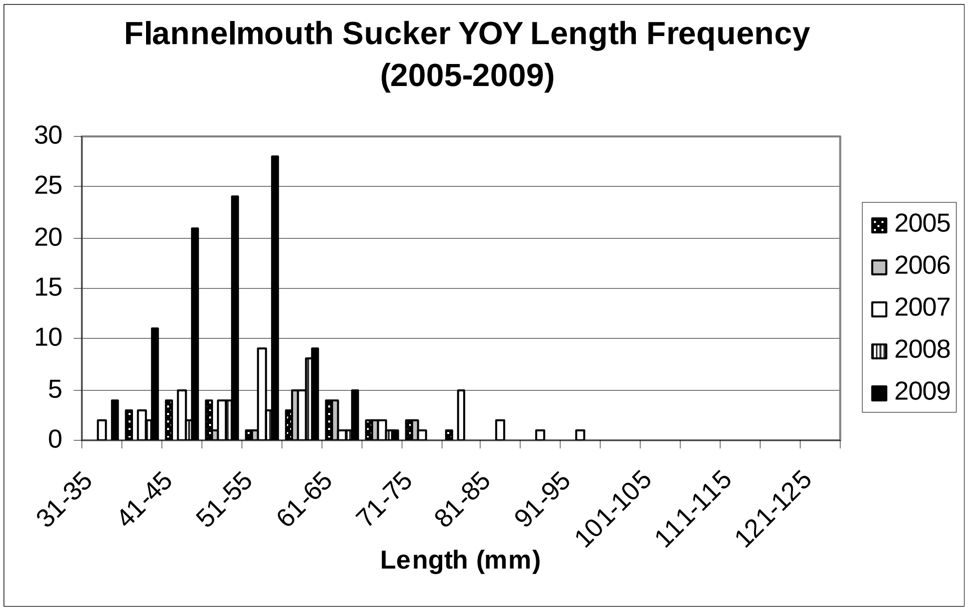

Figure 3. Length frequencies for all flannelmouth suckers captured during the 2005-2009 YOY/Native Fish Response sampling effort.

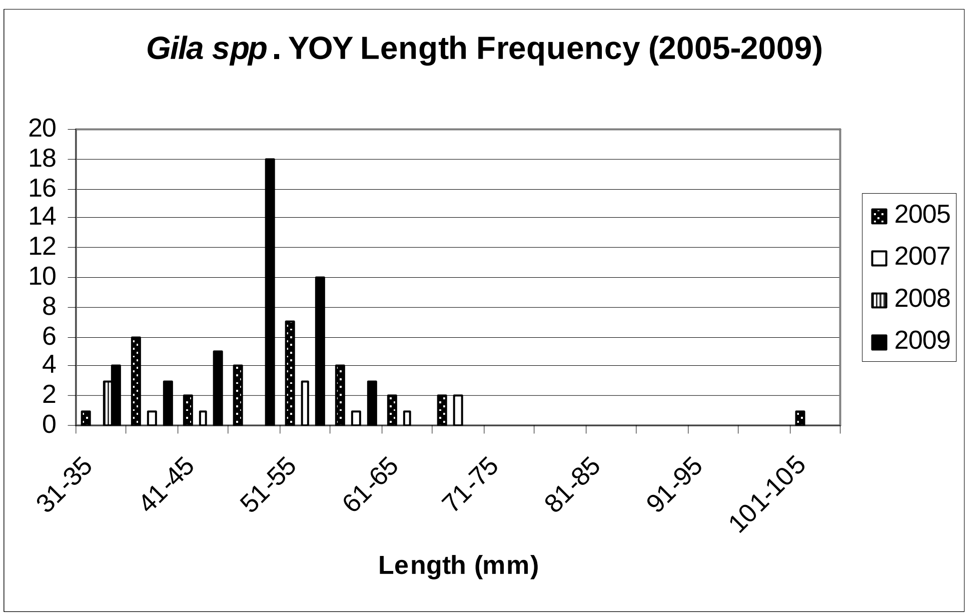

Figure 4. Length frequencies for all *Gila* spp. captured during the 2005-2009 YOY/Native Fish Response sampling effort.

The next step in evaluating native fish response to nonnative fish removal, is to view electrofishing effort (total and average by pass), average smallmouth bass catch rates, smallmouth bass population estimates, and estimates of smallmouth bass per mile to determine if any can be correlated with native fish catch rates. Unfortunately, even with a very positive response year for native fish, no relationship could be concluded. Average smallmouth bass catch rates were highest in 2007, but were not significantly different in any other year of the study, including 2009 (Figure 5). Average effort by year was significantly higher in 2006, the year with the lowest catch rate for native fish, but no other differences were detected (Figure 6). And while total electrofishing effort did increase from 2005 to 2009, 2008 effort was greater than 2009 (due to the pikeminnow abundance estimates; significance unknown), suggesting that this is not likely the reason for the increase in native fish catch rates. Finally, population estimates for smallmouth bass were examined over the course of the study and converted to fish/mile. Not enough recaptures were available in 2005 or 2006 for a population estimate; however, from 2007 to 2009, the population estimate for adult bass increased, as did the estimate of bass per mile. The difference is not likely significant (2007 = 22.9 fish/mile; 2008 = 22.4 fish/mile; 2009 = 25.9 fish/mile), but neither is it likely a major factor in the increase in native fish observed during the study in 2009.

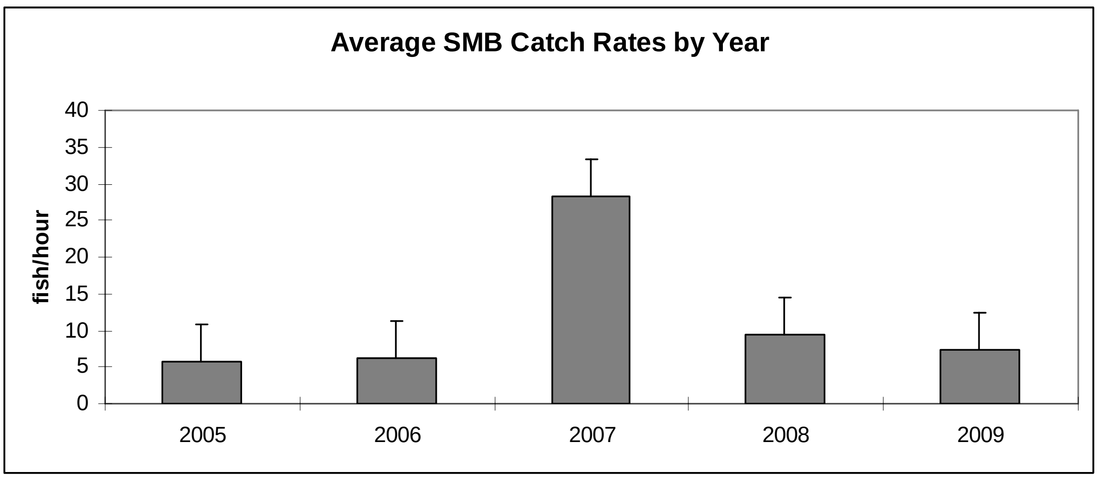

Figure 5. Catch rates of smallmouth bass captured and removed only (not captured and tagged) during smallmouth bass removal efforts during project #123b. 2005 and 2006 are potentially confounded due to lower effort and a focus of effort during slower catch rate times (i.e., summer).

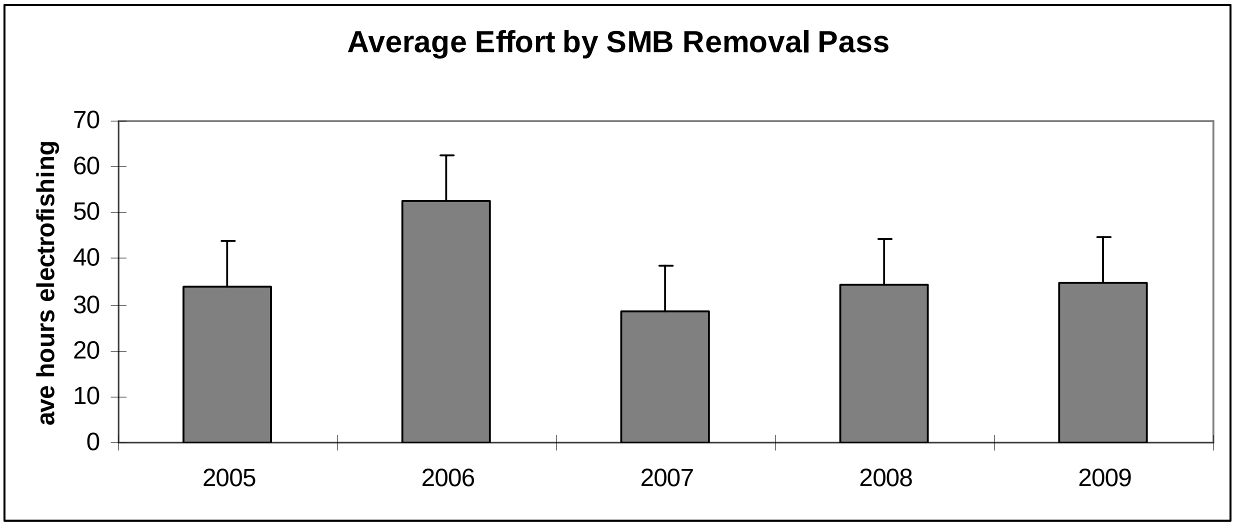

Figure 6. Average number of hours spent electrofishing for smallmouth bass removal by year. Effort expended includes only those passes spent on removal.

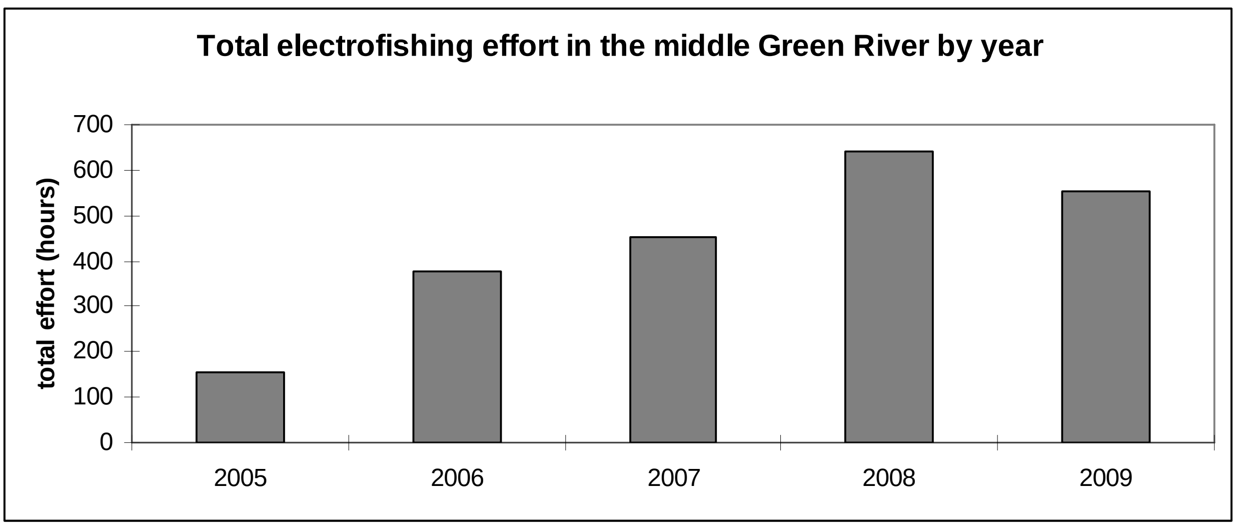

Figure 7. Total electrofishing effort for all activities in the middle Green River (includes pikeminnow abundance estimates, three species activities, etc.).

VII. Recommendations:

- Continue this research (under project #138) and others intended to determine whether we can affect numbers of YOY in the middle Green River or whether environmental variables play a larger role.

VIII. Project Status: on track and ongoing

IX. FY 2009 Budget Status

A. Funds Provided: $15,904
B. Funds Expended: $15,904
C. Difference: $0
D. Percent of the FY 2009 work completed, and projected costs to complete: 100%
E. Recovery Program funds spent for publication charges: $0

X. Status of Data Submission: Data will be submitted to database manager January 2008.

XI. Signed: Trina Hedrick — November 6, 2009
Principal Investigator — Date

XII. References

Carpenter, J. and G.A. Mueller. 2008. Small nonnative fishes as predators of larval razorback suckers. The Southwestern Naturalist 53(2): 236-242.