

I. Project Title: **Removal of Smallmouth Bass in the Upper Colorado River between Price-Stubb Dam near Palisade, Colorado, and Westwater, Utah.**

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III. Project Summary: The purpose of this study is to 1) remove as many smallmouth bass of all sizes in main channel riverine habitats in a 61-mile reach of the Upper Colorado River between Price-Stubb Dam and Westwater boat landing in eastern Utah. The goal is to reduce the abundance of smallmouth bass as quickly as possible in this reach which will ultimately benefit native listed fishes, and possibly contribute to their recovery. An additional objective was added for 2006: obtain an abundance estimate [for smallmouth bass] during 2006 by mark and recapture methods for the Upper Colorado River between Price Stubb Dam and Fruita State Park.

Total number of fish collected with boat and raft-based electrofishing by species during the 2006 smallmouth bass removal from Price Stubb Dam to the Westwater, Utah, ranger station and the Lower Gunnison River was, smallmouth bass: 751; largemouth bass: 1,094; black crappie: 70; green sunfish: 1,395; bluegill: 307. Numbers of smallmouth bass declined by 45% from 2005 and 36% from 2004 in the Grand Valley river reaches and decreased 66% from Rifle to Beavertail Mountain. On the other hand, largemouth bass numbers in 2006 increased 86% from 2005 and 295% from 2004 in the Grand Valley reaches. From Rifle to Beavertail Mountain, largemouth bass numbers in 2006 increased 455% from 2005. Green sunfish numbers in 2006 increased 33% in the Grand Valley reaches over 2005 but declined 19% between Rifle and Beavertail Mountain; black crappie numbers increased 71% in the Grand Valley reaches. Bluegill numbers declined in both the Grand Valley reaches (3%) and Rifle to Beavertail Mountain reaches (70%).

We also detected a decline in abundance of smallmouth bass in 2006 from the previous two years using catch effort indices (fish/hour and fish/mile) in main channel habitats of the Colorado River in western Colorado and eastern Utah and the Lower Gunnison River. In the Grand Valley reaches, overall mean catch effort for smallmouth bass declined in 2006 (4.64) from 2005 (7.83) and 2004 (6.91). However, largemouth bass catch rate was the highest in 2006 (6.76) compared to 3.37 in 2005 and 1.64 in 2004. Green sunfish/black crappie/bluegill aggregate catch rate was the highest during 2006 (10.94)

compared to 8.07 (2005) and 4.51 (2004). Between Rifle and Beavertail Mountain, smallmouth bass catch rate in 2006 (2.10) declined from 2005 (5.78); largemouth bass catch rate increased in 2006 (5.62) from 2005 (0.95) and 2004 (3.29).

A statistically significant increase ( $\alpha=.05$ ) in mean total length was detected in 3 of 5 river segments which may be due in part to the loss of smallmouth bass between 100 and 180 mm. Also, it was apparent from collections, that in some river segments (15-mile reach [GVIC Diversion Dam to the Colorado/Gunnison River confluence], 18-mile reach [Colorado/Gunnison River confluence to the Loma Boat Landing], and Rifle to Beavertail Mountain), smallmouth bass reproduced during 2006 as they did during 2004 and 2005.

The abundance for smallmouth bass ( $\geq 100$  mm) in the 18- and 15- mile reaches plus the 2.3 miles of the Lower Gunnison River for 2006 was estimated to be  $3,197 \pm 2,100$  (95% CI) individuals.

A synthesis report of field results over the past 3 years is due 1 March 2007. Future field activities are uncertain at this time.

IV. Study Schedule:

- a. initial year: 2004
- b. final year: 2007

V. Relationship to RIPRAP:

Colorado River Action Plan: Mainstem  
Colorado River Action Plan: Mainstem

- III. Reduce negative impacts of nonnative fishes and sportfish management activities.
- III.A. Develop and implement control programs in reaches of the Colorado River occupied by endangered fishes.

VI. Accomplishment of FY 2006 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

A. FY-2006 Tasks and Deliverables:

Task 1. Remove all sizes of smallmouth bass.

Sub-Task 1a. Mark and release smallmouth bass during pass 1 in 2006.

Tasks completed.

Task 2. a) analyze data; b) prepare annual RIP reports.

Task completed. Preparation of the annual report also sufficed for the December 2006 nonnative fish workshop.

## B. Findings (2006 Highlights)

### General

*Study Direction.* The study area encompassed a 61-mile section of the Colorado River in western Colorado from the Price-Stubb Dam to the Westwater, Utah, BLM River Ranger Station, and a 2.3-mile section of the Lower Gunnison River from the Redlands Diversion Dam to the Colorado/Gunnison River confluence. The Lower Gunnison River was not identified as part of the removal area in the original scope of work. However, it was added because smallmouth bass were collected there in the spring of 2004 during the Colorado pikeminnow population monitoring.

The river segments from Price-Stubb Dam to the Loma Boat Landing include the 15- and 18-mile reaches. These river segments along with the Lower Gunnison River flow through a wide alluvial section of the Grand Valley. The river segments between the Loma Boat Landing and the Westwater Ranger station have different hydro-geomorphic features than the upstream segments. The river downstream from the Loma Boat Landing flows through a canyon-bound area and is considered a quasi-alluvial section. For sampling logistics and data analyses purposes, the Colorado River was divided into eight different river segments and the Lower Gunnison River into one.

The decision was made during the December 14, 2005, Biology Committee meeting to obtain an abundance estimate for smallmouth bass in concentration areas of the Upper Colorado River from Price Stubb Dam to Westwater, Utah. This endeavor entailed marking and releasing smallmouth bass during an initial pass starting in the summer of 2006, and lethally removing and recording previously marked smallmouth bass in all subsequent passes. Marking smallmouth bass included the river segments from the Grand Valley Irrigation Company (GVIC) Diversion Dam to the Loma Boat Landing and the 2.3 miles of the Lower Gunnison River from the Redlands Dam to the Colorado/Gunnison River confluence. Logistical problems and safety concerns associated with the installation of an Obermeyer gate on the GVIC Diversion Dam precluded us from sampling and therefore marking and releasing any smallmouth bass between Price-Stubb Dam and the GVIC Dam. These river segments had been identified as moderate to high concentrations areas for smallmouth bass based on capture data from the summers of 2004 and 2005. An additional first pass was added to accomplish the marking. Four successive passes were performed during 2006 in the concentration areas to lethally remove smallmouth bass as was conducted in both 2004 and 2005.

*Methodology.* Two electrofishing rafts were used to collect centrarchid fishes during the marking pass. All smallmouth bass collected were marked and released. All other centrarchid fishes collected were removed. Following the marking pass, four removal passes were made using aluminum boat and raft-based electrofishing to collect centrarchid fishes from 25 July to 19 September 2006. Two electrofishing craft were used in every river segment during passes 1, 2, and 3. One electrofishing craft was used in pass 4 (see Tables 2 and 3). The number of removal passes for areas of low densities of smallmouth bass as determined from 2004 and 2005 capture data was reduced during

2006. These river segments included the canyon-bound reaches of Ruby and Horsethief canyons to Westwater, Utah (RM 152.6 – 127.6). The reduced effort in these reaches was re-directed to increase the number of removal passes in river segments where smallmouth bass had proliferated over the past two years. Therefore, only one pass was performed from the Loma Boat Landing to Westwater, Utah, during 2006. Pass 4 was dedicated to electrofishing the higher abundance areas, and was termed a “concentration pass”. Some river segments were not electrofished during pass 4 (e.g., Loma Boat Landing to the Westwater Ranger Station and Price-Stubb Dam to GVIC).

A 45-mile reach of the Upper Colorado River from the Rifle Bridge (river mile 240.4) to Beavertail Mountain in Debeque Canyon (river mile 195.7) was sampled with raft electrofishing between July 5 and 12. A river segment from the Rifle Bridge to river mile 235.5 was sampled again with one electrofishing boat on September 19. This river reach was outside the original defined removal area. However, this reach was added in 2004 because there were unsubstantiated reports that anglers had encountered smallmouth bass in these upstream reaches, and it was determined that a “reconnaissance” sampling trip was warranted to confirm or refute these claims. Furthermore, a notable increase in smallmouth bass abundance was recorded between the Rifle Bridge and Beavertail Mountain during 2005 from 2004. In 2004, 21 smallmouth bass were collected in this reach; 20 being collected in a 10.7-mile reach between Rifle and Rulison. During 2005, 230 fish were collected in the 45-mile reach, an 11-fold increase from 2004. Accordingly, smallmouth bass catch rate increased 5.5 fold between Rifle and Beavertail Mountain from 1.06 fish/hour during 2004 to 5.78 fish/hour in 2005.

Although smallmouth bass were the target fish for removal in this project, all other centrarchid fishes encountered were collected. The reason for this was that the Colorado Division of Wildlife (CDOW) requested that the Fish and Wildlife Service remove and preserve all centrarchid fishes collected during the removal effort for their analyses of origin study. These fishes included largemouth bass, green sunfish, bluegill, and black crappie. All centrarchid fishes collected during the smallmouth bass removal project were handed over to Pat Martinez of the CDOW.

The number of individuals and total length were recorded for each smallmouth bass and largemouth bass collected. For all other centrarchids total length was recorded for those specimens that were greater than 100 mm. Capture date and corresponding river mile for each centrarchid fish collected were recorded along with actual time electrofished (seconds; converted to hrs fished). For the population estimate, smallmouth bass were marked with a Fiskars® hole punch (1/4-inch diameter) in the dorsal part of the caudal fin. Chapman’s (1951) modification of the Petersen-Lincoln estimator was used to determine the abundance of smallmouth bass. This estimator was believed to be the most appropriate because it would reduce bias due to the small number of recaptured smallmouth bass. Probability of capture ( $\hat{p}$ )(after White et al. 1982) and the coefficient of variation (CV:  $SE/\hat{N} \times 100$  [where  $\hat{N}$ =estimated population size])(Pollock et al. 1990) were also computed.

## Results

*Size Distribution–Length Frequency.* Length frequency distribution of all sizes of smallmouth bass collected with electrofishing during 2004, 2005, and 2006 between Price-Stubb Dam and Westwater, Utah, and the Lower Gunnison River were plotted (Figure 1). A separate length frequency distribution of all size of smallmouth bass collected during 2006 were plotted for the 45-mile reach between Rifle and Beavertail Mountain (Figure 2).

Changes in size (i.e., length) have been used to detect changes in age composition of a fish population over time. In this instance, we are looking for a indice that could reliably be used to detect changes in the overall size [age] structure of smallmouth bass in the designated river segments over time. Size structure changes over time then could be used to evaluate whether mechanical removal is reducing the numbers of a particular size [length] group, and therefore, if this technique could be recommended as an effective management tool for removal.

The mean total length and confidence intervals were calculated for smallmouth bass for all passes combined for five different river segments for 2004, 2005, and 2006 (Figure 3). This analyses was performed to determine if there had been any change (increase or decrease) in the length structure of the smallmouth bass captured over the four passes among 2004, 2005, and 2006. During 2006, overall mean total length increased in four river segments: Westwater Ranger Station to the Loma Boat Landing, Loma Boat Landing to the Colorado/Gunnison River confluence, Lower Gunnison River, and Beavertail Mountain to Rifle (Figure 3). In three of these four river segments there was a statistically significant increase ( $\alpha=.05$ ) in the mean total length of smallmouth bass captured between 2006 and 2005. In only one segment did the overall mean total length decline: Colorado/Gunnison River confluence to Price-Stubb Dam; but the size decline was not statistically significant ( $\alpha=.05$ )(Figure 3). This increase in average size is most probably due in part to the lack of or absence of smallmouth bass catches between 100 and 180 mm in the Grand Valley reaches of the Colorado River during 2006.

All age groups of smallmouth bass (young-of-the-year, juveniles, and adults) were represented in the 2006 summer collections. These ranged from young-of-the-year (42 mm) to adult (394 mm) fish. Length frequency data from smallmouth bass collected during the channel catfish removal evaluation of 2003, and smallmouth bass removal during the summers of 2004 and 2005 are provided for comparison (Figure 1). Between Price-Stubb Dam and Westwater, Utah, and the Lower Gunnison River, it does appear that in 2006, there was a significant decline in the number of smallmouth bass comprising the size group between 100 and 180 mm. In viewing the 2005 length frequency, it appears that the size group of smallmouth bass between 50 and 100 mm were lost to the population during the winter of 2005/2006 or simply were not captured in 2006. In any event, if these fish did not recruit, the reason is unknown. It is also apparent that the number of smallmouth bass within all size groups in 2006 declined from 2004 and 2005.

In the Rifle to Beavertail Mountain reach, smallmouth bass numbers during 2006 in the main channel habitats declined from 2005. Also apparent is the lack or even absence of smallmouth bass between 100 and 200 mm, similar to that observed in the Grand Valley reaches of the Colorado River (Figure 2). Also, it was apparent from collections, that in some river segments (15-mile reach [GVIC Diversion Dam to the Colorado/Gunnison River confluence], 18-mile reach [Colorado/Gunnison River confluence to the Loma Boat Landing], and Rifle to Beavertail Mountain), smallmouth bass reproduced during 2004, 2005, and 2006. We cannot prove if these fish were produced in the river, or in off-channel habitats (e.g., ponds or irrigation returns that connect to the main river) and later escaped to the river.

*Actual Numbers.* Number of smallmouth bass marked and released along with the number of largemouth bass, and aggregate number of green sunfish/black crappie/bluegill collected and removed during the marking pass is provided (Table 1). Summary statistics for five centrarchid fishes (smallmouth bass, largemouth bass, green sunfish, black crappie, and bluegill) collected with boat and raft-based electrofishing during each of the four removal passes were tallied for 2004, 2005, and 2006 for four major river segments (Table 2). Total number fish collected by species during the 2006 smallmouth bass removal from Price-Stubb Dam to the Westwater, Utah, ranger station was, smallmouth bass: 751; largemouth bass: 1,094; black crappie: 70; green sunfish: 1,395; bluegill: 307. Smallmouth bass numbers declined 45% from 2005 (1,366) to 2006; largemouth bass numbers increased 86% (589 vs. 1,094); black crappie numbers increased 71% (41 vs. 70); bluegill numbers slightly declined 3% (316 vs. 307); and green sunfish numbers increased 33% (1,051 vs 1,395). Smallmouth bass declined 36% in 2006 (751) from 2004 (1,165); largemouth bass increased 295% (277 vs. 1,094); and black crappie/bluegill/green sunfish increased 133% (761 vs. 1,771).

The number of smallmouth bass collected in the fish trap of the Redlands Diversion Dam passageway has been recorded for 11 years. From 1996–2001, only one smallmouth bass was captured. However, 13 were collected in 2002, 6 in 2003, 9 in 2004, and 21 in 2005. To no surprise and keeping with the pattern of lower smallmouth bass catches in main channel habitats, no smallmouth bass were found in the Redlands fish trap during 2006.

The total number of centrarchid fishes collected by pass for nine individual river segments from Price Stubb Dam to the Westwater, Utah, ranger station and the Lower Gunnison River is provided in Table 3.

Between Rifle and Beavertail Mountain, the number of smallmouth bass captured in main channel habitats also declined in 2006 from 2005. Smallmouth bass declined 66% (79 vs. 230), green sunfish declined 19% (492 vs. 606); black crappie declined 50% (1 vs. 2); and bluegill declined 60% (4 vs.10). However, largemouth bass numbers increased by 455% (211 vs. 38)(Table 7).

*Catch/Effort.* Catch rate or catch effort can be used because it is directly proportional to abundance and is an index of the population size. During 2004 and 2005, since all centrarchids captured were lethally removed, fish were not marked and thus a population

estimate was not possible. For those years, catch/effort was used to monitor increases and declines in centrarchid populations. To determine if densities of smallmouth bass and largemouth bass were being depleted as a result of the removal effort, we calculated and interpreted catch effort indices (e.g., fish/hour) over time (i.e., by pass) in each river segment (Table 5). Because population estimates for smallmouth bass are not available for 2004 and 2005, we continued to compute catch effort and use it as a trend indice to compare annual abundance of smallmouth bass and other centrarchids during 2004–2006.

The number of smallmouth bass/river mile was also calculated for five river segments on the Colorado River and one segment on the Lower Gunnison River (Table 6).

Electrofishing effort in 2004 (168.665 hours) was similar to 2005 (174.560 hours) between Price Stubb Dam and the Westwater, Utah, ranger station and the Lower Gunnison River. In 2006, electrofishing effort in these reaches was 161.906 hours. Between Rifle and Beavertail Mountain, the effort expended in 2004 was 19.750 hours compared to 39.799 hours during 2005 and 37.512 hours during 2006.

From Price Stubb Dam to the Westwater ranger station, overall mean catch effort (Table 5) for smallmouth bass during passes 1–4 was: 4.30, 3.87, 5.57, and 5.34 fish/hour, respectively. Largemouth bass catch/effort during each of the four passes was: 3.38, 7.93, 10.37, and 7.16 fish/hour, respectively. For black crappie, bluegill, and green sunfish, the aggregate catch/effort steadily increased from pass 1 through pass 3 (17.27 fish/hour) but dramatically increased to 34.23 fish/hour during pass 4.

Sampling crews on the Colorado River noted in both 2005 and 2006 that catch rates did not decrease when water turbidity was high and water clarity low. Some netters actually felt that catch rates for smallmouth bass were higher during turbid water conditions rather than clear water conditions. At first, this may seem perplexing since one might assume that catch rates may be lower during turbid water conditions. However, researchers performing smallmouth bass removal in the Green River sub-basin noted that their highest catch rates were associated with high turbid water conditions in both 2005 (e-mail transmittal, Mark H. Fuller, FWS, Vernal, UT, 8/26/2005) and 2006. Possibly smallmouth bass are less capable of avoiding electroshock and capture and, thus, are more vulnerable to capture when turbid water conditions exist.

For smallmouth bass in 2006, the highest catch rate in main channel habitats was between Corn Lake and the Colorado/Gunnison River confluence (8.94 fish/hour; all passes combined). The second highest river reach was from GVIC Diversion Dam to Corn Lake (6.81 fish/hour) followed third by the reach from Price-Stubb Dam to GVIC (3.89 fish/hour). The Colorado/Gunnison River confluence to Fruita State Park had the fourth highest abundance of smallmouth bass (3.80 fish/hour). Smallmouth bass catch rate increased 5.5 fold between Rifle and Beavertail Mountain from 1.06 fish/hour during 2004 to 5.78 fish/hour in 2005. However, during 2006 in this reach, smallmouth bass catch rate precipitously declined to 2.10 fish/hour. On the other hand, largemouth bass catch rate increased in 2006 (5.62) from 2005 (0.95) and 2004 (3.29).

In 2006, the highest catch rate for largemouth bass in main channel habitats was between Corn Lake and the Colorado/Gunnison River confluence (11.84 fish/hour; all passes combined) followed by the river reach between GVIC Dam and Corn Lake (9.90 fish/hour), and the segment between Fruita State Park and the Loma Boat Landing (8.45 fish/hour) (Table 5). The highest aggregate catch rate for black crappie, green sunfish, and bluegill during 2006 were between Fruita State Park and the Loma Boat Landing (38.28 fish/hour).

Overall mean catch rates (all passes combined between Price-Stubb and Westwater, Utah + the Lower Gunnison River) indicate that smallmouth bass and largemouth bass increased between the summer of 2004 and summer of 2005. Smallmouth bass catch rate increased from 6.91 to 7.83; largemouth bass increased from 1.64 to 3.37. Black crappie, bluegill, and green sunfish aggregate catch rate increased from 4.51 to 8.07 (Table 5). Therefore, catch rate for these five centrarchid fishes during 2005 exceeded that of the summer of 2004. But in 2006, smallmouth bass catch rate declined to 4.64, the lowest within three years. Instead, largemouth bass increased to a 3-year high of 6.76. Black crappie, bluegill, and green sunfish aggregate catch rate also increased to a 3-year high of 10.94.

Therefore, in main channel habitats of the Colorado River in western Colorado and eastern Utah and the Lower Gunnison River in western Colorado during the summer of 2006, we did show a significant (45% in numbers; 41% in catch/effort) decline for smallmouth bass and a slight but rather insignificant decline (3% in numbers) for bluegill from 2005. Abundance for smallmouth bass during 2006 was even lower than that of 2004 (36% in numbers; 32% in catch effort). However, we detected a significant increase for largemouth bass (86% in numbers; 101% in catch/effort). Green sunfish abundance increased (33% in numbers; 43% in catch/effort) from 2005 to 2006.

*Population Size: smallmouth bass.* A total of 131 smallmouth bass ranging from 66 to 394 mm total length were marked and released alive between the GVIC Diversion Dam and the Loma Boat Landing and 2.3 miles of the Lower Gunnison River (Table 1). Eight smallmouth bass (202–372 mm) were later recaptured in successive passes. Six of these fish were recaptured in pass 1, one each in passes 2 and 3; no fish were recaptured in pass 4. All eight of the marked smallmouth bass were recaptured within the original marking reaches. Two smallmouth bass were recaptured in the 15-mile reach, five in the 18-mile reach, and one in the Lower Gunnison River.

The population estimate generated was for the 15- and 18-mile reaches of the Colorado River and 2.3 miles of the Lower Gunnison River downstream from Redlands Diversion Dam. Four different estimates were calculated: 1a) all smallmouth bass sizes (41–394 mm), using smallmouth bass recaptured from pass 1 only, 1b) all smallmouth bass sizes (41–394), using smallmouth bass recaptured from passes 1, 2, and 3; 2a) only smallmouth bass  $\geq 100$  mm, using smallmouth bass recaptured from pass 1 only, and 2b) only smallmouth bass  $\geq 100$  mm, using smallmouth bass recaptured from passes 1, 2, and 3 (Table 8). Since smallmouth bass  $< 100$  mm, which mostly represent young-of-the-year fish, were not available to sampling during the marking pass, the abundance estimate

which did not include fish  $< 100$  is probably the better population estimate for the smallmouth bass population. Using recaptured smallmouth bass from pass 1 only and smallmouth bass  $\geq 100$  mm, the population point estimate (95% C.I. in parenthesis) was 3,197 (1,097–5,297). The probability of capture ( $\hat{p}$ ) was computed as 0.033; the CV: 33.5%. Using recaptured smallmouth bass from passes 1, 2, and 3 and smallmouth bass  $\geq 100$  mm, the population point estimate was elevated to 5,247 (2,152–8,342). The probability of capture ( $\hat{p}$ ) was computed as 0.021; the CV: 30.1%. The CV can be used as a measure of estimate precision and Pollock et al. (1990) suggests a good ‘rule of thumb’ is to achieve a CV of 20% or less. This level of precision was never met in any of the four abundance estimates computed for smallmouth bass during 2006.

Now that a population estimate has been calculated, this serves as a baseline for any future abundance estimation comparisons. One other useful tool from this exercise is that one can calculate the percentage of fish removed annually (i.e., how efficient are we at mechanical removal) from the total population estimated using the actual number of fish removed, the point estimate, and 95% C.I.s. For example, 181 smallmouth bass  $\geq 100$  mm were actually removed during pass 1. We, then, removed as few as 3.4% (181/5,297: upper limit of the 95% C.I) or as many as 16.5% (181/1,097: lower limit of the 95% C.I.) of the estimated population. The percentage removed using the point estimate would simply be 5.7% (181/3,197) (Table 8).

*Concentration Areas.* Identifying concentration areas is important because it may allow managers to focus on riverine areas of high densities of smallmouth bass to expedite removal and reduction to control their proliferation/invasiveness and potential negative impacts to native fish conservation and endangered fish recovery. High to low smallmouth bass concentration areas in riverine reaches in the Colorado and Lower Gunnison rivers were determined using 2004, 2005 and 2006 catch/effort values (Table 9). An arbitrary relative concentration rating was developed and is provided.

The river reach between Corn Lake and the Colorado/Gunnison River confluence has consistently been the highest area of concentration for smallmouth bass during the summers of 2004, 2005, and 2006. The next highest area is between the Colorado/Gunnison River confluence and Fruita State Park. The third highest concentration area is from the GVIC Dam to Corn Lake. The 2.3 miles of the Lower Gunnison River ranks fourth after 3 years which is no surprise because it is adjacent to the two highest concentration areas in the Upper Colorado River. However, during 2006 catch rate decreased in all river reaches from 2005. Only one reach, GVIC to Corn Lake retained its relative concentration rating of ‘Moderately High’. The Colorado/Gunnison River confluence to Fruita State Park reach fell from a ‘Highest’ to ‘Medium’ rating. The reaches from Rifle to Beavertail Mountain and the Lower Gunnison River fell from ‘Moderately High’ to ‘Moderately Low’. In 2005, the greatest increase in concentration was between Price Stubb Dam to the GVIC Dam. However, in 2006 this reach fell from a rating of ‘Highest’ to ‘Moderately Low’.

*Other Nonnative Game Fishes.* Six adult walleye pike (total length 483–586 mm) were collected near Rifle (river mile 236.4– 240.2) compared to one each in both 2004 and 2005. One 65 mm yellow perch was collected in the 15-mile reach. Approximately 100 channel catfish were collected in the 18-mile reach for a CDOW bioenergetics study. All of these fish were provided to Pat Martinez of the CDOW.

*Other Nonnative Non Game Fishes.* Twelve adult gizzard shad (338–462 mm) were collected during 2006 during the smallmouth marking/removal study. Eleven of these fish were collected in the 15- and 18-mile reaches and one in the plunge pool of the Redlands Diversion Dam in the Lower Gunnison River. This is believed to be the first sightings of gizzard shad in the Grand Valley area of the Upper Colorado River.

VII. Recommendations: (this assumes that some level of field activities will resume in 2007 in the Upper Colorado River, although none are budgeted for at this time)

1. Continue to collect and lethally remove all centrarchids from the Colorado and Gunnison rivers during all station sampling studies which includes sampling on the Colorado and Gunnison rivers during 2007.
2. Suspend all electrofishing operations when it is determined that Colorado pikeminnow show signs of preparing to spawn, e.g., mid- to late-June. Electrofishing will be suspended during this period to eliminate the likelihood of harassment, interference, and injury to spawning Colorado pikeminnow.
3. Downstream from Price-Stubbs Dam, electrofishing should commence following cessation of spawning of Colorado pikeminnow which should be sometime in mid- to late-July.
4. Duplicate or possibly increase the number of electrofishing passes in river segments that have higher concentrations of smallmouth bass in 2007 as was performed in 2006. This should maximize catches of centrarchid fishes while at the same time minimizing harassment and negative impacts to native fishes in reaches where centrarchid abundance is low. Concomitantly, decrease electrofishing effort in river reaches of low smallmouth bass densities.
5. Target specific in-river features that provide habitat for centrarchid fishes. These include but are not limited to beaver lodges, tree stumps and logs, rock piles, and concrete rip-rap. Sampling these features with electrofishing may increase catches of centrarchid fishes.
6. Continue sampling the Upper Colorado reaches from the Rifle Bridge to Beavertail Mountain in Debeque Canyon. This is necessary to 1) build upon the existing fishery community database and monitor abundance of nonnative centrarchid fishes in these reaches which is within critical habitat for Colorado pikeminnow and razorback sucker, and 2) particularly determine if smallmouth bass continue to proliferate in the river reach from Rifle to Rulison. Include fish sampling the Colorado River in

Garfield County upstream through designated critical habitat to the bridge at Rifle, Colorado, in the 2007 Colorado scientific collection permit. This sampling can be commence in early-July since there are no known Colorado pikeminnow spawning areas in this 45-mile river reach.

VIII. Project Status:

- A. "On track". A synthesis report is currently being prepared to meet the 1 March 2007 deadline.
- B. Presently, field activities for 2007 are not planned. Study direction and field sampling design and effort for 2007 may be adjusted pending the outcome of the nonnative fish workshop in mid-December 2006.

IX. FY 2006 Budget Status

- A. Funds Provided: \$ 96,018
- B. Funds Expended: \$ 96,018
- C. Difference: \$ -0-
- D. Percent of the FY 2006 work completed, and projected costs to complete: 100%.
- E. Recovery Program funds spent for publication charges: \$ -0-

- X. Status of Data Submission (Where applicable): All endangered fish collected during this evaluation were checked for a PIT tag in the field. Those wild Colorado pikeminnow that did not have a PIT tag were implanted with one. All data associated with the capture and release of endangered fish were computerized. These data are available and will be electronically transmitted to the UCRB database coordinator in Grand Junction upon his request. Data recorded for all centrarchid fishes collected were computerized on entered on EXCEL spreadsheet.

- XI. Signed: Bob B. Burdick 25 October 2006  
Principal Investigator Date

APPENDIX:

- A. More comprehensive/final project reports. If distributed previously, simply reference the document or report. None.
- B. Appendix A: 9 tables attached  
4 figures attached
- C. References

Chapman, A. D. 1951. Some properties of the hypergeometric distribution with applications to zoological sample censuses, University of California Publ. Stat. 1(7):131-160.

Pollock, K. H., J. D. Nichols, C. Brownie, and J. E. Hines. 1990. Statistical inference for capture-recapture experiments. Wildlife Monographs 107.

White, G.C., D. R. Anderson, K. P. Burnham, and D. L. Otis. 1982. Capture-recapture and removal methods for sampling closed populations. Los Alamos National Laboratory, Los Alamos, New Mexico. LA-8787-NERP. 235 pp.

Prepared and compiled by Bob D. Burdick, 10/25/2006  
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APPENDIX

Table 1. Number and size of smallmouth bass and other centrarchids captured during the marking pass during July 2006 in main channel habitats on the Colorado and Lower Gunnison rivers in western Colorado.

River (River Miles) River Segment	<u>Marking Pass</u>			Black Crappie/ Green Sunfish/ <u>Bluegill</u>
	<u>Smth</u> <u>Bass</u>	<u>Total</u> <u>Length (mm)</u>	<u>Lrgth</u> <u>Bass</u>	
Colorado River (RM 187.7–127.6)				
Price-Stubb▶GVIC Dam	n/s		n/s	n/s
GVIC Dam ▶ Corn Lake	15	151–353	33	14
Corn Lake ▶Colo/Gunn River Confluence	41	88 –394	29	16
Colo/Gunn R. Confl. ▶ Fruita State Park	45	104–298	15	65
Fruita State Park Loma Boat Landing	25	66 –328	9	35
Loma Boat Landing ▶ Salt Creek Wash	n/s		n/s	n/s
Salt Creek Wash ▶ Utah/Colo Stateline	n/s		n/s	n/s
Utah/Colo Stateline ▶ Westwater, Utah BLM Ranger Station	n/s		n/s	n/s
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Lower Gunnison River (RM 3.0–0.7)				
Redlands Div. Dam ▶ Colo/Gunn R. Confluence	5	168–314	0	29
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Totals	131		86	159
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Table 2. Numbers of centrarchid fishes collected with raft and aluminum boat electrofishing during removal passes 1, 2, 3, and 4 of the smallmouth bass removal project from main channel habitats in the Upper Colorado River and Lower Gunnison River in western Colorado and eastern Utah, July, August, and September 2004, 2005, and 2006. Note: pass 4 was a “concentration pass” which sampled sections of river with high densities of centrarchids determined from passes 1, 2, and 3.

River River Segment (River Miles)	Number of Centrarchids														
	Smth Bass			Lrgth Bass			Green Sunfish			Black Crappie			Bluegill		
Colorado River Rifle to Beavertail Mtn (240.7–195.7)	'06	'05	'04	'06	'05	'04	'06	'05	'04	'06	'05	'04	'06	'05	'04
Pass 1	79	230	21	211	38	65	492	606	36	0	2	0	3	10	0
Colorado River Price-Stubbs Dam- Westwater, UT (187.7–127.6) & Lower Gunnison River Redlands Dam- Colo/Gunn River Confluence (3.0–0.7)															
Pass 1 <sup>a</sup>	258	475	219	203	247	28	309	271	119	26	17	2	45	109	20
Pass 2 <sup>a</sup>	159	119	256	326	119	23	320	236	87	18	6	4	90	53	14
Pass 3 <sup>a</sup>	225	313	504	419	168	146	568	366	321	14	8	1	116	103	62
GVIC-Loma + Lower Gunnison River (185.3–152.6 + 3.0–0.7)															
Pass 4 <sup>b</sup>	109	167	186	146	55	80	198	178	116	12	10	0	56	51	15
Year Totals	<b>751</b>	<b>1366</b>	<b>1165</b>	<b>1094</b>	<b>589</b>	<b>277</b>	<b>1395</b>	<b>1051</b>	<b>643</b>	<b>70</b>	<b>41</b>	<b>7</b>	<b>307</b>	<b>316</b>	<b>111</b>

<sup>a</sup> Two electrofishing craft used.

<sup>b</sup> One electrofishing craft used.

Table 3. Numbers of centrarchid fishes collected during removal passes (P) 1, 2, 3, and 4 of the smallmouth bass removal project from main channel habitats on the Colorado and Lower Gunnison rivers in western Colorado and eastern Utah, July, August, and September 2006. Note: n/s=not sampled; two electrofishing craft were used for passes 1, 2, and 3; one electrofishing craft was used for pass 4. Note: 2004 and 2005 species totals are provided for annual comparisons.

River (River Miles) River Segment	No. of Centrarchids											
	Smallmouth Bass				Largemouth Bass				Black Crappie/ Green Sunfish/ Bluegill			
	P-1	P-2	P-3	P-4	P-1	P-2	P-3	P-4	P-1	P-2	P-3	P-4
Colorado River (RM 187.7–127.6)												
Price-Stubb ▶ GVIC Dam	10	8	12	n/s	14	3	9	n/s	8	1	6	n/s
GVIC Dam ▶ Corn Lake	75	48	42	44	59	75	118	52	57	26	38	23
Corn Lake ▶ Colo/Gunn River Confluence	43	49	102	34	44	100	123	35	21	30	63	29
Colo/Gunn R. Confl. ▶ Fruita State Park	78	38	52	17	50	78	102	45	132	154	203	119
Fruita State Park ▶ Loma Boat Landing	12	7	12	11	22	68	63	12	130	200	335	82
Loma Boat Landing ▶ Salt Creek Wash	23	n/s	n/s	n/s	7	n/s	n/s	n/s	20	n/s	n/s	n/s
Salt Creek Wash ▶ Utah/Colo Stateline	8	n/s	n/s	n/s	2	n/s	n/s	n/s	4	n/s	n/s	n/s
Utah/Colo Stateline ▶ Westwater, Utah BLM Ranger Station	3	n/s	n/s	n/s	3	n/s	n/s	n/s	3	n/s	n/s	n/s
-----												
Lower Gunnison River (RM 3.0–0.7)												
Redlands Div. Dam ▶ Colo/Gunn R. Confluence	6	9	5	3	2	2	4	2	5	17	53	13
2006 Pass Totals	<b>258</b>	<b>159</b>	<b>225</b>	<b>109</b>	<b>203</b>	<b>326</b>	<b>419</b>	<b>146</b>	<b>380</b>	<b>428</b>	<b>698</b>	<b>266</b>
2006 Species Totals				751			1,094				1,771	
2005 Species Totals				1,366			589				1,408	
2004 Species Totals				1,165			277				761	

Table 4. Amount of effort (electrofishing hours) expended during four removal passes of the smallmouth bass removal project sampling main channel habitats on the Colorado and Lower Gunnison rivers in western Colorado and eastern Utah, July, August, and September 2006. Note: n/s=not sampled; two electrofishing craft were used for passes 1, 2, and 3; one electrofishing craft was used for pass 4.

River (River Miles) River Segment	Electrofishing Effort (hr)			
	P-1	P-2	P-3	P-4
Colorado River (RM 187.7–127.6)				
Price-Stubb ▶ GVIC Dam	3.739	3.792	2.861	n/s
GVIC Dam ▶ Corn Lake	9.439	8.021	8.540	4.706
Corn Lake ▶ Colo/Gunn River Confluence	6.455	7.178	7.574	4.289
Colo/Gunn R. Confl. ▶ Fruita State Park	14.242	13.633	13.088	7.704
Fruita State Park ▶ Loma Boat Landing	5.018	6.360	5.771	2.367
Loma Boat Landing ▶ Salt Creek Wash	7.557	n/s	n/s	n/s
Salt Creek Wash ▶ Utah/Colo Stateline	7.607	n/s	n/s	n/s
Utah/Colo Stateline ▶ Westwater, Utah BLM Ranger Station	3.202	n/s	n/s	n/s
-----				
Lower Gunnison River (RM 3.0–0.7)				
Redlands Div. Dam ▶ Colo/Gunn R. Confluence	2.573	2.108	2.574	1.328
-----				
2006 Pass Totals	60.012	41.092	40.408	20.394
2006 Total				<i>161.906</i>
2005 Total				<i>174.560</i>
2004 Total				<i>168.665</i>

Table 5. Catch effort (fish/hour) of centrarchid fishes collected during removal passes (P) 1, 2, 3, and 4 of the smallmouth bass removal project from main channel habitats on the Colorado and Lower Gunnison rivers in western Colorado and eastern Utah, July, August, September 2006. Note: n/s=not sampled; two electrofishing craft were used for passes 1, 2, and 3; one electrofishing craft was used for pass 4. Note: 2004 and 2005 catch/effort by species is provided for annual comparisons.

River (River Miles) River Segment	Catch/Effort (fish/hr)											
	Smallmouth Bass				Largemouth Bass				Black Crappie/ Green Sunfish/ Bluegill			
	P-1	P-2	P-3	P-4	P-1	P-2	P-3	P-4	P-1	P-2	P-3	P-4
Colorado River (RM 187.7–127.6)												
Price-Stubb ▶ GVIC Dam	2.67	2.11	4.19	n/s	3.74	0.79	3.15	n/s	2.14	0.26	2.10	n/s
GVIC Dam ▶ Corn Lake	7.95	5.98	4.92	9.35	0.53	9.35	13.82	11.05	6.04	3.24	4.45	4.89
Corn Lake ▶ Colo/Gunn River Confluence	6.66	6.83	13.47	7.93	4.66	13.93	16.24	8.16	3.25	4.18	8.32	4.29
Colo/Gunn R. Confl. ▶ Fruita State Park	5.48	2.79	3.81	2.21	7.75	5.72	7.79	5.84	9.27	11.30	15.51	15.45
Fruita State Park ▶ Loma Boat Landing	0.20	1.10	2.08	4.65	4.38	10.69	10.92	5.07	25.91	31.44	58.05	34.64
Loma Boat Landing ▶ Salt Creek Wash	3.04	n/s	n/s	n/s	0.93	n/s	n/s	n/s	2.65	n/s	n/s	n/s
Salt Creek Wash ▶ Utah/Colo Stateline	1.05	n/s	n/s	n/s	0.26	n/s	n/s	n/s	0.53	n/s	n/s	n/s
Utah/Colo Stateline ▶ Westwater, Utah BLM Ranger Station	0.94	n/s	n/s	n/s	0.94	n/s	n/s	n/s	0.94	n/s	n/s	n/s
-----												
Lower Gunnison River (RM 3.0–0.7)												
Redlands Div. Dam ▶  Colo/Gunn R. Confluence	2.18	4.27	1.94	2.26	0.73	0.95	1.55	1.51	1.82	8.06	20.59	9.79
Mean of 2006 Passes	4.30	3.87	5.57	5.34	3.38	7.87	10.37	7.16	6.33	10.42	17.27	13.04
Mean of 2006 Species				4.64				6.76				10.94
Mean of 2005 Species				7.83				3.37				8.07
Mean of 2004 Species				6.91				1.64				4.51

Table 6. Number and catch effort (fish/mile) for smallmouth bass collected from main channel habitats with electrofishing in the Upper Colorado River from river mile 187.7–127.6 (Price-Stubb Dam to Westwater Ranger Station, Utah), and the Lower Gunnison River from river mile 3.0–0.7 (Redlands Diversion Dam to the Colorado/Gunnison River confluence) during July, August, and September 2006. Note: see Table 4 for the total electrofishing effort (hrs) sampled for each river segment; n/s=not sampled. Two electrofishing craft were used for removal passes 1, 2, and 3; one electrofishing craft was used for removal pass 4. Values for 2005 are italicized; values for 2004 and underlined for annual comparisons.

	Smallmouth Bass							
	No. of Fish				Fish/Mile			
	P-1	P-2	P-3	P-4	P-1	P-2	P-3	P-4
<b>Colorado River</b>								
Price-Stubb Dam-	128	105	156	<sup>a</sup> 78	3.8	3.1	4.7	5.5
Colo/Gunn Confl.	<i>169</i>	<i>180</i>	<i>145</i>	<sup>a</sup> <i>84</i>	<i>5.1</i>	<i>5.4</i>	<i>4.3</i>	<i>5.9</i>
Segment Length: 16.7 miles	<u>106</u>	<u>94</u>	<u>174</u>	<sup>a</sup> <u>78</u>	<u>3.2</u>	<u>2.8</u>	<u>5.5</u>	<u>5.5</u>
Miles Sampled: 33.4								
Colo/Gunn Confl-	90	45	64	<sup>b</sup> 28	2.5	1.2	1.7	1.5
Loma Boat Landing	<i>189</i>	<i>160</i>	<i>94</i>	<sup>b</sup> <i>79</i>	<i>5.1</i>	<i>4.3</i>	<i>1.2</i>	<i>4.3</i>
Segment Length: 18.4 miles	<u>55</u>	<u>101</u>	<u>238</u>	<sup>b</sup> <u>97</u>	<u>1.5</u>	<u>2.8</u>	<u>6.5</u>	<u>5.3</u>
Miles Sampled: 36.8								
Loma Boat Landing-	23	n/s	n/s	n/s	1.4	n/s	n/s	n/s
Salt Creek Wash	<i>79</i>	<i>19</i>	<i>27</i>	<i>n/s</i>	<i>4.7</i>	<i>1.1</i>	<i>1.6</i>	<i>n/s</i>
Segment Length: 8.4 miles	<u>23</u>	<u>13</u>	<u>30</u>	<u>n/s</u>	<u>1.4</u>	<u>0.8</u>	<u>1.8</u>	<u>n/s</u>
Miles Sampled: 16.8								
Salt Creek Wash-	8	n/s	n/s	n/s	0.3	n/s	n/s	n/s
Utah/Colo Stateline	<i>17</i>	<i>9</i>	<i>13</i>	<i>n/s</i>	<i>0.7</i>	<i>0.4</i>	<i>0.5</i>	<i>n/s</i>
Segment Length: 12.3 miles	<u>6</u>	<u>19</u>	<u>14</u>	<u>n/s</u>	<u>0.2</u>	<u>0.8</u>	<u>0.6</u>	<u>n/s</u>
Miles Sampled: 24.6								
Utah/Colo Stateline-	3	n/s	n/s	n/s	0.3	n/s	n/s	n/s
Westwater Ranger	<i>6</i>	<i>1</i>	<i>2</i>	<i>n/s</i>	<i>0.7</i>	<i>0.1</i>	<i>0.2</i>	<i>n/s</i>
Station, Utah	<u>1</u>	<u>1</u>	<u>1</u>	<u>n/s</u>	<u>0.1</u>	<u>0.1</u>	<u>0.1</u>	<u>n/s</u>
Segment Length: 4.3 miles								
Miles Sampled: 8.6								
<b>Lower Gunnison River</b>								
Redlands Div. Dam-	6	9	5	<sup>c</sup> 3	1.3	2.0	1.1	0.7
Colo/Gunn Confl.	<i>15</i>	<i>42</i>	<i>32</i>	<sup>c</sup> <i>4</i>	<i>3.3</i>	<i>9.1</i>	<i>6.7</i>	<i>1.7</i>
Segment Length: 2.3 miles	<u>28</u>	<u>28</u>	<u>47</u>	<sup>c</sup> <u>11</u>	<u>6.1</u>	<u>6.1</u>	<u>10.2</u>	<u>4.8</u>
Miles Sampled: 4.6								

<sup>a</sup> Price-Stubb Dam to GVIC Diversion Dam river segment was not sampled during pass 4. Only 14.3 miles were sampled: 185.3–171.0.

<sup>b</sup> One electrofishing craft was used; miles sampled=18.4 for Pass 4.

<sup>c</sup> One electrofishing craft was used; miles sampled=2.3 for Pass 4.

Table 7. Summary statistics of centrarchids collected during reconnaissance sampling in main channel habitats of the Upper Colorado River from Rifle, Colorado, to Beavertail Mountain in Debeque Canyon, July 5–7; 10; 12; September 19, 2006.

Reach: Rifle Bridge–Rulison Bridge  
 River Mile: 240.4–230.0; River Mile Length: 10.4  
 Number of Electrofishing Crafts: 3  
 Effort (hr): 12.567

Smallmouth Bass				Largemouth Bass				Green Sunfish				Bluegill				Black Crappie			
No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)		
	Min	Max	Mean		Min	Max	Mean		Min	Max	Mean		Min	Max	Mean		Min	Max	Mean
72	58	384	195	115	53	114	430	201	27	158	91	3	112	176	140	0	--	--	--

Reach: Rulison Bridge–Parachute Bridge  
 River Mile: 229.9–223.0; River Mile Length: 6  
 Number of Electrofishing Crafts: 2  
 Effort (hr): 5.563

Smallmouth Bass				Largemouth Bass				Green Sunfish				Bluegill				Black Crappie			
No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)		
	Min	Max	Mean		Min	Max	Mean		Min	Max	Mean		Min	Max	Mean		Min	Max	Mean
1	--	--	80	0	--	--	--	17	< 100	147	~ 115	0	--	--	--	0	--	--	--

Reach: Parachute Bridge–Debeque I-70 Bridge  
 River Mile: 223.0–209.7; River Mile Length: 13.3  
 Number of Electrofishing Crafts: 2  
 Effort (hr): 8.100

Smallmouth Bass				Largemouth Bass				Green Sunfish				Bluegill				Black Crappie			
No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)		
	Min	Max	Mean		Min	Max	Mean		Min	Max	Mean		Min	Max	Mean		Min	Max	Mean
5	270	357	308	38	45	329	128	97	42	172	94	0	--	--	--	1	--	--	170

Reach: Debeque I-70 Bridge–Beavertail Mountain (Debeque Canyon)  
 River Mile: 209.7–195.7; River Mile Length: 14.0  
 Number of Electrofishing Crafts: 2  
 Effort (hr): 11.282

Smallmouth Bass				Largemouth Bass				Green Sunfish				Bluegill				Black Crappie			
No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)			No. of Fish	Total Length (mm)		
	Min	Max	Mean		Min	Max	Mean		Min	Max	Mean		Min	Max	Mean		Min	Max	Mean
1	--	--	82	58	43	161	74	177	41	131	77	1	--	--	< 100	0	--	--	--

Table 8. Population point estimates (N-hat) with 95% confidence intervals (CI) for smallmouth bass for the 15- and 18-mile reaches (river miles 185.3 to 152.6) of the Upper Colorado River and 2.3 miles of the Lower Gunnison River (Redlands Diversion Dam to the Colorado/Gunnison River confluence) for the summer of 2006, and the projected percentage of smallmouth bass removed annually by electrofishing relative to the 95% population interval. Chapman's (1951) modification of the Petersen-Lincoln estimator was used to determine the abundance of smallmouth bass; probability of capture (p-hat) determined from White et al. (1982). Coefficient of variation (CV: SE/N-hat x 100) from Pollock et al. (1990).

<u>Smallmouth Bass--All Fish (41-394 mm)</u>									
<u>Pass No. 1 Only</u>					<u>Pass Nos. 1, 2, &amp; 3</u>				
<u>Pop Est</u>	<u>95% CI</u>	<u>Total No. of Fish Removed</u>	<u>Total Recaps</u>	<u>% of fish removed annually<sup>a</sup></u>	<u>Pop Est</u>	<u>95% CI</u>	<u>Total No. of Fish Removed</u>	<u>Total Recaps</u>	<u>% of fish removed annually<sup>a</sup></u>
3,789	± 2,511	200	6	3.8–15.6%	8,300	± 4,927	565	8	4.3–16.8%
probability of capture: 0.03 CV: 33.8%					probability of capture: 0.014 CV: 30.3%				
<u>Smallmouth Bass ≥ 100 mm</u>									
<u>Pass No. 1 Only</u>					<u>Pass Nos. 1, 2, &amp; 3</u>				
<u>Pop Est</u>	<u>95% CI</u>	<u>Total No. of Fish Removed</u>	<u>Total Recaps</u>	<u>% of fish removed annually<sup>a</sup></u>	<u>Pop Est</u>	<u>95% CI</u>	<u>Total No. of Fish Removed</u>	<u>Total Recaps</u>	<u>% of fish removed annually<sup>a</sup></u>
3,197	± 2,100	181	6	3.4–16.5%	5,247	± 3,095	383	8	4.6–17.8%
probability of capture: 0.033 CV: 33.5%					probability of capture: 0.021 CV: 30.1%				

<sup>a</sup> Calculated from the actual number of smallmouth bass removed, point estimate, and 95% CI.

<u>Pass Type &amp; No.</u>	<u>No. of Smallmouth Bass<sup>a</sup></u>			<u>Marked Recaps</u>
	<u>All Fish (41-394 mm)</u>	<u>≥ 100 mm</u>	<u>&lt; 100 mm</u>	
Marking Pass	131	122	9	- -
Removal Pass No. 1 <sup>b</sup>	200	181	19	6
Removal Pass No. 2 <sup>b</sup>	152	96	56	1
<u>Removal Pass No. 3<sup>b</sup></u>	<u>213</u>	<u>106</u>	<u>107</u>	<u>1</u>
Total	565	383	182	8
Removal Pass No. 4 <sup>c</sup>	109	53	56	0

<sup>a</sup> Includes captures and recaptures of smallmouth bass in the Upper Colorado River from river mile 185.3–152.6 (15- and 18-mile reaches) and Lower Gunnison River from river mile 3.0–0.7.

<sup>b</sup> Two electrofishing craft used.

<sup>c</sup> One electrofishing craft used; “concentration removal pass” (not used in population estimate).

Table 9. Concentration areas for smallmouth bass in the Upper Colorado and Lower Gunnison rivers during the summer of 2004, 2005, and 2006 using catch effort indices. See Figure 4.

River River Segment	2004 Concentration		2005 Concentration		2006 Concentration	
	Catch/Effort <sup>a</sup>	Rating <sup>b</sup>	Catch/Effort <sup>a</sup>	Rating <sup>b</sup>	Catch/Effort <sup>a</sup>	Rating <sup>b</sup>
Upper Colorado River Rifle-Beavertail Mtn	1.06	Lowest	5.78	Moderately High	2.11	Moderately Low
Price Stubb Dam-GVIC Dam	4.07	Medium	11.02	Highest	2.89	Moderately Low
GVIC Dam-Corn Lake	7.05	Moderately High	8.97	Moderately High	5.09	Moderately High
Corn Lake-Colo/Gunn River confluence	11.88	Highest	16.36	Highest	8.94	Moderately High
Colo/Gunn River confluence- Fruita State Park	9.47	Highest	10.43	Highest	3.80	Medium
Fruita State Park- Loma Boat Landing	5.35	Moderately High	3.78	Medium	2.15	Moderately Low
Loma Boat Landing- Salt Creek	3.19	Medium	6.21	Moderately High	3.04	Medium
Salt Creek-Utah/Colo Stateline	1.92	Lowest	1.60	Lowest	1.05	Lowest
Utah/Colo Stateline- Westwater, UT, Ranger Station Station	0.47	Lowest	1.02	Lowest	0.94	Lowest
Lower Gunnison River Redlands Dam- Colo/Gunn River confluence	9.21	Highest	7.44	Moderately High	2.68	Moderately Low

<sup>a</sup> All passes combined.

<sup>b</sup> Key

Catch/Effort Value	Relative Concentration Rating
12.00-9.00	Highest
8.99-5.00	Moderately High
4.99-3.00	Medium
2.99-2.00	Moderately Low
< 2.00	Lowest

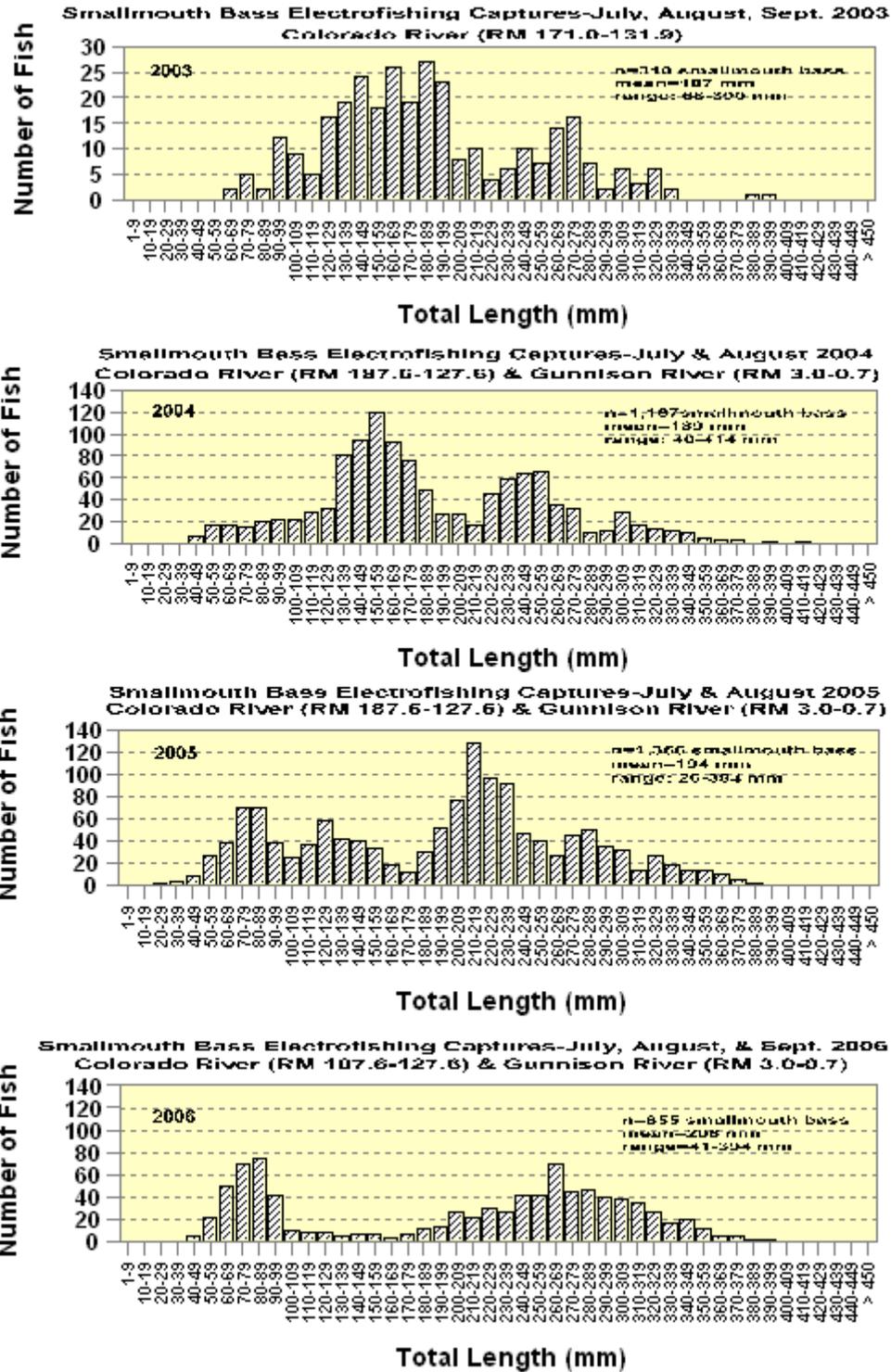


Figure 1. Length frequency comparison for all smallmouth bass collected during the summer of 2003, 2004, 2005, and 2006.

**Colorado River  
Rifle Bridge-Beavertail Mountain (Debeque Canyon)  
1 Pass**

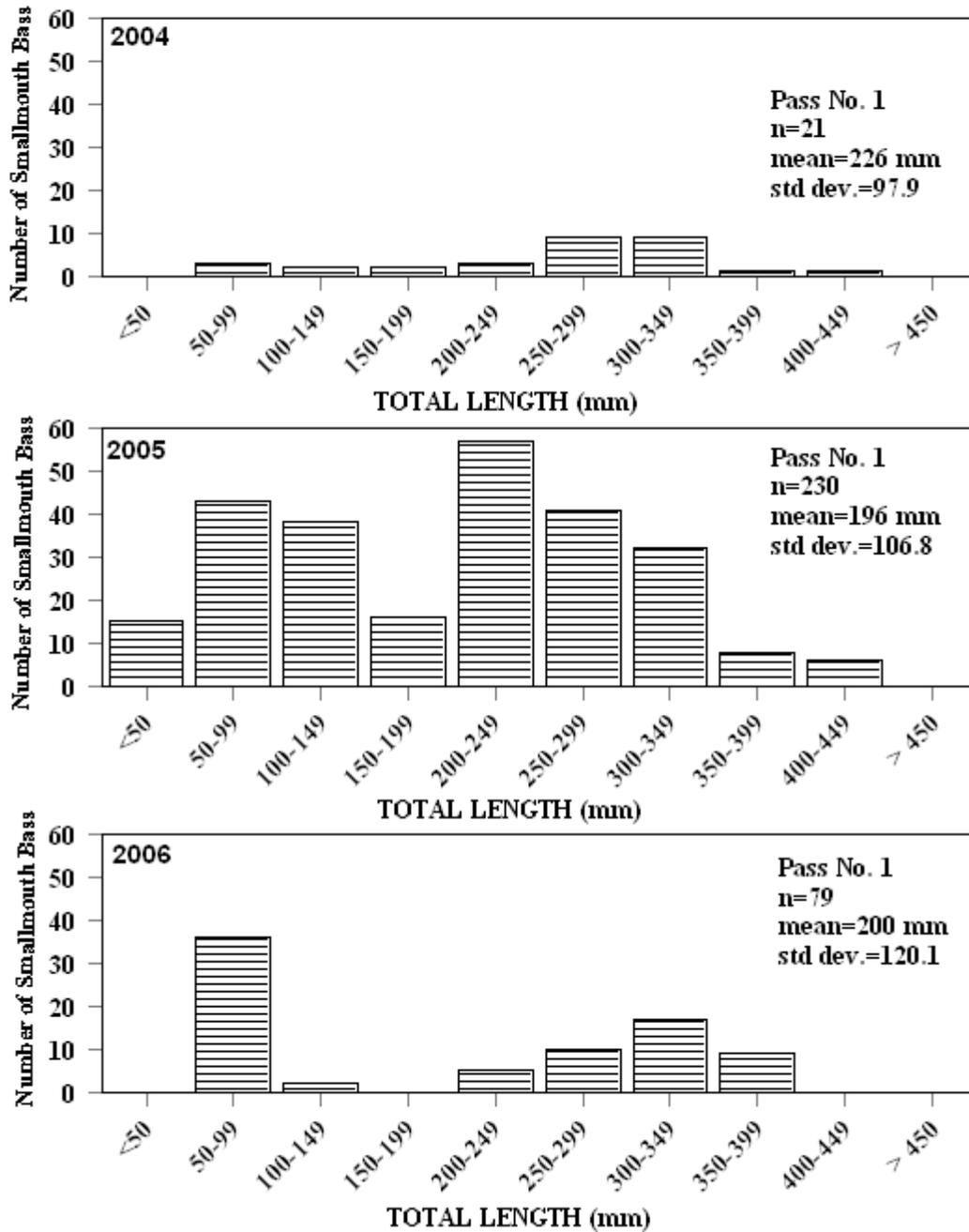


Figure 2. Total length frequency comparison of all smallmouth bass collected with electrofishing during one pass from the Rifle Bridge to Beavertail Mountain in Debeque Canyon (river mile 240.7–195.7) in the Upper Colorado River, late-August 2004, mid-July 2005, and mid-July and mid-September 2006.

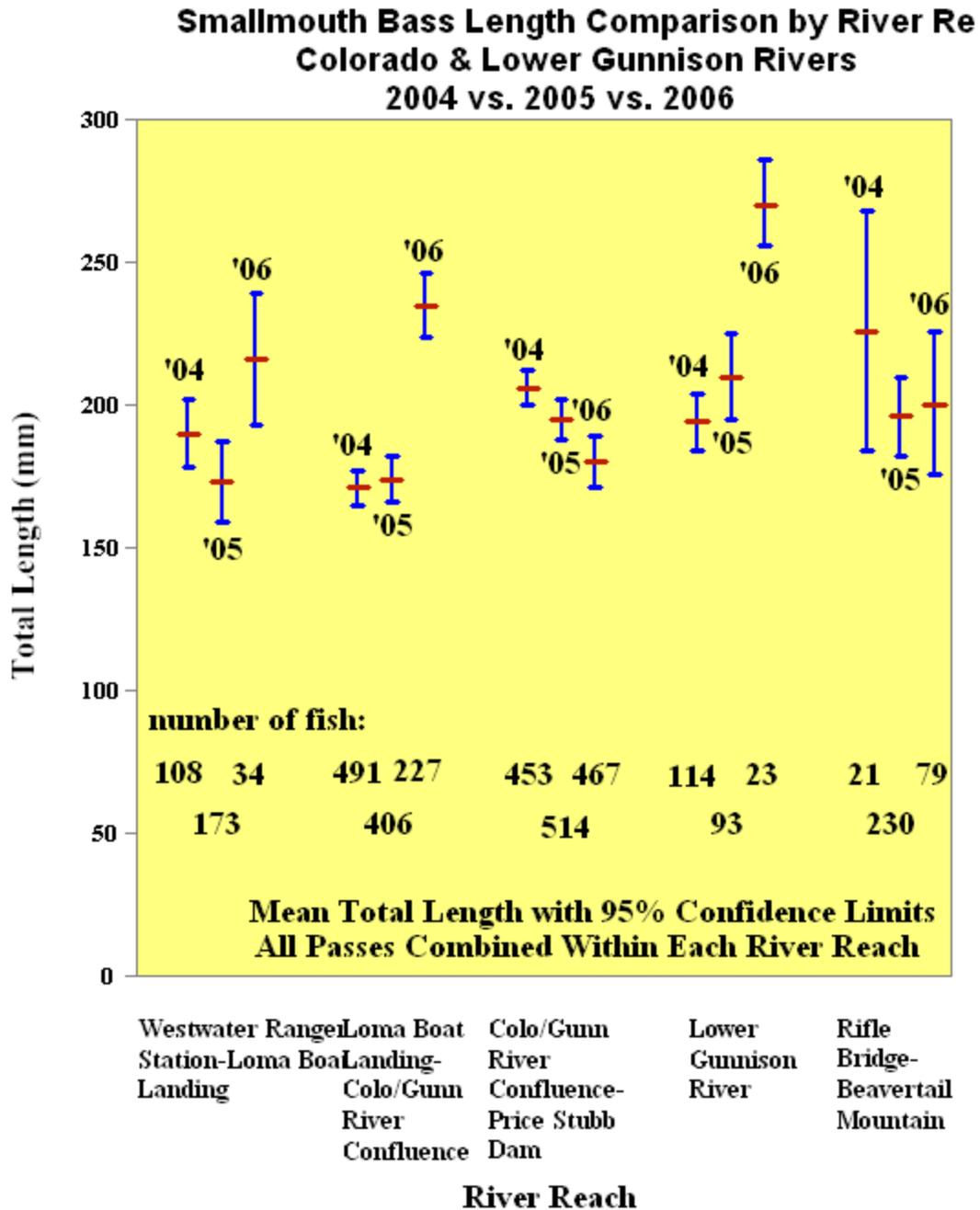


Figure 3. Comparison between the mean total length and 95% confidence interval for smallmouth bass collected with electrofishing from five major river segments on the Colorado and Gunnison rivers during the summer of 2004, 2005, and 2006. The mean is the middle horizontal line; the 95% confidence intervals are represented by the error bars ( $\pm$ ).

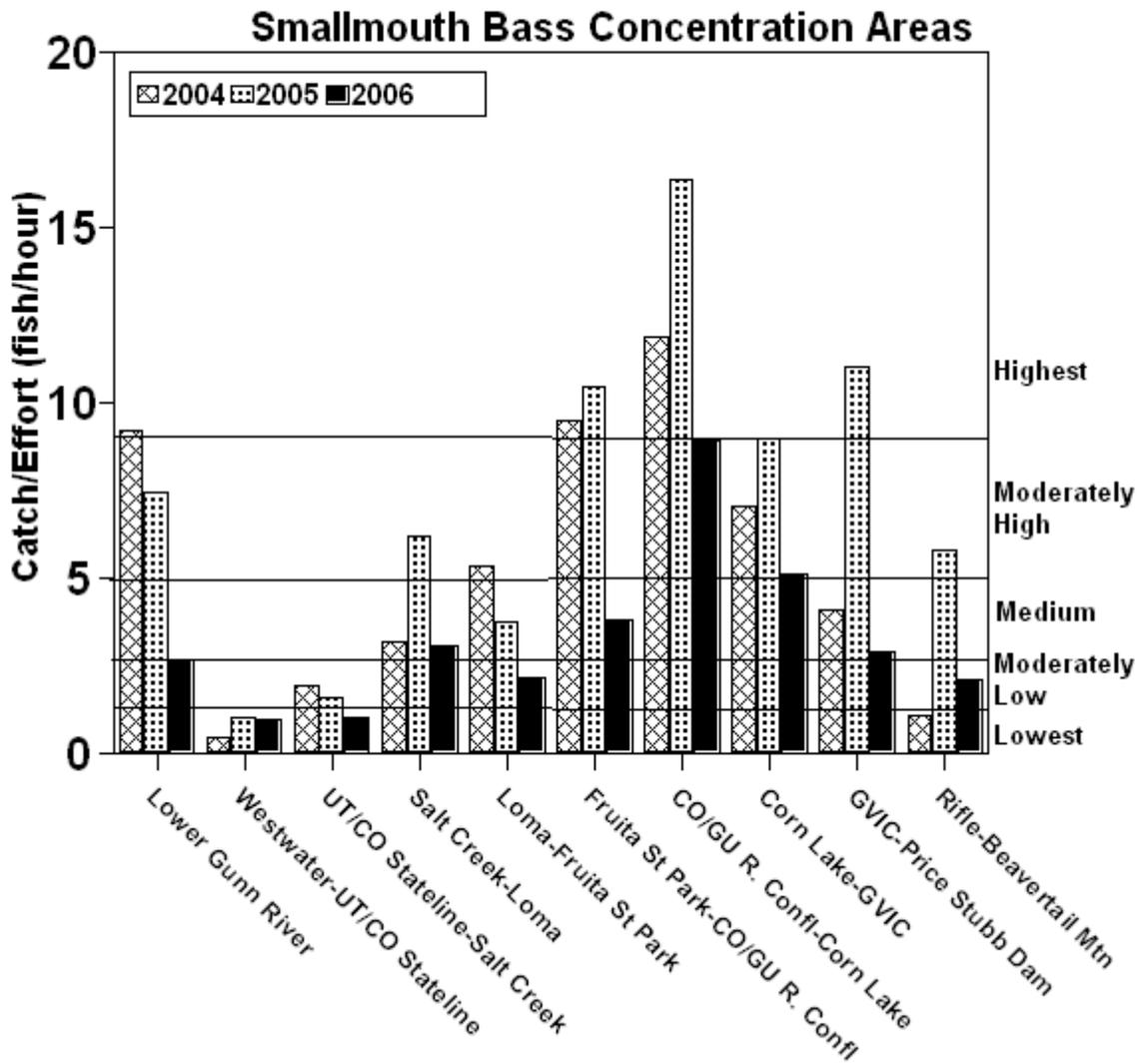


Figure 4. Concentration areas for smallmouth bass in 10 different river reaches of the Upper Colorado and Lower Gunnison rivers during the summer of 2004, 2005, and 2006 using catch effort indices. See Table 9 for actual values.