

**COLORADO RIVER RECOVERY PROGRAM**  
**FY-2008-2009 PROPOSED SCOPE OF WORK for:**  
Colorado River smallmouth bass removal

Project #: 126(a)

Lead Agency: Fish and Wildlife Service  
Colorado River Fishery Project

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Category:

- Ongoing project
- Ongoing-revised project
- Requested new project
- Unsolicited proposal

Expected Funding Source:

- Annual funds
- Capital funds
- Other (explain)

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

III. Study Background/Rationale and Hypotheses:

General

Significant anthropogenic changes to the physical riverine habitat have undoubtedly played an important role in the decline and endangered status of Colorado pikeminnow, humpback chub, bonytail, and razorback sucker, but changes in the biological environment may also have been equally significant. Physical changes in the riverine habitat have been accompanied by the introduction, establishment, and proliferation of nonnative fishes, and concomitant declines in native fishes in the Upper Colorado River basin. The role of nonnative fishes is often identified, in association with habitat changes, as a major obstacle to conservation of native fish communities.

At least 67 nonnative fishes have been introduced actively or passively into the Colorado River system during the last 100 years (Minckley 1982; Tyus et al. 1982; Carlson and Muth 1989; Minckley and Deacon 1991; Maddux et al. 1993). By 1980, more than 50 nonnative fishes had been actively introduced into rivers and reservoirs of the Colorado

River basin (Minckley 1982; Tyus et al. 1982; Carlson and Muth 1989). Native big river fishes have disappeared from about three-fourths of their original habitat while introduced fishes have become more widespread and abundant. Former studies have also documented a decline in the abundance of native fish species as nonnative species increased in abundance (Joseph et al. 1977; Behnke 1980; Osmundson and Kaeding 1989; Quarterone 1993).

Many of the nonnative fishes introduced into the Colorado River basin are suspected of adversely affecting the native mainstem fishes in some fashion. Warmwater gamefish are thought to have the greatest adverse effect on endangered native fishes. Centrarchids (e. g., largemouth bass, green sunfish, bluegill, black crappie, and smallmouth bass), ictalurids (e. g., channel catfish and black bullhead), and esocids (northern pike) are frequently listed as contributors to the decline of native fishes. An increasing body of evidence characterizes the negative interactions of nonnative fishes with the endangered big river fishes (Hawkins and Nesler 1991; Minckley et al. 1991; Maddux et al. 1993; Lentsch et al. 1996). Some of this evidence is indirect, including inferences from field data or results from laboratory studies of predation by nonnatives on natives. Laboratory studies have documented agonistic behavior, resource sharing, and vulnerability to predation (Papoulias and Minckley 1990; Karp and Tyus 1990; Ruppert et al. 1993; Johnson et al. 1993). Direct evidence of predation includes native fishes obtained from stomach contents of nonnative fishes and by visual observation of predation. Other means by which nonnative fishes may adversely affect native fishes are by competition for food, which limits the success of razorback sucker (Papoulias and Minckley 1990). The extent of predation pressure by some nonnative fishes on populations of native fishes is not exactly known. Tyus and Saunders (1996) went on to conclude that smallmouth bass along with channel catfish and northern pike were the main threat to juvenile Colorado pikeminnow and razorback sucker.

### Smallmouth Bass

Until 2003, smallmouth bass were only reported as incidental, rare captures in the Upper Colorado River from Price Stubb Dam (river mile 188.3) to the Colorado/Green River confluence. However, Fish and Wildlife sampling crews involved with the channel catfish removal evaluation recorded and documented the capture of 318 smallmouth bass in main channel riverine habitats in a 39-mile reach of the Upper Colorado River from the Gunnison/Colorado River confluence to the Utah/Colorado stateline (Burdick 2003(a)). Catch rates (fish/hour and fish/mile) steadily increased throughout the 4-month sampling period (30 June to 31 October)(Table 1). The source(s) of these smallmouth bass are unknown.

Table 1. Number, catch effort (fish/hr and fish/mile) for largemouth bass and smallmouth bass collected from main channel habitats in the Upper Colorado River with electrofishing from river mile 171.0 to 132.0 (Colorado/Gunnison River confluence to the Utah/Colorado stateline), 30 June to 31 October 2003. Note: data for the Upper Reach (Colorado/Gunnison River confluence to the Loma Boat Landing) and Lower Reach (Loma Boat Landing to the Colorado/Utah stateline) were combined. Total effort (hrs) = 132.82; total miles sampled = 293.

	Largemouth Bass			Smallmouth Bass		
	No.	Fish/hr	Fish/Mile	No.	Fish/hr	Fish/Mile
Pass 1	8	0.27	0.11	39	1.34	0.53
Pass 2	13	0.42	0.17	41	1.31	0.54
Pass 3	6	0.06	0.14	33	1.94	0.76
Pass 4	41	1.43	0.70	96	3.35	1.63
Pass 5	46	1.72	1.07	109	4.07	2.54
Totals	114	0.86	0.39	318	2.39	1.09

Upper Colorado River (Colorado)

In the Upper Colorado River between Price-Stubb Dam (river mile [RM] 188.3) and the head of Westwater Canyon, (RM 125), abundance and distribution information is limited for smallmouth bass. However, the increase in the number of smallmouth bass reported during the channel catfish removal evaluation had biologists and managers concerned that smallmouth bass abundance could increase quickly, and further impact recovery of native endangered fishes. Smallmouth bass have the potential to predate or compete with different life stages of the four native endangered fishes.

Fish passage has been restored at the Grand Valley Irrigation Company Diversion Dam near Palisade, the Government Highline Diversion Dam, and recently (March 2008) at the Price-Stubb Diversion Dam. For the first time in over 100 years fish now have upstream access from the Grand Valley to upstream reaches in the Upper Colorado River. Only a fish trap at the Government Highline fish passageway can prevent unimpeded movement upstream. Smallmouth bass are located in Rifle Gap Reservoir and adult smallmouth bass have been reported in the Colorado River between Rifle and Price-Stubb Dam (Anderson 1997; Burdick 2008). No “naturally occurring” Colorado pikeminnow have been reported upstream of Price-Stubb Dam during fishery investigations over the past 23 years (Valdez et al. 1982; Wydoski 1994; Anderson 1997). The last wild razorback sucker captured upstream of Price-Stubb Dam was at RMs 205, 220.7, and 223.7 in 1980 and 1981 (Valdez et al. 1982). However, both wild and domestic-reared Colorado pikeminnow along with domestic-reared razorback sucker have been stocked in the Upper Colorado River upstream from Price-Stubb Dam between 1999 and 2004 (Burdick 2002; records from CRFP database manager).

Adult Colorado pikeminnow have been captured in the reach between Grand Valley Irrigation Diversion Dam (RM 185.3) and Price-Stubb Dam. Burdick (1999) collected 10 adult Colorado pikeminnow between 19 August and 24 September during 1998. Eight adult pikeminnow were collected between 29 April and 22 June 1999 and seven were

collected in 2000 between 27 April and 19 May (personal communication, Douglas B. Osmundson). One radio-tagged Colorado pikeminnow was detected at the base of Price-Stubb Dam between mid-July and late-September in 1986 and 1987 (Osmundson and Kaeding 1989). Adult Colorado pikeminnow presently occupy the 15- and 18-mile reaches of the Colorado River in the Grand Valley and reaches downstream. Some of the last wild razorback sucker were captured in the 15-mile reach. Domestic-reared razorback sucker stocked near Parachute have been found in backwaters in the 15- and 18-mile reaches (Burdick 2002).

### Lower Gunnison River

In the fish trap of the Redlands Dam fish passageway in the Lower Gunnison River, the number of smallmouth bass have increased (19 fish in 2002 and 2003)(Burdick 2003(a)) over previous years of monitoring (1996–2001: 1 fish)(Burdick 2001). Nine smallmouth bass were collected in the fish trap at Redlands during 2004 (Burdick 2004a) and 21 during 2005 (Burdick 2005a). No smallmouth bass were collected in the fish trap during 2006 (Burdick, 2006(a)) or 2007 (Burdick 2007). About 1,800 fingerling smallmouth bass were stocked by the Colorado Division of Wildlife (CDOW) in 1973 in the Gunnison River near Delta (Wiltzius 1978) upstream from Redlands Diversion Dam. None of these stocked smallmouth bass have been subsequently captured upstream from the diversion dam (Wiltzius 1978, Valdez et al. 1982; Burdick 1995). Redlands Dam (RM 3.0) provides an effective barrier to smallmouth bass and all other fish attempting to move further upstream in the Gunnison River.

### Control of Nonnative Fish by Mechanical Removal

Control of smallmouth bass and other nonnative fish species is a primary emphasis, along with habitat restoration, propagation and stocking, and instream flow management within the Recovery Program for the four endangered fish species. In the strategic plan for the control of nonnative fishes in the Upper Colorado River Basin (Tyus and Saunders 1996), “control” was defined as “reducing the numbers of one of more nonnative species to levels below which they are no longer an impediment to the recovery of endangered fish species.” The goal for nonnative fish control or management in the Upper Colorado River Basin is to reduce the adverse impacts of nonnative fishes on the endangered fishes which will hopefully increase the distribution and abundance of the endangered fishes and contribute to their recovery. It is not likely that nonnative fishes that have become established in the Upper Colorado River Basin can be eliminated. However, preventive measures and active control programs could be implemented to reduce the abundance of nonnative fishes in riverine and adjacent floodplain habitats. Consequently, then, reducing the abundance of some problematic, nonnative fishes would reduce the potential for predation and competition on native listed and non-listed fishes. Management to promote recovery of listed fish species may have to include long-term or periodic suppression of some problematic nonnatives, such as mechanical removal, that minimizes impacts to remaining native fishes.

### 2004 Study Results

Total number of fish collected with boat and raft-based electrofishing by species during the 2004 smallmouth bass removal were, smallmouth bass: 1,165; largemouth bass: 277; black crappie/green sunfish/bluegill in the aggregate: 761 (Burdick 2004b).

There did not appear to be an obvious reduction in the abundance using catch effort indices (fish/hour and fish/mile) for smallmouth bass, largemouth bass, or the three other centrarchid fishes (black crappie, bluegill, and green sunfish) during the 2-month removal period in 2004. Overall mean catch effort for all these fishes actually increased with each subsequent pass in 2004. Therefore, during the summer of 2004, we did not show a depletion for either smallmouth bass or largemouth bass in main channel habitats of the Colorado River in western Colorado and eastern Utah and the Lower Gunnison River in western Colorado.

We also concluded that there was no statistically significant ( $\alpha=.05$ ) decline in the size (i.e., mean total length) of smallmouth bass over the four passes during the summer of 2004. Also, it was apparent from collections, that in some river segments (18-mile reach [Colorado/Gunnison River confluence to the Loma Boat Landing]), smallmouth bass reproduced during 2004.

The number of smallmouth bass recently collected as compared to those collected during investigations from previous years now leads researchers to believe that this species is quickly emerging as an abundant nonnative fish in the Grand Valley and Ruby and Horsethief canyons in the Upper Colorado River. And apparently, according to catch effort analyses between 2003 and 2004, smallmouth bass abundance is still increasing in the Grand Valley and Ruby and Horsethief canyons of the Upper Colorado River. It also appears that the abundance of smallmouth bass and largemouth bass collected with electrofishing in main channel habitats during the summer of 2004 was considerably greater than the number collected during the channel catfish removal evaluation that was conducted in the summer of 2003 and during the population monitoring for Colorado pikeminnow performed in the spring of 2004.

### 2005 Study Results

Total number of fish collected with boat and raft-based electrofishing by species during the 2005 smallmouth bass removal from Price Stubb Dam to the Westwater, UT, ranger station and the Lower Gunnison River was, smallmouth bass: 1,366; largemouth bass: 589; black crappie: 41; green sunfish: 643; bluegill: 316. Abundance for all five centrarchid fishes during 2005 increased from 2004. Abundance of smallmouth bass increased 11 fold from 21 to 230 fish from Rifle to Beavertail Mountain (Burdick 2005b). There did not appear to be an obvious reduction in abundance using catch effort indices (fish/hour and fish/mile) for smallmouth bass, largemouth bass, or the three other centrarchid fishes (black crappie, bluegill, and green sunfish) during the 2-month removal period in 2005. Therefore, during the summer of 2005, as was the case during the summer of 2004, we did not show a depletion for either smallmouth bass or largemouth bass in main channel habitats of the Colorado River in western Colorado and eastern Utah and the Lower Gunnison River in western Colorado. Overall mean catch effort for smallmouth bass increased in 2005 from 2004 (6.91 to 7.38); largemouth bass increased from 1.64 to 3.37; and black crappie/bluegill/green sunfish aggregate catch/effort increased from 4.51 to 8.07.

We also concluded that there was no statistically significant ( $\alpha=.05$ ) decline in the size (i.e., mean total length) of smallmouth bass between 2004 and 2005 in five river reaches of the Upper Colorado and Lower Gunnison rivers. Also, it was apparent from

collections, that in some river segments (18-mile reach [Colorado/Gunnison River confluence to the Loma Boat Landing]), smallmouth bass reproduced during 2005 as they did during 2004.

The number of smallmouth bass recorded during 2004 and 2005 compared to those collected during investigations from previous years indicates that not only has this species emerged as an abundant nonnative fish but is proliferating in some river segments of the Grand Valley, Ruby and Horsethief canyons, and between Rifle and Rulison in the Upper Colorado River. And apparently, according to catch effort analyses from the summer of 2003, 2004, and 2005, smallmouth bass abundance is still increasing in the Grand Valley and Ruby and Horsethief canyons of the Upper Colorado River.

### 2006 Study Results

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, rangerstation 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%)(Burdick 2006(b)).

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 ( $\alpha=0.05$ ) 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.

## 2007 Study Results

In the Grand Valley reaches of the Upper Colorado and Lower Gunnison rivers, smallmouth bass catch rates (fish  $\geq 100$  mm) declined to 2.27 fish/hr, the lowest in four years. The highest catch rate was 6.38 in both 2004 and 2005 for smallmouth bass  $\geq 100$  mm. This decline was consistent with the population estimate generated in 2006 and 2007 using a single mark and first removal pass. 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 2007 using a single mark and first removal pass was estimated to be  $1,427 \pm 986$  individuals or about a mean of 40.4 smallmouth bass  $\geq 100$  mm/mile. This compares to a population estimate of  $3,197 \pm 2,100$  (91 fish/mile) smallmouth bass of the same length sizes in 2006 which was a 55 % decline. However, abundance of smallmouth bass  $< 100$  mm was 4.54 fish/hr in 2007 and has steadily increased since 2004. This is evidence 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 2007 as they did during 2004, 2005, and 2006. In the Silt to Beavertail Mountain reaches, overall smallmouth bass (all length sizes) abundance has declined for the third year in row.

On the other hand, largemouth bass abundance for fish  $< 100$  mm and  $\geq 100$  mm both steadily increased over the past four years in the Grand Valley river reaches and were most abundant during 2007. Largemouth bass  $< 100$  mm catch rate increased from 1.03 fish/hr (2004) to 4.54 fish/hr (2007). Largemouth bass  $\geq 100$  mm catch rate increased from 0.63 fish/hr (2004) to 4.04 fish/hr (2007). In the Silt to Beavertail Mountain reaches, no apparent trend from year to year appears to be evident. Largemouth bass catch rates declined from 5.62 fish/hr (2006) to 3.30 fish/hr (2007). Abundance of young-of-the-year and age-1 largemouth bass and smallmouth bass is considerably less than that of Grand Valley reaches suggesting that spawning for these centrarchid fishes in the upper reaches is not as successful as the downstream reaches of the Grand Valley. In the Grand Valley reaches, green sunfish, bluegill, and black crappie captures do not appear to be declining.

Mean total length for smallmouth bass  $\geq 100$  mm decreased in four of the major river reaches from 2006 to 2007. In two of these reaches, the decrease was statistically significant ( $\alpha=.05$ ). Between 2005 and 2006, mean total length increased in all five major river reaches, four being statistically significant ( $\alpha=.05$ ) which may have been due in part to the loss of smallmouth bass between 100 and 180 mm.

A draft final report of field results over the past 3 years (2004–2006) was prepared and submitted to the Recovery Program in early-March 2007 for review. This draft final report was reviewed by four peer reviewers and their comments included in a revised version by the P.I. The report was approved as final in January 2008. The final synthesis report summarized various abundance indices (actual numbers, fish/hr, fish/mile, population estimate) for smallmouth bass captured by sub-reach, and attempted to determine any changes in mean individual size of smallmouth bass from 2004 to 2006 (Burdick 2008).

IV. Study Goals, Objectives, End Product:

Study Goals/Objectives

The purpose of this proposed study is to 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. The study objectives are to:

1. remove all sizes of smallmouth bass in the Upper Colorado River by boat and raft-based electrofishing, and
2. obtain an abundance estimate by mark and recapture methods for the Upper Colorado River between GVIC Dam and Loma Boat Landing and the Lower Gunnison River between Redlands Dam and the Colorado/Gunnison river confluence.

FINAL PRODUCT: Draft Synthesis Report to coordinator: 3/01/2007  
Draft Report to peer reviewers/BC: 4/01/2007  
Revised Report for BC consideration: 6/15/2007  
**FINAL REPORT approved: 1/17/2008**

- V. Study Area: sixty-one miles of the Upper Colorado River:  
Price-Stubb Dam downstream to Westwater boat landing (RM 188.3 – 127.6) & the Lower Gunnison River (RM 3.0 – 0.7);  
Rifle Bridge to Beavertail Mountain (RM 240.4 – 195.7) [added in 2004]  
Silt to Rifle (RMs ~ 250.0 – 240.4)[added in 2007]

VI. Study Methods/Approach:

General–Study Direction and Evolution

December 2003. One of the conclusions agreed upon by participants at the December 2003 Nonnative Fish Control Workshop in Grand Junction was that smallmouth bass posed a greater threat to native fishes than other nonnative game fishes (e.g., channel catfish). Northern pike was viewed as the present number one threat to native fishes. At this workshop, the priority was established to start removing smallmouth bass from the Upper Colorado River in western Colorado as soon as possible to head off a possible increase in the abundance of this species. Recovery of listed native fishes might be more attainable if the threats (i.e., predation and competition) posed by certain nonnative fishes, such as smallmouth bass, could be minimized or eliminated.

FY2006 Study Modifications. 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. In essence 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. Smallmouth bass were marked in the river segments from Price Stubb Dam to Fruita State Park in the Upper Colorado River and a 2.3-mile segment of the Lower Gunnison River. These river segments were 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.

The budget was increased to account for the additional manpower and other resources necessary to accomplish the objective of marking smallmouth bass during the initial pass in 2006. It was estimated that about 7 additional days (1.4 weeks) entailing about 35-person days was required for this additional initial pass to mark fish. Some marking equipment was also required.

The number of removal passes for areas of low densities of smallmouth bass as determined from 2004 and 2005 capture data were 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 have proliferated over the past two years. One such river reach was the 45-mile reach of the Upper Colorado River from the Rifle Bridge to Beavertail Mountain and, in particular, the 10 mile river segment from Rifle to Rulison. In 2005, the number of smallmouth bass collected in these reaches increased 11 fold and catch effort increased about 5.5 times. Re-focusing the removal effort resulted in a zero net budget change.

### Methodology

Currently, 2008 will be the fifth year of this removal study. A final synthesis report describing results from 2004 to 2006 was completed in January 2008. To date, sampling efforts have focused on a reach and not river-wide scale. For logistical considerations, the entire 61-mile section of the Upper Colorado River from Price-Stubb Dam to the Westwater, Utah, was divided into three different sub-reaches based on hydro-geomorphic features.

Three general sub-reaches were sampled in 2004, 2005, 2006, and 2007. These included, 1) a 3-mile section between Price-Stubb and Grand Valley Irrigation dams and the 15-mile section that extends from Palisade to the Gunnison/Colorado River confluence (RMs 185.5–171), 2) the 18-mile reach that extends from the confluence of the Gunnison and Colorado rivers to the Loma Boat Landing (RMs 171.0–152.6), and 3) Ruby and Horsethief canyons (RMs 152.6–127.6) which extends from the Loma Boat Landing to the Westwater, Utah. The 15- and 18-mile sub-reaches flow through a wide alluvial section of the lower Grand Valley; the canyon-bound sub-reach is considered a quasi-alluvial sub-reach. The number of sampling occasions (i.e., passes) in the 15-mile reach may be affected by the availability of sufficient water for sampling craft to operate due to extended drought conditions. Sampling the 3-mile section between Price-Stubb and Grand Valley Irrigation dams may be reduced due to poor access and low-water conditions in mid- to late-summer.

A 45-mile reach of the Upper Colorado River from the Rifle Bridge (river mile 240.7) to Beavertail Mountain in Debeque Canyon (river mile 195.7) was sampled with raftelectrofishing between August 23–26, 2004, mid-July 2005, and mid-July and mid-September 2006. This river reach was outside the original defined removal area. However, 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. One pass of this 45-mile reach was

accomplished during 2004. In 2005, and 2006 two passes were performed in the reaches where high concentrations of smallmouth bass occurred.

Each sub-reach between Price-Stubb Dam and Westwater, Utah, during 2004 and 2005 was sampled at least three times with electrofishing. Some sub-reaches where high concentrations of smallmouth bass were collected during the first three passes were sampled a fourth time. The study utilized jon boat and raft-based electrofishing to remove smallmouth bass. Each electrofishing craft was equipped with a Smith-Root (Model GPP 5.0) electrofishing unit. Actual time spent electrofishing (actual circuit time) was also recorded. Main channel habitats sampled included mostly shorelines and backwaters. Two electrofishing craft were used concurrently to collect fish. All smallmouth bass collected were removed and sacrificed. All smallmouth bass collected were provided to Pat Martinez of the Colorado Division of Wildlife for use in the analyses of origin (stable-isotope) study. Samples were preserved according to criteria provided by CDOW.

All other centrarchid fishes collected (e.g., largemouth bass, green sunfish, bluegill, and black crappie) were also sacrificed and preserved for the CDOW analyses of origin study. Other introduced game species (e.g. walleye and northern pike) inadvertently collected were sacrificed and provided to the CDOW. Additionally, as per Pat Martinez' request, FWS crews provided him about 110 channel catfish during the summer of 2005 and 2006 for another CDOW study.

All juvenile and adult endangered fish collected were checked for a PIT tag, weighed, measured, and immediately returned to the river.

#### FY 2007; FY 2008

*Sampling Protocol.* During 2007, the sampling protocol was similar to that performed in 2006. An initial pass was again performed to mark and release all smallmouth bass collected in the moderate to high concentration areas of the Upper Colorado River from GVIC Diversion Dam to Loma Boat Landing and the lower 2.3 miles of the Gunnison River. Smallmouth bass collected during the first pass were marked with a Fiskars® hole punch (1/4-inch diameter) in the dorsal part of the caudal fin. Six removal passes followed. Subsequent recaptures of smallmouth bass marked during the marking pass were recorded for determining an abundance estimate. In late-September, the Colorado Division of Wildlife performed two removal passes within four high concentration reaches for smallmouth bass in the Upper Colorado and Lower Gunnison rivers in the Grand Valley.

Aluminum boat and raft electrofishing were used to collect fish during 2007. Sampling occurred in Garfield and Mesa counties during July, August, and September. Additional passes from Rifle to Beavertail Mountain were added in 2007 in sub-reaches where high concentrations of smallmouth bass were detected in the past and in earlier passes performed during 2007. Reconnaissance sampling in the Upper Colorado River from Silt to Rifle was also conducted in 2007 to determine if smallmouth bass occurrence in this sub-reach. In 2007 field data were again recorded from all juvenile and adult endangered fish collected. They were also checked for a PIT tag, weighed, measured, and immediately returned to the river.

Fish sampling protocol in 2008 will be similar to that of 2007.

*Fish Disposal.* All smallmouth bass (except for fish marked and released during the marking pass) and all other centrarchids plus any inadvertent northern pike, walleye, gizzard shad, grass carp, and yellow perch collected will be lethally removed. Disposal of all the aforementioned fishes will be as follows: following capture, fish will be euthanized afield and preserved with ice. All dead fish will be held on station in freezers and disposed of in the Mesa County landfill southeast of Grand Junction.

*Data Analyses.* All smallmouth bass captured within each of the sub-reaches were enumerated in 2004, 2005, 2006, and 2007. Total numbers of smallmouth bass and largemouth bass collected and catch/effort (fish/hr) were also determined for each sub-reach per sampling pass for each of these 3 years. Length data were recorded for 2004, 2005, 2006, and 2007 to determine the size structure of smallmouth bass removed. This protocol will continue during 2008.

Data summary analyses similar to that employed for the 2004, 2005, 2006, and 2007 field results will be used to analyze the 2008 data. During 2008, mark-recapture data will be subjected to an abundance estimator to obtain a population estimate for smallmouth bass from the 15- and 18-mile reaches and the lower 2.3 miles of the Gunnison River. Chapman's (1951) modification of the Petersen-Lincoln estimator was used to determine the abundance of smallmouth bass in 2006 and 2007 and will be used again in 2008. Probability of capture ( $p$ -hat)(after White et al. 1982) and the coefficient of variation (CV:  $SE/N$ -hat  $\times$  100 [where  $N$ =estimated population size])(Pollock et al. 1990) will also be computed. All centrarchid fishes captured during the 2008 field work will also be analyzed similar to the data analyzed for 2004, 2005, 2006, and 2007 for among year comparisons.

## VII. Task Description and Schedule

### Description

Task 1. Remove all sizes of smallmouth bass.

Sub-task 1a. Mark and release smallmouth bass during pass 1 in 2008.

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

Task 3. Write a) draft and b) final synthesis report. **COMPLETED: 1/2008**

### Schedule

Task 1. 6/2008 – 10/2008;

Sub-task 1a. 7/2008

Task 2. a) 8/2008 – 10/2008; b) & c) 11/2008

Task 3. a) 11/2006 – 1/2007; b) 1/2007 – 6/2007 **COMPLETED 1/2008**

## VIII. FY-2008 Work (fifth year of multi-year study)

### Deliverables/Due Dates:

Annual Report due 11/2008

Budget (actual salary rates w/ benefits provided by CRFP Administrative Officer used for labor; equipment & vehicle expenses adjusted by 3% from 2007 budget)

Task 1: remove all smallmouth bass; sub-task 1a: mark & release smallmouth bass on pass 1 for population estimate

1. Labor (salary and benefits)			
Project Leader (1-GS-14 @ 2,245)	4 weeks		\$ 8,980
Project Fishery Biologist (1-GS-12 @ 2,025)	28 weeks		\$ 56,700
Seasonal Technicians GS-5 @ 632 (4)	17 weeks		\$ 42,976
Administrative Asst. (1-GS-9 @ 1,391)	5 weeks		\$ 6,955
		Subtotal	\$ 115,611
2. Travel (RP meetings/workshops)			
	1 week		\$ 1,050
		Subtotal	\$ 1,050
3. Equipment			
Gasoline, 2-cycle outboard oil for outboards; props, jet-pump impellers, liners, parts			\$ 3,000
Maintenance (Boat Motors, Generators, GPPs, aluminum boat repair)			\$ 7,555
Office (paper, telephones, postage, office supplies, computer software/support, misc.)			\$ 1,555
Dip nets; stainless steel spheres, cable, hardware			\$ 1,160
Marking equipment (Fiskars® scissors/punches)			\$ 105
		Subtotal	\$ 13,375
4. Vehicles (GSA-leased, FWS-owned: gas/tires/maintenance)			
Fish Collections			\$ 9,080
		Subtotal	\$ 9,080
		Task 1 Subtotal	\$ 139,116

Task 2. Computerize field data; analyze data; prepare RIP annual report.

1. Labor (salary and benefits)			
Project Fishery Biologist (1-GS-12 @ 2,025)	4 weeks		\$ 8,100
		Subtotal	\$ 8,100
	Task 2	Subtotal	\$ 8,100
		FY2008 All Tasks Total	\$ 147,216

FY-2009 Work (sixth year of multi-year study)

Deliverables/Due Dates:

Annual Report due 11/2009

Budget (actual salary rates w/ benefits provided by CRFP Administrative Officer used for labor; equipment & vehicle expenses adjusted by 3% from 2008 budget)

Task 1: remove all smallmouth bass; sub-task 1a: mark & release smallmouth bass on pass 1 for population estimate

1. Labor (salary and benefits)			
Project Leader (1-GS-14 @ 2,353)	4 weeks		\$ 9,412
Project Fishery Biologist (1-GS-12 @ 2,246)	28 weeks		\$ 62,888
Seasonal Technicians GS-5 @ 654 (4)	17 weeks		\$ 44,472
Administrative Asst. (1-GS-9 @ 1,485)	5 weeks		\$ 7,425
	Subtotal		\$ 124,197
2. Travel (RP meetings/workshops)			
	1 week		\$ 1,085
	Subtotal		\$ 1,085
3. Equipment			
Gasoline, 2-cycle outboard oil for outboards; props, jet-pump impellers, liners, parts			\$ 3,100
Maintenance (Boat Motors, Generators, GPPs, aluminum boat repair)			\$ 7,785
Office (paper, telephones, postage, office supplies, computer software/support, misc.)			\$ 1,600
Dip nets; stainless steel spheres, cable, hardware			\$ 1,200
Marking equipment (Fiskars® scissors/punches)			\$ 110
	Subtotal		\$ 13,795
4. Vehicles (GSA-leased, FWS-owned: gas/tires/maintenance)			
Fish Collections			\$ 9,110
	Subtotal		\$ 9,110
	Task 1 Subtotal		\$ 148,187
Task 2. Computerize field data; analyze data; prepare RIP annual report.			
1. Labor (salary and benefits)			
Project Fishery Biologist (1-GS-12 @ 2,246)	4 weeks		\$ 8,984
	Subtotal		\$ 8,984
	Task 2 Subtotal		\$ 8,984
	FY2009 All Tasks Total		\$ 157,171

IX. Budget Summary

FY-2008	\$ 147,216
<u>FY-2009</u>	<u>\$ 157,171</u>
Grand:	
Total:	\$ 304,387

X. Reviewers: None

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