I. Project Title: Assessment of larval Colorado pikeminnow presence and survival in low velocity habitats in the middle Green River

II. Principal Investigator(s):

Trina Hedrick/Leisa Monroe
Utah Division of Wildlife Resources
152 East 100 North
Vernal, UT 84078
435-789-9453; fax: 435-789-8343
Email: trinahedrick@utah.gov
leisamonroe@utah.gov

Tildon Jones
Colorado River Fish Project
U. S. Fish and Wildlife Service
Vernal, UT 84078
Phone: (435) 789-0366; Fax: (435) 789-4805
E-mail: tildon_jones@fws.gov

III. Project Summary:

This study seeks to address the possible influence nonnative fishes may have on age-0 Colorado pikeminnow (CPM) as they arrive and grow in backwater habitats. A second focus is to confirm the arrival and entrainment of larval CPM into backwaters in the middle Green River. The following objectives have been outlined for young-of-the-year (YOY) CPM:

1. Verify that larval CPM are arriving in nursery habitat

2. Document abundance of larval CPM in backwaters as season progresses

3. Reduce densities of nonnative fish, particularly cyprinids, in backwater habitats before and after arrival of CPM

4. Determine success of removing and excluding nonnative fish from backwaters using various blocking techniques and depletion treatments

5. Assess small-bodied fish community effects from removing nonnative fishes from backwaters

IV. Study Schedule:

a. Initial year: 2009
b. Final field year: 2011
c. Final report year: 2012

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.
III.A.2.f. Develop control program for removal of small nonnative cyprinids in backwaters and other low velocity habitats.

GREEN RIVER ACTION PLAN: MAINSTEM

III. Reduce impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).
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.
III.A.4.b. Nonnative cyprinids and centrarchids in nursery habitats.
III.A.4.b.(1) Small nonnative cyprinids from backwaters and other low velocity habitats in the lower Green River.

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

Task Description (FY 2009):

Task 1. Determine abundance of larval CPM present in drift at Split Mountain and arriving in backwaters in the Ouray reach.

Task 2. Deplete nonnative fish in backwaters prior to larval CPM drift and experiment with a blocking scenario to keep backwaters free of nonnative fish.

Task 3. Determine fish community in manipulated and control backwaters.

Task 1:

In order to collect drifting larval CPM, three drift nets were deployed at the Split Mountain site beginning 16 July 2009, shortly after the detection of drifting larval fish at Echo Park. Drift collecting nets were set for two hours at dawn each day, and sampling occurred five days per week for 5 weeks (16 July through 20 August). River discharge measured at the USGS Jensen gage decreased from approximately 3,530cfs to 2,460cfs during this time. Samples were sorted and preserved in 100% ethanol, and were sent to the Larval Fish Laboratory at Colorado State University for positive identification. Few CPM were detected, with any one net capturing one or two CPM on a sampling occasion. Most CPM were collected 21-29 July and ranged in size from 9-11 mm. Three CPM (15-18 mm) were caught at the end of sampling on 19 August.

To determine the numbers of CPM arriving in backwaters in the Ouray reach, backwater seining was conducted periodically 28 July 2009 through 18 August 2009. One pass was completed sampling selected backwaters from Red Wash boat ramp (river mile 298.4) to the beginning of the Ouray National Wildlife Refuge (Refuge), and then two passes were completed by sampling all backwaters within the Refuge boundary. After noting the presence of what were verified as juvenile CPM on 17-18 August, further sampling was conducted from 22-24 September 2009, where a complete pass was conducted in backwaters within the Refuge boundary.

Larval fish from the first round of sampling (28 July-18 August) were preserved and sent to LFL for processing. Preliminary samples resulted in at least 41 CPM (16-26mm TL) from one backwater sampled 13 August, and then 124 CPM (17-33mm TL) from the same backwater 18 August. Another backwater sampled 17 August had 62 CPM ranging in size 16-27mm TL. The other samples are still being processed, and final results are pending.

The later round of sampling in September resulted in nineteen backwaters being sampled. Of these, thirteen (68.4%) backwaters had at least one CPM. A total of 345 CPM were caught (20-62mm TL), with a mean length of 41.8mm (Figure 1).

The purpose of the drift net site at Split Mountain was to verify pulses of larval CPM at Echo Park were arriving downstream. This would be especially important if no fish were observed in the nursery reach between Red Wash and the Refuge. To the contrary, many CPM were caught in the nursery reach. Drift net results from Echo Park are not available at this time for comparison with the Split Mountain site. Despite low numbers of fish collected at Split Mountain (n=18), many fish were found in the backwater reaches sampled downstream.

Task 2:

Depletion of backwaters began on 20 July and was conducted bimonthly through 29 September 2009. Nine backwaters were chosen starting below Red Wash boat ramp and ending in the Refuge. Three backwaters were treated as controls, three backwaters were considered Treatment A and three backwaters were considered Treatment B. Treatment A backwaters were blocked with a block net at the mouth of the backwater, depleted of all nonnative fish possible, and then opened to restore connection to the river. Treatment B backwaters were blocked with a block net at the mouth of the backwater and then depleted of all nonnative fish possible. The block net was left up throughout the study period for Treatment B. A recording HOBO® Pendant temperature data logger was placed in each backwater. Backwater temperatures ranged from 9.5°C to 33.7°C throughout the study. Logger placement was adjusted throughout the study as backwater size decreased. Green River discharge (as measured at the Jensen gauge) ranged from 3,250 cfs (at the start) to 2,570 cfs (at the end) during the sampling period and did not seem to fluctuate drastically between days.

Due to diversity in habitat throughout each backwater, we tended to capture varying amounts of fish throughout the backwater depending upon the depth, vegetation, substrate, and cover. Comparing the complete seining passes of the three Treatment B backwaters for the first two sampling occasions, the number of fish tended to decrease with each complete sampling pass through the backwater (Figure 2). A true depletion was not achieved; however, if we would have continued to seine the backwaters, we would have come closer to a true initial depletion. A depletion effort was only attempted on the first two passes. When we were able to identify CPM, the depletion effort was no longer attempted to avoid the stress this would have caused to the CPM. Also, despite the use of a block net, keeping the backwaters free from nonnative fish over time proved problematic. Throughout the study period, we observed even larger YOY nonnative fish that seemed to be getting through the block nets, or that were not removed at the initial depletion effort and captured at a later date. Treatment A backwaters and the control backwaters continued to have nonnative fish present in them as well throughout the study period. Comparing the control backwaters and the Treatment A backwaters for the first sampling occasion, with a 95% confidence interval and a t value of 0.1868, the results between the two types of backwaters was considered to be not statistically significant. Comparing the control backwaters and the Treatment A backwaters during the sampling occasion, with a 95% confidence interval and a t value of 0.7738, these results between the two types of backwaters was considered to be not statistically significant as well.

During the third sampling trip, which began on 17 August and was completed on 20 August, multiple (88) young of year CPM were found in the Control (1) backwater with an average length of 40.1 mm. After such large numbers of CPM were discovered in this particular backwater, a block net was put up in the mouth for the remainder of the study. Twelve young of year CPM were

measured from the Control (2) backwater with an average length of 39.3 mm. No block net was put in at this location. Three CPM were found in Treatment B (2) with an average length of 38 mm. Seven CPM averaging 34 mm were seined from Treatment A (2). After this sampling, the block net was left up at this backwater. Two CPM averaging 33 mm were sampled from Treatment A (3) and hundreds of CPM were seined from Treatment B (3). To reduce the potential for harm, none of these CPM were measured during this sampling period. Based on these findings, the selection and blocking of backwaters in August (after reaching the base flow periods) would have been sufficient. With CPM entering even the control backwaters with no block nets present, the installation of block nets is not necessary before the CPM arrive, but perhaps is most important after they arrive in August. In addition, many of the backwaters that were chosen in July changed over time, with one specific backwater (Treatment B (1)) becoming nearly completely cut off from the river. By waiting until August or when flows fall to at least 3000 cfs, we would have a better image of what the backwater will look like over the course of the study.

After the third sampling trip, it was decided that we would start sampling the backwaters according to young of year CPM monitoring protocol to reduce CPM mortality. The young of year CPM monitoring protocol calls for much less effort than the intensive attempt we were putting into a depletion effort during the first three sampling trips. This could be a factor into why the number of CPM we observed in the backwaters decreased during the subsequent sampling trips (Table 1). During the fourth sampling trip from 31 August until 2 September, one CPM was found in the Control (1) backwater, with no measurement taken. Treatment B (2) had 9 CPM with an average length of 46.4 mm. During this sampling trip, it was discovered that the block net had been stolen, so this backwater remained unblocked for the remainder of the study. Treatment B (3) had 106 CPM averaging 43 mm.

During the fifth sampling trip on September 14th and 15th, Treatment B (2) had three CPM averaging 44 mm, Treatment A (2) had 12 CPM averaging 34 mm and Treatment B (3) had 41 CPM with an average length of 36 mm.

Additional native species collected include: flannelmouth sucker (n = 8), bluehead sucker (n = 2), and bonytail (n = 1; TL=209). Seine samples were dominated by nonnative cyprinids including red shiner, sand shiner, and fathead minnow. There were a total of 11 nonnative species collected in seine samples. Nonnative species include red shiner (n = 24,783), sand shiner (n = 5,264), fathead minnow (n = 2,540), carp (n = 1,947), green sunfish (n = 1,157), black bullhead (n = 94), white sucker (n = 35), channel catfish (n = 12), smallmouth bass (n = 10), brook stickleback (n = 12) and black crappie (n = 1); however, there may be even more as small fish during the first few weeks were sent to the Larval Fish Lab for later identification.

Task 3:

To determine the fish community in the manipulated and control backwaters, the sixth and final sampling trip was conducted simultaneously with the young of year CPM monitoring. Sampling in study backwaters took place from 23 September until 29 September. Very few CPM were found in the study backwaters on this sampling trip, compared to earlier sampling trips. Treatment A (2) had one CPM with a length of 36 mm. Treatment A (3) had one CPM with a length of 52 mm and Treatment B (3) had 88 CPM with an average length of 45 mm. Treatment B (1) was predominately nonnative fish (99%) with only one flannelmouth sucker. The rest of the seine hauls were dominated by 87 carp, 19 fathead minnow, 9 green sunfish and 2 brook sticklebacks. Treatment A (1) was 100% nonnative fish consisting of 26 red shiner, 24 green sunfish, 20 carp, 7 sandshiner and 6 fathead. Control (1) was also 100% nonnative fish with 74 green sunfish, 24 carp, 23 red shiner and one smallmouth bass. Control (2) had 2 native fish present, 1 bluehead sucker and 1 flannelmouth sucker, but was still composed primarily of nonnative fish (98%), with 72 carp, 17 red shiner, 10 green sunfish and 4 fathead. Treatment B (2) was 100% nonnative fish with 101 red shiner, 2 sand shiner, 1 fathead, 1 green sunfish and 1 carp. Treatment A (2) was 94% nonnative fish with 11 red shiner, 3 sand shiner, 2 carp and the one CPM. Control (3) backwater was 100% nonnative fish with 153 red shiner, 19 sand shiner, and 7 fathead. Treatment A (3) was 99% nonnative fish with 740 red shiner, 13 fathead,11 sand shiner and the one CPM and Treatment B (3) was 90% nonnative fish with 788 red shiner, 48 carp, 30 fathead, 8 sand shiner, 1 green sunfish and the 88 CPM.

The fish community changed from July to September, which may have affected CPM numbers. The first sampling period took place in July and all backwaters were composed primarily of nonnative fish species as well as many fish that were too small to identify. During the first sampling period, we seined 10,253 red shiner, 1,449 sand shiner, 1,336 fathead, 445 carp, over 241 unknown fish, 51 green sunfish, 44 black bullhead, 20 white sucker, 12 unknown sucker, 6 channel catfish and one bonytail (TL 209). The second, third and fourth sampling trips all took place primarily in August, with backwaters 5-9 of the fourth sampling trip being sampled on September 2nd. There were still many fish that could not be identified in August. Seventy unknown sucker were collected as well as thousands of unknown fish. We did sample 163 CPM in August as well as two more native fish species. We saw 6 flannelmouth sucker and one bluehead sucker. We also saw the addition of some nonnative fish species that were not present in July. These included 10 brook sticklebacks, 7 smallmouth bass, and one black crappie. The remainder of the fish in the seine hauls were dominated by the same nonnative fish species as in July, with 11,447 red shiner, 3,518 sand shiner, 1,143 carp, 938 green sunfish, 843 fathead, 50 black bullhead, 11 white sucker, and 2 channel catfish. The fifth and sixth sampling trips took place in September. The same

native fish were present in September as compared with August. We sampled one bluehead sucker, two flannelmouth sucker, and 150 CPM as well as the same nonnative fish species as in August – 3,154 red shiner, 376 fathead, 359 carp, 297 sand shiner, 168 green sunfish, four channel catfish, three smallmouth bass, three white sucker, two brook stickleback, and one black bullhead. There were no unidentifiable fish species in the September samples.

Task 4:

Report Preparation
Annual report November 2009

Overall, the initial year of this study met many of the 5 objectives that it set out to meet. The drift sampling was able to verify that larval CPM are arriving in nursery habitat in the middle Green River, and with the seining of the backwaters we were able to document the abundance of larval CPM present in the backwaters as the season progressed. Initially, it does look like we were able to effectively reduce the densities of nonnative fish in each of the backwaters during each sampling occasion before the arrival of CPM. With continued experimentation on blocking methods and an increase in the depletion effort, this objective as well as objective four can be met. Objective five will be able to be assessed after the identification of the early samples on unknown species by the Larval Fish Lab.

VII. Recommendations:

a. continue to block selected backwaters using various blocking techniques to determine if it is possible to prevent nonnatives from invading blocked backwaters (i.e., block nets with smaller mesh to prevent YOY carp from re-invading).

b. discontinue Treatment A backwaters, instead focusing only on blocking backwaters for the entire study period.

c. begin the study later in the year (i.e., August or when flows fall below 3,000 or 2,500 cfs) when young-of-year fish are more readily identifiable.

d. Compare the Split Mtn. drift net data and backwater sampling data to Echo park drift net sampling and ISMP sampling in order to get an overall picture of CPM reproduction and recruitment this year. Compare this data to previous years. Continue to collect backwater samples in order to assess drift net and ISMP sampling as indicators of overall reproductive and recruitment success.

VIII. Project Status:

On track and ongoing

IX. FY 2009 Budget Status

A. Funds Provided: $78,930.80
B. Funds Expended: $78,931.00
C. Difference: 0.00
D. Percent of FY 2009 work completed: 90%
E. Recovery Program funds spent for publication charges: $0

X. Status of Data Submission:

XI. Signed: Leisa Monroe and Tildon Jones 11/5/09
Investigators Date

Table 1. Number of Age-0 CPM collected during sampling passes 3 through 6 in Green River control and treatment backwaters. The fourth and subsequent sampling trips consisted of less intensive sampling and followed the YOY CPM sampling protocol.

	Sampling Dates (8/31/09 and beyond are sampling trips with less effort)			
	8/17/09-8/20/09	**8/31/09-9/2/09**	**9/14/09-9/15/09**	**9/23/09-9/29/09**
Control (1)	88	1		
Control (2)	12			
Control (3)				
Trt A (1)				
Trt A (2)	7		12	1
Trt A (3)	2			1
Trt B (1)				
Trt B (2)	3	9	3	
Trt B (3)	100’s	106	41	88

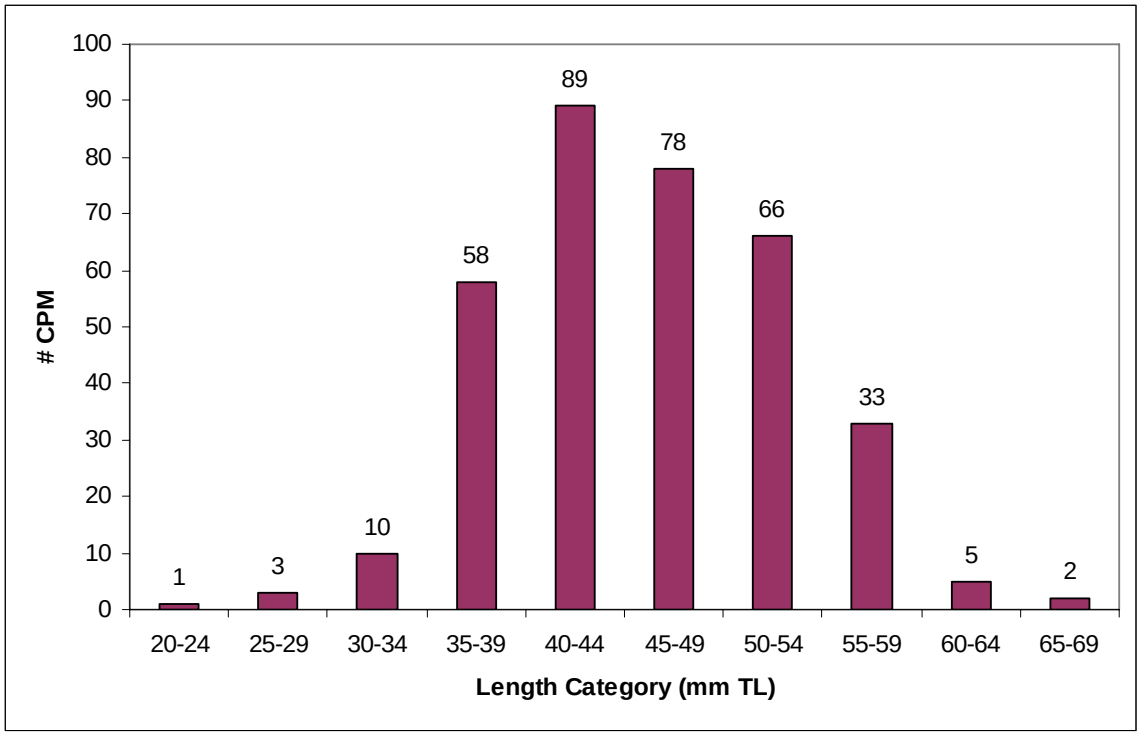
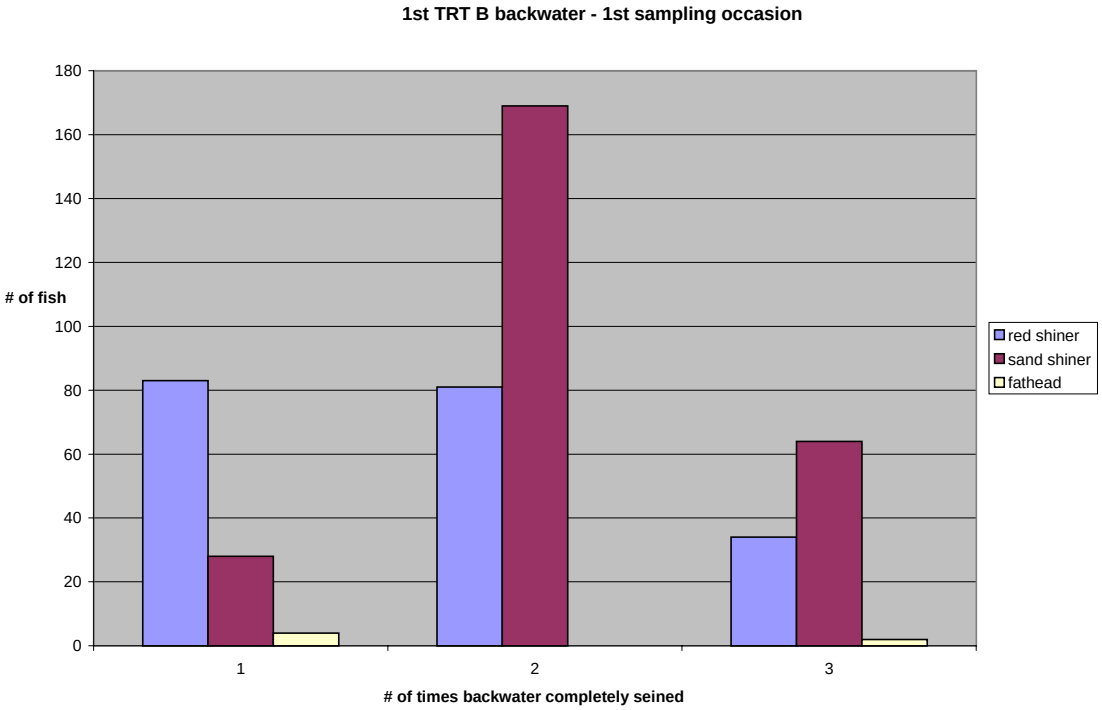
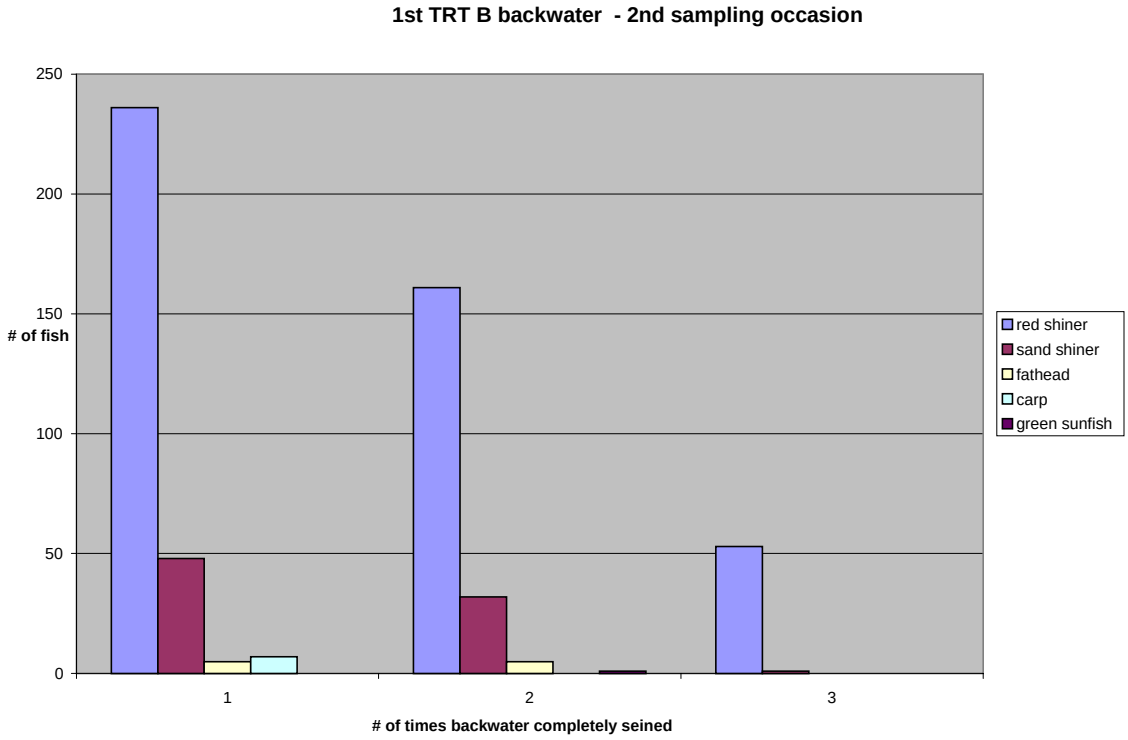
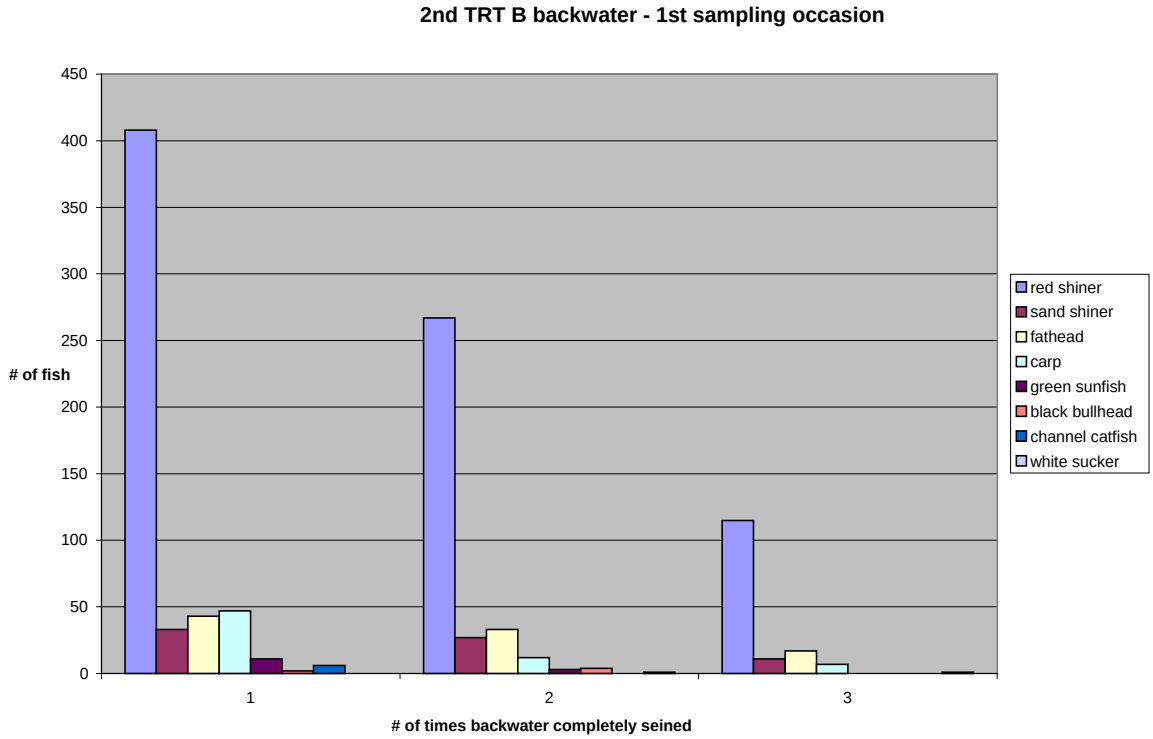
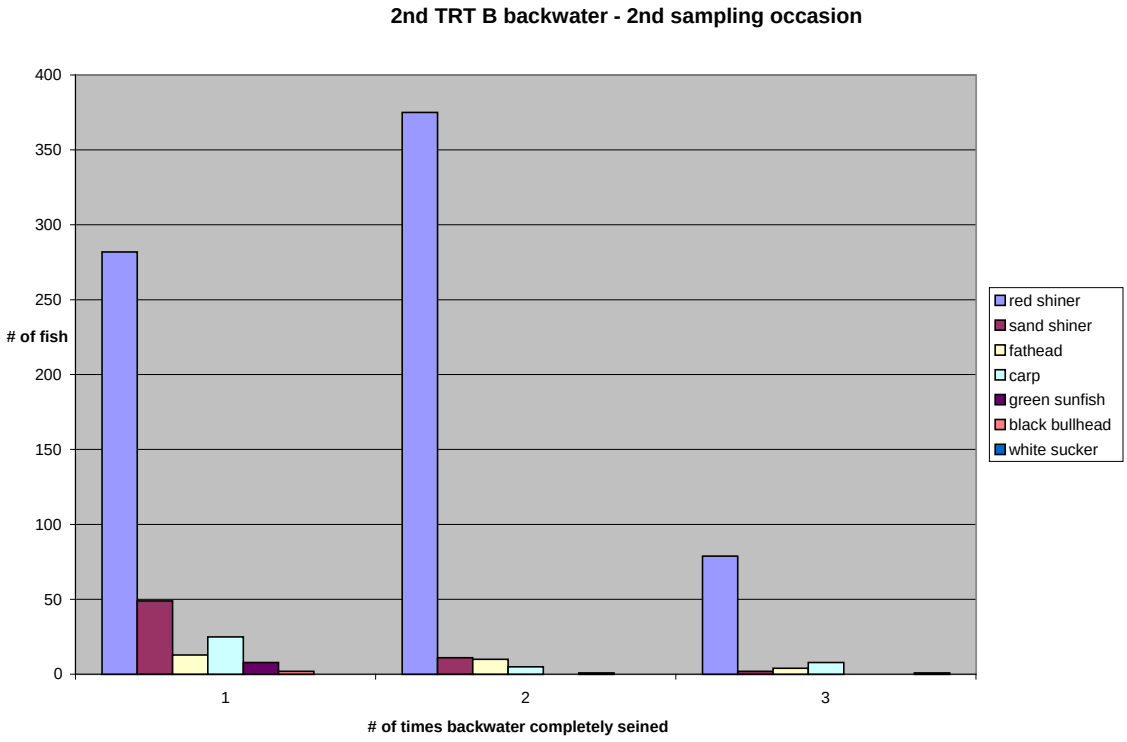


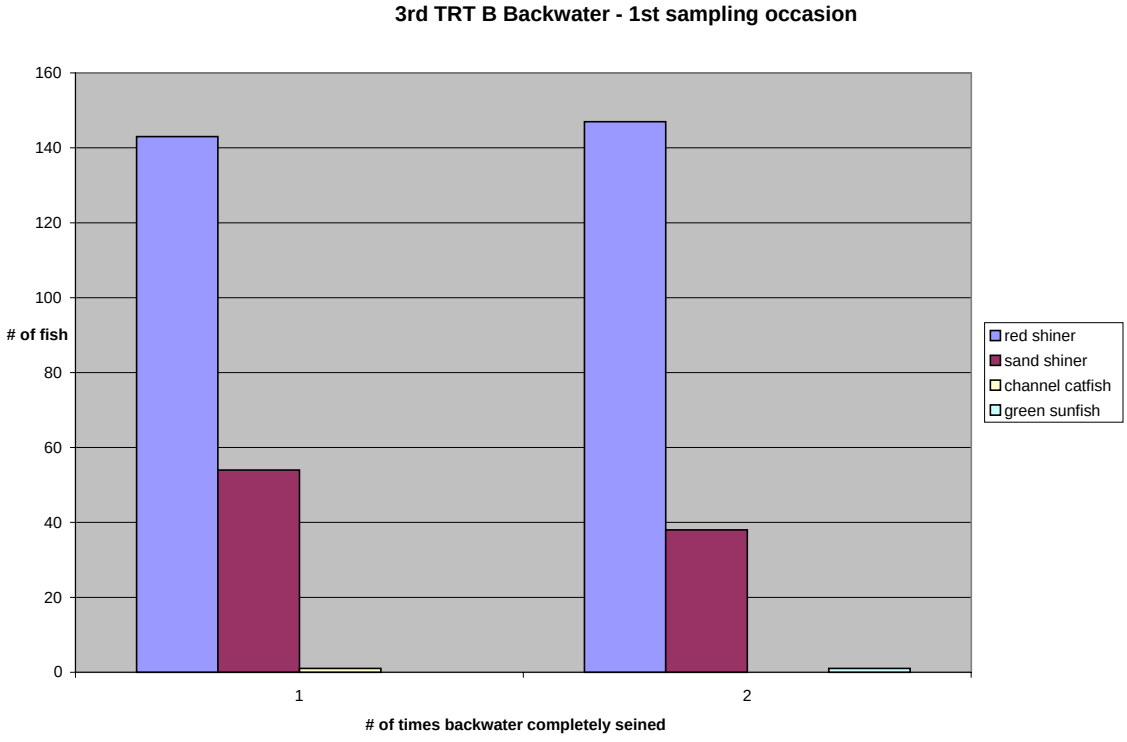
Figure 1. Length frequency of Colorado pikeminnow (CPM) caught during backwater seining on the Green River, Ouray NWR, 22-24 September.




1st TRT B backwater - 2nd sampling occasion
250
200
150
100
50
0
# of fish
1
2
3
# of times backwater completely seined
red shiner
sand shiner
fathead
carp
green sunfish


2nd TRT B backwater - 1st sampling occasion
450
400
350
300
250
200
150
100
50
0
# of fish
1
2
3
# of times backwater completely seined
red shiner
sand shiner
fathead
carp
green sunfish
black bullhead
channel catfish
white sucker


2nd TRT B backwater - 2nd sampling occasion
400
350
300
250
200
150
100
50
0
# of fish
1
2
3
# of times backwater completely seined
red shiner
sand shiner
fathead
carp
green sunfish
black bullhead
white sucker


3rd TRT B Backwater - 1st sampling occasion
160
140
120
100
80
60
40
20
0
# of fish
1
2
# of times backwater completely seined
red shiner
sand shiner
channel catfish
green sunfish

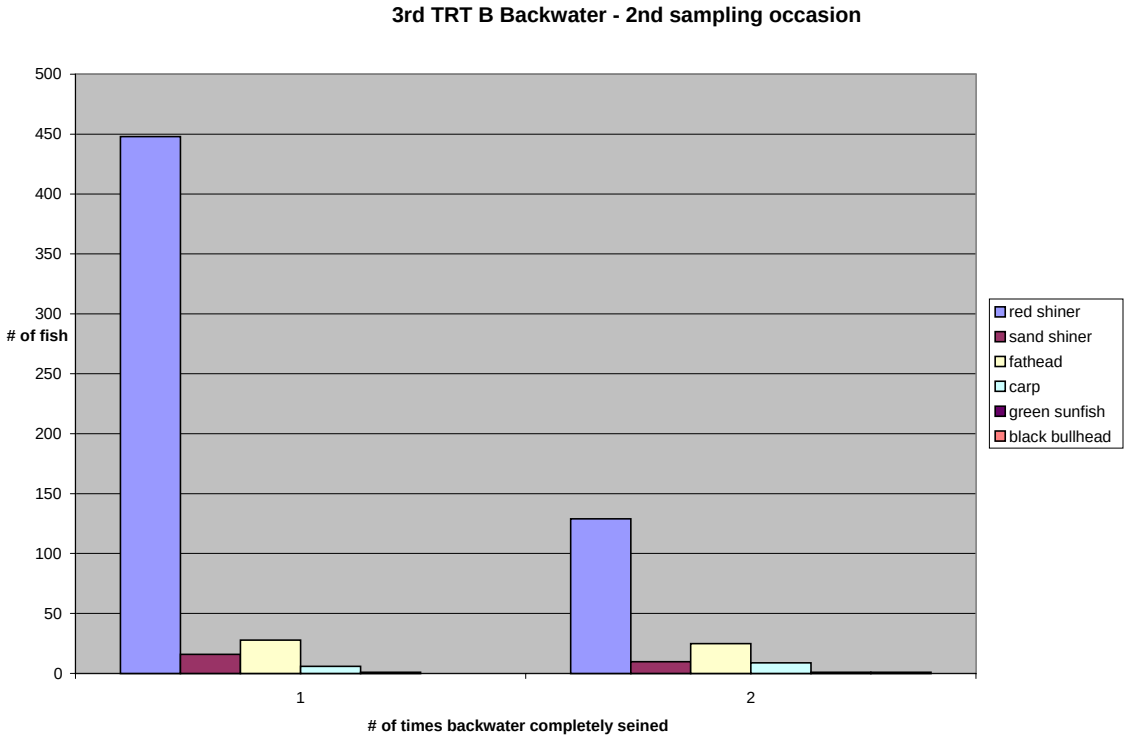


Figure 2. The three Treatment B backwaters that had the block nets left up. Each graph indicates either 2 or 3 complete seining passes through each backwater to remove nonnative fish. The number of fish that were caught during each complete seining pass for the first two sampling occasions for each of the Treatment B backwaters are shown, indicating that during each sampling occasion, we were successful at reducing the number of nonnative fish present in that particular backwater.