

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

II. Principal Investigator:

Trina Hedrick/Leisa Monroe
Utah Division of Wildlife Resources
Northeast Regional Office
152 East 100 North
Vernal, Utah 84078
435-789-3103/(fax) 435-789-8343
trinahedrick@utah.gov
leisamonroe@utah.gov

III. Project Summary:

Control actions targeting nonnative gamefish species are being evaluated across the Upper Basin to determine the level of reduction in abundance of these species necessary to minimize the threat to the recovery of the endangered Colorado River fishes. There are two key aspects to evaluating control of nonnative fishes: (1) can the abundance of the target species be reduced significantly by the approaches employed, and (2) is there a measurable positive response by populations of the endangered fish species and associated native fish community?

Given the preliminary stage of nonnative fish control evaluations and the confinement to select river reaches, the most likely first observed positive response will be evident in early life-stages of the native fish community (e.g. flannelmouth and bluehead sucker, roundtail chub, and speckled dace). Adult response will not be observed for several years following any significant removal. Also, a response may not be observed because of the large ranging area of adults. A positive response in endangered fish species may be more difficult to measure statistically without a longer time frame for observation due to generation times within endangered fish populations. Data necessary for these analyses will be generated by current and future young-of-year sampling and population estimation projects for these endangered species in conjunction with nonnative fish removal efforts.

This project will focus on determining a response of early life-stages of native and small-bodied fishes to removal of nonnative predators, primarily smallmouth bass and northern pike. These fish will serve as indicators of the response that would be experienced by endangered fish species occupying the same habitat types, if their numbers were high enough to detect such a response. This project is slated to continue through FY2008.

IV. Study Schedule: 2005 – 2008

IV. 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 2007 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Objective 1: Implement removal of northern pike from Island Park to Sand Wash and smallmouth bass from Split Mountain to Sand Wash (the Duchesne River beginning in 2007).

Removal of northern pike in the middle Green River began in the spring of 2001 from Island Park to Sand Wash (Project # 109); however, through experimentation, crews discovered that the concentration areas for northern pike seemed to be between Split Mountain and Ashley Creek (thus, most effort has re-located to this stretch).

Smallmouth bass removal was initiated in early June 2004 beginning at Split Mountain to Sand Wash (Project # 123) and continued unchanged through 2006. However, in 2007, due to recommendations from the Nonnative Removal Workshop held in Grand Junction, CO the previous December, smallmouth bass removal efforts intensified (increased from four passes to 10 passes) from Split Mountain to the Duchesne River. No smallmouth bass removal was done downstream of the Duchesne River.

Objective 2: Assess abundance of northern pike and smallmouth bass in the middle Green River to determine removal effect.

All northern pike captured from Island Park to Sand Wash were initially removed only during northern pike removal efforts (which began in 2001). Since the initiation of the project, catch rates have declined substantially. In 2001, 248 northern pike were removed from the middle Green River and with approximately the same effort in 2003, only 22 were captured and removed. This numbers appears to be steady as 19 fish were captured and removed in 2007 (most of these, however, during other projects). Catch-per-effort has been used each year to estimate annual abundance of northern pike in the middle Green River. Because we reduced our effort from 2006 and 2007, but caught nearly the same number of northern pike in early spring removal efforts, our catch-per-effort returned to 2001 levels; however, this increase is likely nothing to be concerned about because it equates to only four fish. The remaining 15 fish were captured during other

efforts in the middle Green River.

From 2004 to 2006, capture-recapture abundance estimates were planned for smallmouth bass each year by completing one tagging pass and three removal passes from Split Mountain (RM 318) to Sand Wash (RM 215). However, our recapture rates were too low in 2005 and 2006, which made an abundance estimate impossible to calculate. We did attempt a depletion estimate over the entire three years; however, we are unsure of the amount of immigration/emigration in this stretch of river and thus we cannot be sure of the accuracy of the depletion estimate.

In 2007, we had six recaptures and were able to do a population estimate. A two-pass Lincoln-Peterson population estimate for smallmouth bass <200mm gave 20,148 bass with a 95% confidence interval of 3,077 – 43,373. This was calculated using only one recapture. While the estimate is not ideal, we can be sure that there are numerous smallmouth bass less than 200mm in the middle Green River. The two-pass population estimate for smallmouth bass ≥ 200 mm was 1,672 with a 95% confidence interval of 329 to 3,014 fish.

Objective 3: Estimate response of small-bodied native fish to removal of northern pike and smallmouth bass in the middle Green River.

2005

Sampling to evaluate a response of small-bodied native fish to nonnative predator removal was conducted by seining suitable low-flow and backwater habitats. Three low-velocity habitats were sampled every five miles dependent upon the number of these habits available within the reach. Currently, the first two backwaters encountered in each 5-mile subreach are sampled under project # 138, YOY Colorado pikeminnow monitoring; however, information from all three backwaters is included in this report. Sampled backwaters were blocked at the mouth using a large small mesh seine to allow for closed sampling and a better evaluation of fish species composition and densities. This was also to facilitate depletion sampling for abundance estimation.

Backwater/low velocity habitats were sampled using a 1.2 m x 4 m seine with 3 mm mesh. At least two non-overlapping seine hauls were conducted in each habitat sampled. Preferably the two seine hauls were parallel to one another and perpendicular to the axis of the backwater. However, if water depth was too great, a haul was completed along one shoreline. The first two seine hauls were taken at 1/3 and 2/3 the distance from the mouth of the backwater. Additional seine hauls were sometimes completed in other portions of the habitat including the mouth or shallow tail of a backwater. Length of each seine haul, maximum depth, and average depth were recorded for each sample. All endangered and native fishes were identified, measured (mm) for total length, and returned alive to the habitat (Table 1). Ray counts were completed for all chubs (*Gila* spp.) captured. All nonnative fishes were enumerated and returned to the backwater habitat (Table 2).

Table 1. Total numbers, lengths and mean catch-per-unit-effort (CPUE; fish/100m²), by species for native fish and white sucker caught in backwater habitats of the middle Green River in October 2005. Total area sampled was 10,863m².

Species	Number Caught	Mean Length (mm)	Length Range (mm)	CPUE (Fish/100m ²)
Bluehead sucker	6	56	50 – 60	0.1
Chub (<i>Gila</i> spp.)	29	52	31 – 104	0.3
YOY Colorado pikeminnow	55	48	30 – 70	0.5
Juvenile Colorado Pikeminnow	2	128	123 – 132	0.02
Flannelmouth sucker	25	58	38 – 123	0.2
Speckled dace	3	51	49 – 52	0.03
White Sucker	48	64	44 - 87	0.4

Table 2. Total numbers, lengths and mean catch-per-unit-effort (CPUE; fish/100m²), by species for small-bodied nonnative fish caught in backwater habitats of the middle Green River in October 2005. Total area sampled was 10,863m².

Species	Number Caught	CPUE (Fish/100m ²)
Black crappie	105	1.0
Black bullhead	1	0.01
Channel catfish	8	0.1
Carp	46	0.4
Fathead minnow	1849	17.0

Green sunfish	38	0.3
Red shiner	38,705	356.3
Sand shiner	12,113	111.5
Smallmouth bass	7	0.1

2006

Sampling to evaluate a response of small-bodied native fish to nonnative predator removal was conducted by seining suitable low-flow and backwater habitats. Three low-velocity habitats were sampled every five miles dependent upon the number of these habitats available within the reach. Information from all three backwaters is summarized in this report. Currently, the first two backwaters encountered in each 5-mile subreach are sampled under project # 138, YOY Colorado pikeminnow monitoring, and information from these two backwaters specifically is contained in that project report.

Backwater/low velocity habitats were sampled using a 1.2 m x 4 m seine with 3 mm mesh. At least two non-overlapping seine hauls were conducted in each habitat sampled. Many backwaters were large and required three or even four seine hauls to sample the targeted 25% of backwater area. Preferably the two seine hauls were parallel to one another and perpendicular to the axis of the backwater. However, if water depth was too great, a haul was completed along one shoreline. The first two seine hauls were taken at 1/3 and 2/3 the distance from the mouth of the backwater. Additional seine hauls were sometimes completed in other portions of the habitat including the mouth, but not the shallow tail of a backwater. Length of each seine haul, maximum depth, and average depth were recorded for each sample. All endangered and native fishes were identified, measured (mm) for total length, and returned alive to the habitat (Table 3). All nonnative fishes were enumerated and discarded (Table 4).

Logistical differences between effort in 2005 vs. 2006 include dates: 29 September through 18 October in 2005 vs. 13 September through 3 October in 2006; temperatures: 10°C to 14°C (main channel), 10°C to 16°C (backwaters) in 2005 vs. 7°C to 22°C (main channel), 9°C to 23°C (backwaters) in 2006; and flow: 1800 – 2200cfs in 2005 vs. 1100 – 1800cfs in 2006. In addition, crews in 2005 used a block net to keep fish from exiting the backwater during sampling. This block was not used in 2006.

Of potential interest in 2006 is the more than double catch rate of red shiner, from 356.3 fish/100m² to 861.34 fish/100m²; the observation of small gizzard shad in backwaters; and the decrease in the number of native species and the number of individuals within each native species. Not all gizzard shad were measured; however, of those that were (n = 8), their mean length was 39.75mm. Lengths of these fish ranged from 36mm to 41mm. Given that fish of such small total lengths were found in multiple backwaters from river

mile 281 to 215 (nine total backwaters), a logical conclusion is that this species has begun to reproduce in the middle Green River. Detection of recruitment will be reported if observed in future electrofishing efforts.

Table 3. Total numbers, lengths and mean catch-per-unit-effort (CPUE; fish/100m²), by species for native fish caught in backwater habitats of the middle Green River in September and October, 2006. Total area sampled was 9,861m².

Species	Number Caught	Mean Length (mm)	Length Range (mm)	CPUE (Fish/100m ²)
Colorado pikeminnow	5	45.8	36 – 50	0.05
Flannelmouth sucker	18	61.6	45 – 75	0.18
Bluehead sucker	2	47	47	0.02

Table 4. Total numbers, lengths and mean catch-per-unit-effort (CPUE; fish/100m²), by species for small-bodied nonnative fish caught in backwater habitats of the middle Green River in September and October, 2006. Total area sampled was 9,861m².

Species	Number Caught	CPUE (Fish/100m ²)	Change from 2005
Black crappie	26	0.26	-0.74
Black bullhead	9	0.09	+0.08
Gizzard shad	51	0.52	N/A
Carp	180	1.83	+1.43
Fathead minnow	4356	44.17	+27.17
Green sunfish	24	0.24	-0.06
Red shiner	84,937	861.34	+505.04
Sand shiner	7083	71.83	+60.33
White sucker	11	0.11	-0.29

Bluegill	3	0.03	N/A
Brown trout	21	0.21	N/A
Smallmouth bass	5	0.05	-0.05
Unidentified shiner	12,030	122.00	N/A

2007

Sampling to evaluate a response of small-bodied native fish to nonnative predator removal was conducted by seining suitable backwater habitats (at least 30m² and at least 1' deep at its deepest point). Three low-velocity habitats were sampled every five miles dependent upon the number of these habitats available within the reach. Information from all three backwaters is summarized in this report. Currently, the first two backwaters encountered in each 5-mile subreach are sampled under project # 138, YOY Colorado pikeminnow monitoring, and information from these two backwaters specifically is contained in that project report.

Backwater/low velocity habitats were sampled using a 1.2 m x 4.6 m seine with 3 mm mesh. At least two non-overlapping seine hauls were conducted in each habitat sampled. Preferably, the two seine hauls were parallel to one another and perpendicular to the axis of the backwater. However, if water depth was too great, a haul was completed along one shoreline. The first two seine hauls were taken at 1/3 and 2/3 the distance from the mouth of the backwater. Additional seine hauls were sometimes completed in other portions of the habitat including the mouth or shallow tail of a backwater. Length of each seine haul, maximum depth, and average depth were recorded for each sample. All endangered and native fishes were identified, measured (mm) for total length, and returned alive to the habitat (Table 5). Ray counts were completed for all chubs (*Gila* spp.) captured. All nonnative fishes were enumerated in the first seine haul and discarded; in the second and third (if needed) seine hauls, only nonnative, non-cyprinid species were enumerated (Table 6).

Logistical differences between effort in 2006 vs. 2007 include dates: 13 September through 3 October in 2006 vs. 24 September through 5 October in 2007; temperatures: 7°C to 22°C (main channel), 9°C to 23°C (backwaters) in 2006 vs. 10°C to 18°C (main channel), 10°C to 19°C (backwaters) in 2007; and flow: 1100 – 1800 cfs in 2006 vs. 1250-1490 cfs in 2007.

Of potential interest in 2007 is the dramatic decrease in the red shiner population. It was noticeable during the sampling effort and is reflected in the CPUE decrease of 564 fewer red shiner per 100m² this year compared with last year. The most likely explanation for this is the apparent cyclical nature of the red shiner population over the last 20 years (a draft of the final report is due in May 2008 and this point will be elaborated on in that document). This decrease in red shiner population occurred in conjunction with an

increase in CPUE for sand shiner. Fathead minnow CPUE actually decreased from 2006 to 2007; however, in the Horseshoe Bend/Stirrup reach, we noticed that in seine hauls done “just for fun” with no dimension measurements (thus these fish were only counted as anecdotal observations), we caught a large number of fathead minnow. It is difficult, therefore, to draw conclusions from both the observed decline in catch rates and the anecdotal observation.

In addition, gizzard shad appear to be doing quite well in the middle Green River since the first observed occurrence in 2005. In addition to numerous adult fish captured during fall electrofishing, we saw an increase in the number of young-of-year and age-1 gizzard shad as well. These fish were captured throughout the reach; however, the majority of gizzard shad were caught from one backwater (RM 257.7; just below Leota Bottom). If the fish from that backwater were not included in the CPUE, it would fall to 0.16, a decrease from 2006.

Essentially, we saw an increase in the catch rate of every non-cyprinid, nonnative species, with the exception of bluegill. White sucker increased from 2006 and for the first time, we recorded white sucker x flannelmouth sucker hybrids in this reach. We began a white sucker removal project this year in hopes of keeping white sucker numbers and average lengths as low as possible to minimize potential for these hybrids to occur. Young-of-year observations for this species in 2008 and 2009 will be quite telling with regards to whether or not we can cause a decrease or an overall length decrease in the white sucker population.

Smallmouth bass catch rates also increased from 2006. In 2006, we saw only five smallmouth bass; however, in 2007, we saw 27. The last smallmouth bass caught in the 2007 effort was captured at RM 252.7 at the lower end of Ouray National Wildlife Refuge. Most of the smallmouth bass were captured between Split Mountain (RM 319) and Above Brennan (RM 270).

Finally, native fish catch rates all increased from 2006, though the difference is not likely significant. In addition to the native fish captured in Table 5, we did a number of seine hauls “just for fun,” in which we did not take measurements on the haul. These fish cannot be included in the CPUE; however, including these fish, we saw nine more Colorado pikeminnow, seven more bluehead sucker, six more flannelmouth sucker, one additional flannelmouth x bluehead hybrid, and five more roundtail chub. Figures 1-5 show length frequencies for all native fishes captured during the 2005-2007 young-of-year sampling effort, including those not included in the CPUE calculation.

Table 5. Total numbers, lengths and mean catch-per-unit-effort (CPUE; fish/100m²), by species for native fish caught in backwater habitats of the middle Green River in September and October, 2007. Total area sampled was 9120m².

Species	Number Caught	Mean Length (mm)	Length Range (mm)	CPUE (Fish/100m ²)
---------	---------------	------------------	-------------------	--------------------------------

YOY Colorado pikeminnow	9	67.0	42 – 80	0.10
Juvenile Colorado pikeminnow	1	94.0	94.0	0.01
Roundtail chub	4	52.0	38 – 68	0.04
Flannelmouth sucker	35	57.2	33 – 84	0.38
Bluehead sucker	29	64.1	39 – 92	0.32
Flannelmouth x Bluehead sucker	5	87.4	68 – 125	0.05

Table 6. Total numbers, lengths and mean catch-per-unit-effort (CPUE; fish/100m²), by species for small-bodied nonnative fish caught in backwater habitats of the middle Green River in September and October, 2007. Total area sampled for cyprinids was 4419m²; total area sampled for all other nonnatives was 9120m².

Species	Number Caught	CPUE (Fish/100m ²)	Change from 2006
Black crappie	45	0.49	+0.23
Black bullhead	27	0.30	+0.21
Gizzard shad	159	1.74	+1.22
Carp	47	1.06	-0.77
Channel catfish	24	0.26	+0.26
Fathead minnow	1,089	24.6	-19.57
Green sunfish	23	0.25	+0.01
Red shiner	13,124	297.0	-564.3
Sand shiner	11,590	262.2	+190.4
White sucker	41	0.45	+0.34

Bluegill	1	0.01	-0.02
Smallmouth bass	27	0.30	+0.25
White sucker x Flannelmouth sucker	9	0.10	N/A

Figure 1. Length Frequencies for all bluehead sucker captured during the 2005-2007 Native Fish Response sampling effort.

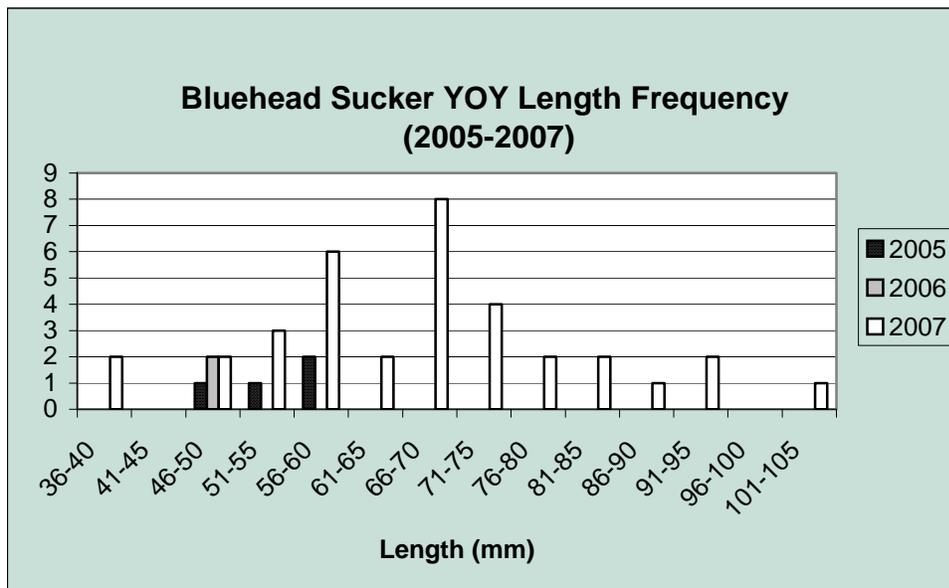


Figure 2. Length Frequencies for all speckled dace captured during the 2005-2007 Native Fish Response sampling effort.

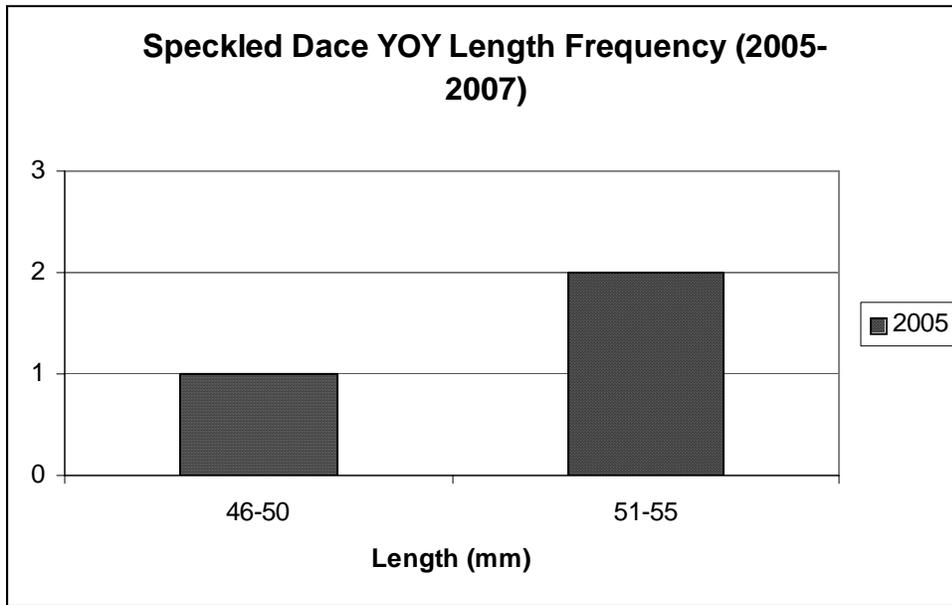


Figure 3. Length Frequencies for all Colorado pikeminnow captured during the 2005-2007 Native Fish Response sampling effort.

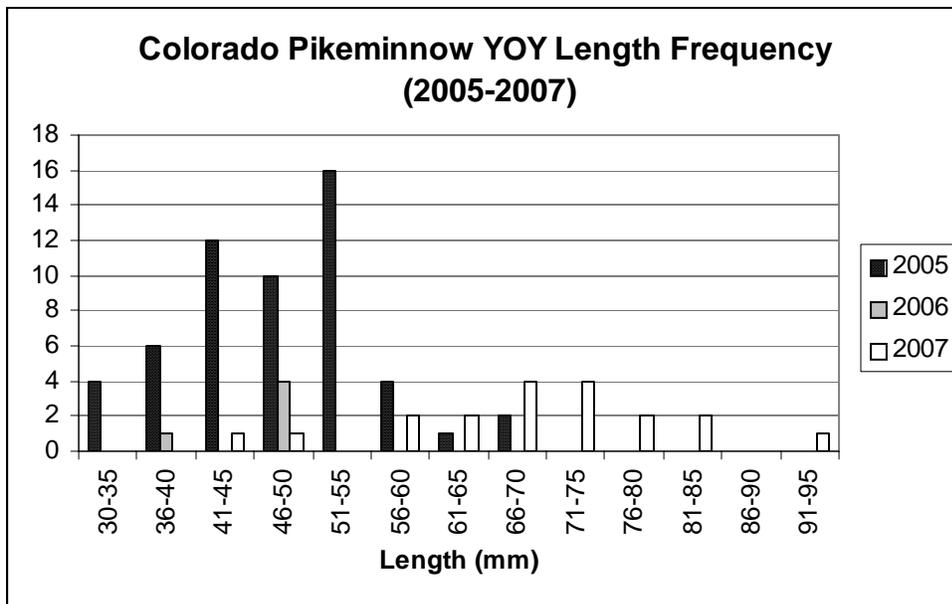


Figure 4. Length Frequencies for all flannelmouth sucker captured during the 2005-2007 Native Fish Response sampling effort.

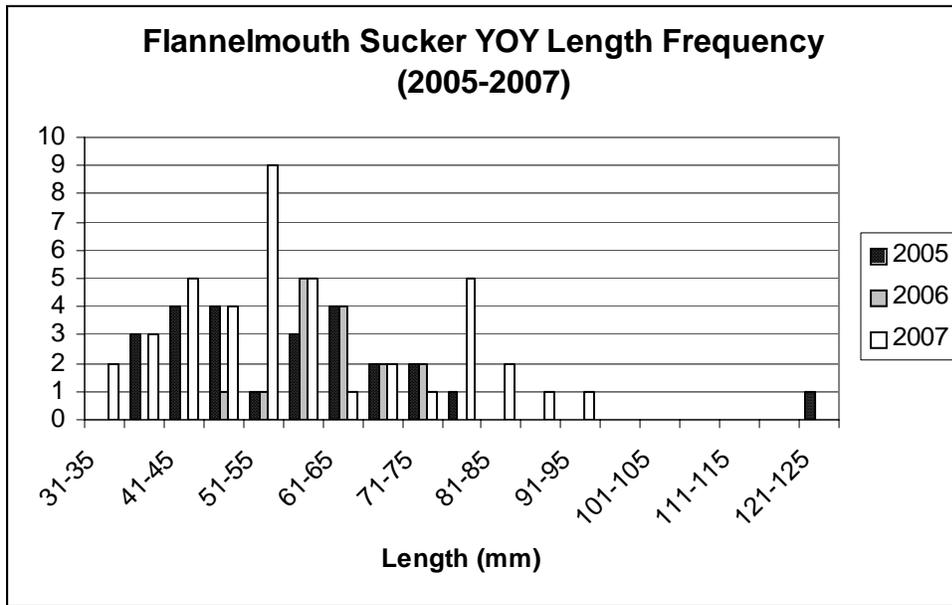
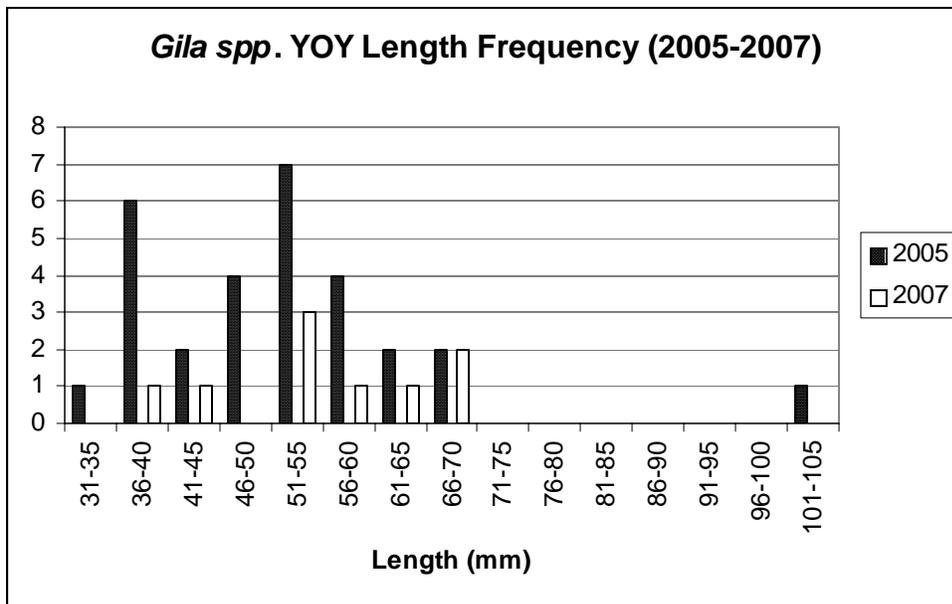


Figure 5. Length Frequencies for all *Gila spp.* captured during the 2005-2007 Native Fish Response sampling effort.



VII. Recommendations: Continue monitoring efforts as outlined in approved scope of work.

VIII. Project Status: on track and ongoing

IX. FY 2007 Budget Status

- A. Funds Provided: \$33,197
- B. Funds Expended: \$29,000
- C. Difference: \$4,197
- D. Percent of the FY 2007 work completed, and projected costs to complete: 90%, \$4,000
- E. Recovery Program funds spent for publication charges: \$0

X. Status of Data Submission: Data will be submitted to database manager January 2007.

XI. Signed: Trina Hedrick November 1, 2007
Principal Investigator Date