

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.

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.

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.

Field activities are scheduled to continue in 2006 with a writeup of field results in 2007.

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 2005 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

A. FY-2005 Tasks and Deliverables: Task 1

Task 1. Remove all sizes of smallmouth bass.

Task Completed.

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

Task completed. Preparation of the annual report also sufficed for the December 2005 nonnative fish workshop.

B. Findings (2005 Highlights)

General

The study area encompassed a 61-mile section of the Colorado River in western Colorado from the Price-Stubb Dam to the Westwater, UT, 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.

Four passes were made using aluminum boat and raft-based electrofishing to collect centrarchid fishes from 25 July to 26 August 2005. 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 1 and 3). After the first three passes, it was determined that some river segments had higher densities of smallmouth bass. Therefore, 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 12 and 21. 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.

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).

Size Distribution–Length Frequency. Length frequency distribution of all sizes of smallmouth bass collected with electrofishing during 2004 and 2005 were plotted for each pass (Figures 1–4). Because sample sizes were small during some passes in some river segments, some river segments were combined. River segments were combined by hydro-geomorphic features (e.g., canyon-bound vs. alluvial). For the Colorado River, these combined segments were: 1) Westwater Ranger Station, UT, to the Loma Boat Landing (canyon-bound), 2) Loma Boat Landing to the Colorado/Gunnison River confluence (alluvial), 3) the Colorado/Gunnison River confluence to Price Stubb

Diversion Dam (alluvial), and 4) Rifle Bridge to Beavertail Mountain. The Rifle Bridge to Beavertail Mountain in Debeque Canyon includes reaches that are both in alluvial and canyon-bound settings. For the Lower Gunnison River the one segment was from the Redlands Diversion Dam to the Colorado/Gunnison River confluence (alluvial). For some graphs (Figures 5-7), passes were combined within these five major river segments for both 2004 and 2005.

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 index 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 the five aforementioned river segments for 2004 and 2005. This analysis 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 between 2004 and 2005. Overall mean total length increased in two river segments: Loma Boat Landing to the Colorado/Gunnison River confluence and Lower Gunnison River (Figure 8). Overall mean length decreased in three other river reaches: Westwater, UT, ranger station to the Loma Boat Landing, Colorado/Gunnison River confluence to the Price-Stubb Dam, and the Rifle Bridge to Beavertail Mountain. However, there was no significant difference ($\alpha=.05$) in the mean total length of smallmouth bass captured between 2005 and 2004 when all passes were combined within each of the five river reaches analyzed (Figure 8).

All age groups of smallmouth bass (young-of-the-year, juveniles, and adults) were represented in our collections in the summer of 2005. These ranged from young (26 mm) to adult (437 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 9). While it is not distinct, it appears that there were about three length groups of smallmouth bass. 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 and 2005. 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. 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 passes were tallied for 2004 and 2005 for four major river segments (Table 1). Total number fish collected by species during the 2005 smallmouth bass removal from Price-Stubb Dam to the Westwater, UT, ranger station was, smallmouth bass: 1,366; largemouth bass: 589; black crappie: 41; green sunfish: 643; bluegill: 316. Smallmouth bass numbers increased 17% from 2004 to 2005;

largemouth bass numbers increased 113%; black crappie numbers increased 83%; bluegill numbers increased 185%; and green sunfish numbers increased 63%. The number of smallmouth bass collected in the fish trap of the Redlands Diversion Dam passageway has been recorded for 10 years (Table 2). 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.

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

A notable increase in smallmouth bass abundance was recorded between the Rifle Bridge and Beavertail Mountain. 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 (Table 8). During 2005, 188 smallmouth bass were collected between the Rifle Bridge and Rulison. One hundred seventy two smallmouth bass (91%) were collected in a 3.8-mile reach immediately downstream from the Rifle Bridge. And of those 172 smallmouth bass, 90% (154) were captured in a backwater/side channel habitat (river mile 236.6) adjacent to where the Pioneer Irrigation Ditch empties into the Colorado River. Rifle Creek empties into the Colorado River at river mile 239.6 and the Pioneer Irrigation Ditch, which receives water from Rifle Creek in the town of Rifle, empties into the Colorado River at river mile 236.9. Rifle Creek drains Rifle Gap Reservoir which has a smallmouth bass fishery.

Catch/Effort. Since all centrarchids captured were lethally removed, fish were not marked and thus a population estimate was not possible. However catch rate or catch/effort can be used because it is directly proportional to abundance and is an index of the population size. 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 (Tables 4 and 5; Figure 10). 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, UT, ranger station and the Lower Gunnison River. Between Rifle and Beavertail Mountain, the effort expended in 2004 was 19.750 hours compared to 39.799 hours during 2005.

From Price Stubb Dam to the Westwater ranger station, overall mean catch/effort (Table 5) for smallmouth bass remained rather static during passes 1 and 2, declined slightly during pass 3 but was greatest during pass 4 (Figure 11). Largemouth bass catch/effort was highest during pass 1 and declined during passes 2, 3, and 4 (Figure 11). For black crappie, bluegill, and green sunfish, the aggregate catch/effort remained about the same during passes 1 and 2, but increased dramatically during passes 3 and 4.

There are several possible explanations for increased catch rate of centrarchid fishes. One explanation for this increase with each subsequent pass was that sampling crews became more knowledgeable about the habitats and in-river features and structures smallmouth inhabited. Thus, sampling crews may have become more skillful and efficient in catching centrarchids as the sampling season progressed. Thus, sampling efficiency was enhanced as workers (i.e., boat operators and netters) gained more experience. The same situation was noted during the 2003 channel catfish removal evaluation on the Colorado River and smallmouth bass removal project during the summer of 2004. Another explanation is that the abundance of centrarchid fishes is simply increasing.

Sampling crews on the Colorado River noted in 2005 that catch rates did not decrease when water turbidity was high and water clarity low. 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 highly turbid water conditions (e-mail transmittal, Mark H. Fuller, FWS, Vernal, UT, 8/26/2005). 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 2005, the highest catch rate in main channel habitats was between Corn Lake and the Colorado/Gunnison River confluence (16.36 fish/hour; all passes combined). The second highest river reach was from Price-Stubb Dam to the GVIC Diversion Dam (11.02 fish/hour) followed third by the reach from the Colorado/Gunnison River confluence to Fruita State Park (10.43 fish/hour)(Table 5). The 2.3-mile segment in the Lower Gunnison River had the fourth highest abundance of smallmouth bass (7.44 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. In 2005, the highest catch rate for largemouth bass in main channel habitats was between Fruita State Park and the Loma Boat Landing (8.19 fish/hour; all passes combined) followed by the river reach between Corn Lake and the Colorado/Gunnison River confluence (6.27 fish/hour), and the segment between the Colorado/Gunnison River confluence to Fruita State Park (Table 5). The highest densities of black crappie, green sunfish, and bluegill during 2005 were between Fruita State Park and the Loma Boat Landing (21.94 fish/hour).

Overall mean catch rates (all passes combined) 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.

The number of smallmouth bass recently recorded compared to those collected during investigations from previous years indicates that this species has emerged as an abundant nonnative fish and is proliferating in some river segments of the Grand Valley, Ruby and Horsethief canyons, and between Rifle and Rulison in the Upper Colorado River.

Annual and seasonal comparison of overall catch/effort of smallmouth bass and largemouth bass will provide population trend indices to determine if densities of these two fish in main channel habitats are declining or increasing. Overall catch/effort (fish/hour) analyses for both smallmouth bass and largemouth bass collected from main channel habitats in the Upper Colorado River were performed between smallmouth bass and largemouth bass collected during the spring 2004 and 2005 Colorado pikeminnow population monitoring and summer 2004 and 2005 smallmouth bass removal project. River reaches within this analyses included, 1) the Redlands Diversion Dam to the Colorado/Gunnison River confluence in the Lower Gunnison River, 2) Westwater Ranger Station in Utah to the Loma Boat Landing, and 3) Loma Boat Landing to the Price-Stubb Dam in the Colorado River.

In each of the three major river sections illustrated, spring smallmouth bass catch rates declined from 2004 to 2005. However, summer smallmouth bass catch rates increased from 2004 to 2005 in two of the three river sections: Price Stubb to the Loma Boat Landing and Loma to the Westwater, UT, ranger station. In the Lower Gunnison River, smallmouth bass summer catch rate decreased slightly (Figure 12). Spring catch rate for largemouth bass was virtually non-existent and remains rather insignificant. However, summer catch rates in all of the three major river sections increased for largemouth bass from 2004 to 2005 (Figure 13).

Catch/effort for smallmouth bass in the spring of 2004 was 2.84 fish/hour compared to 6.91 fish/hour in the summer (Table 7). In 2005, catch/effort for smallmouth bass was only 0.96 fish/hour in the spring whereas the summer catch/effort was 7.83 fish/hour. For largemouth bass, catch rate in the spring of 2004 was 0.03 and the summer catch rate was 2.77 fish/hour. During 2005, catch/effort was 0.04 fish/hour in the spring whereas the summer catch rate was 3.37 fish/hour (Table 7). It appears that both largemouth bass and smallmouth bass are not as vulnerable or available for capture during spring as they are during the summer months of July and August.

Therefore, during the summer of 2005, we did not show a depletion for either smallmouth bass or largemouth bass numbers in main channel habitats of the Colorado River in western Colorado and eastern Utah and the Lower Gunnison River in western Colorado. Rather, abundance (actual numbers and catch rate [fish/hour, fish/mile]) of both species in 2005 actually increased over that of 2004 catches.

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 and 2005 catch/effort values (Table 9). A 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 and 2005. The next highest area is between the Colorado/Gunnison

River confluence and Fruita State Park. The third highest concentration area is the 2.3 miles of the Lower Gunnison River which is no surprise because it is adjacent to the two highest concentration areas in the Upper Colorado River. During 2005, the greatest increase in concentration was between Price Stubb Dam to the GVIC Dam and the reach between Rifle and Beavertail Mountain.

Other Nonnative Game Fishes. One walleye pike (total length 490 mm) was collected between Rifle and Rulison (river mile 239) and one northern pike (total length 589 mm) was collected in the 18-mile reach (river mile 164). 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.

VII. Recommendations:

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 2006.
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. Electrofishing should commence following cessation of spawning of Colorado pikeminnow which should be sometime in mid- to late-July.
4. Increase the number of electrofishing passes in river segments that have higher concentrations of smallmouth bass, if possible, 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 2006 Colorado scientific collection permit.

7. Investigate the possibility of smallmouth bass escapement from Rifle Gap Reservoir into the Colorado River.

VIII. Project Status:

- A. "On track and ongoing".
- B. Study direction and sampling design for 2006 may be adjusted pending the outcome from the nonnative fish workshop in mid-December 2005.

IX. FY 2005 Budget Status

- A. Funds Provided: \$ 71,654
- B. Funds Expended: \$ 71,654
- C. Difference: \$ -0-
- D. Percent of the FY 2005 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 14 November 2005
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
13 figures attached

Prepared and compiled by Bob D. Burdick, 11/14/2005
2005ColoR-smbass-rpt.wpd

APPENDIX

Table 1. Numbers of centrarchid fishes collected with raft and aluminum boat electrofishing during Pass 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 and August 2004 and 2005. Note: Pass 4 was a “concentration pass” which sampled sections of river with high densities of centrarchids determined from Pass 1, 2, and 3.

River River Segment (River Miles)	Number of Centrarchids									
	Smthbass		Lrgmth		Green		Black		Bluegill	
	Bass		Bass		Sunfish		Crappie			
	'05	'04	'05	'04	'05	'04	'05	'04	'05	'04
Colorado River Rifle to Beavertail Mountain (240.4-195.7)										
Pass 1	230	21	38	65	606	36	2	0	10	0
Colorado River Price-Stubb Dam- Westwater, Utah (187.7-127.6) & Lower Gunnison River Redlands Dam- Colo/Gunn River Confluence (3.0-0.7)										
Pass 1	^a 475	219	247	28	271	119	17	2	109	20
Pass 2 ^a	411	256	119	23	236	87	6	4	53	14
Pass 3 ^a	313	504	168	146	366	321	8	1	103	62
GVIC-Loma + Lower Gunnison River (185.3-152.6 + 3.0-0.7)										
Pass 4 ^b	167	186	55	80	178	116	10	0	51	15
Year Totals	1,366	1,165	589	277	1,051	643	41	7	316	111

^a Two electrofishing craft used.

^b One electrofishing craft used.

Table 2. Number of smallmouth bass collected in the fish trap of the Redlands fish passageway, 1996–2005.

	Year									
	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05
	1	0	0	0	0	0	13	6	9	21

Table 3. Numbers of centrarchid fishes collected during pass (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 and August 2005. 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 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	20	60	11	n/s	10	1	4	n/s	48	10	27	n/s
GVIC Dam ▶ Corn Lake	60	46	64	38	4	12	52	18	39	50	105	74
Corn Lake ▶ Colo/Gunn River Confluence	89	74	70	46	33	35	54	6	57	58	60	33
Colo/Gunn R. Confl. ▶ Fruita State Park	183	158	53	75	132	25	23	24	154	50	38	77
Fruita State Park ▶ Loma Boat Landing	6	2	41	4	56	39	19	1	62	44	201	8
Loma Boat Landing ▶ Salt Creek Wash	79	19	27	n/s	5	2	6	n/s	22	5	18	n/s
Salt Creek Wash ▶ Utah/Colo Stateline	17	9	13	n/s	2	0	5	n/s	9	3	9	n/s
Utah/Colo Stateline ▶ Westwater, Utah BLM Ranger Station	6	1	2	n/s	5	5	2	n/s	2	2	2	n/s

Lower Gunnison River (RM 3.0–0.7)												
Redlands Div. Dam ▶ Colo/Gunn R. Confluence	15	42	32	4	0	0	3	6	4	73	17	47
2005 Pass Totals	475	411	313	167	247	119	168	55	397	295	477	239
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 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 and August 2005. 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	<u>Electrofishing Effort (hrs)</u>			
	<u>P-1</u>	<u>P-2</u>	<u>P-3</u>	<u>P-4</u>
Colorado River (RM 187.7–127.6)				
Price-Stubb▶GVIC Dam	2.860	2.460	2.794	n/s
GVIC Dam ▶ Corn Lake	6.322	5.434	7.074	4.371
Corn Lake ▶Colo/Gunn River Confluence	7.048	5.842	4.164	3.355
Colo/Gunn R. Confl. ▶ Fruita State Park	16.430	10.727	11.323	6.508
Fruita State Park ▶ Loma Boat Landing	4.154	3.133	4.647	2.103
Loma Boat Landing ▶ Salt Creek Wash	6.823	6.433	5.745	n/s
Salt Creek Wash ▶ Utah/Colo Stateline	8.005	7.654	8.284	n/s
Utah/Colo Stateline ▶ Westwater, Utah BLM Ranger Station	3.206	2.691	2.950	n/s

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Lower Gunnison River (RM 3.0–0.7)				
Redlands Div. Dam ▶ Colo/Gunn R. Confluence	3.194	3.802	2.981	2.043

2005 Pass Totals	58.042	48.176	49.962	18.380
2005 Total	<i>174.560</i>			

Table 5. Catch/effort (fish/hour) of centrarchid fishes collected during pass (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 and August 2005. 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 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	6.99	24.39	3.94	n/s	3.50	0.41	1.43	n/s	16.78	4.07	9.66	n/s
GVIC Dam ▶ Corn Lake	9.49	8.47	9.05	8.69	0.63	2.21	7.35	4.12	6.17	9.20	14.84	16.93
Corn Lake ▶ Colo/Gunn River Confluence	12.63	12.67	16.81	13.71	4.68	5.99	12.97	1.79	8.09	9.93	14.41	9.84
Colo/Gunn R. Confl. ▶ Fruita State Park	11.20	14.73	4.68	11.52	8.03	2.33	2.03	3.69	9.37	4.46	3.36	11.83
Fruita State Park ▶ Loma Boat Landing	1.44	0.64	8.82	1.90	13.48	12.45	4.09	0.48	14.93	14.04	43.25	3.80
Loma Boat Landing ▶ Salt Creek Wash	11.58	2.95	4.70	n/s	0.73	0.31	1.04	n/s	3.22	0.78	3.13	n/s
Salt Creek Wash ▶ Utah/Colo Stateline	2.12	1.18	1.57	n/s	0.25	0.00	0.60	n/s	1.12	0.39	1.09	n/s
Utah/Colo Stateline ▶ Westwater, Utah BLM Ranger Station	1.87	0.37	0.68	n/s	1.56	1.86	0.68	n/s	0.62	0.74	0.68	n/s

Lower Gunnison River (RM 3.0–0.7)												
Redlands Div. Dam ▶ Colo/Gunn R. Confluence	4.70	11.05	10.73	1.96	0.00	0.00	1.01	2.94	1.25	19.20	5.70	23.01
Mean of 2005 Passes	8.18	8.53	6.26	9.09	4.26	2.47	3.36	2.99	6.84	6.12	9.55	13.00
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 and August, 2005. Note: see Table 2 for the total electrofishing effort (hrs) sampled for each river segment; n/s=not sampled. Two electrofishing craft were used for passes 1, 2, and 3; one electrofishing craft was used for pass 4. Values for 2004 are provided in italics 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
Colorado River								
Price-Stubb Dam- Colo/Gunn Confl. Segment Length: 16.7 miles Miles Sampled: 33.4	169 <i>106</i>	180 <i>94</i>	145 <i>174</i>	^a 84 <i>^a 78</i>	5.1 <i>3.2</i>	5.4 <i>2.8</i>	4.3 <i>5.2</i>	5.9 <i>5.5</i>
Colo/Gunn Confl- Loma Boat Landing Segment Length: 18.4 miles Miles Sampled: 36.8	189 <i>55</i>	160 <i>101</i>	94 <i>238</i>	^b 79 <i>^b 97</i>	5.1 <i>1.5</i>	4.3 <i>2.8</i>	1.2 <i>6.5</i>	4.3 <i>5.3</i>
Loma Boat Landing- Salt Creek Wash Segment Length: 8.4 miles Miles Sampled: 16.8	79 <i>23</i>	19 <i>13</i>	27 <i>30</i>	n/s <i>n/s</i>	4.7 <i>1.4</i>	1.1 <i>0.8</i>	1.6 <i>1.8</i>	n/s <i>n/s</i>
Salt Creek Wash- Utah/Colo Stateline Segment Length: 12.3 miles Miles Sampled: 24.6	17 <i>6</i>	9 <i>19</i>	13 <i>14</i>	n/s <i>n/s</i>	0.7 <i>0.3</i>	0.4 <i>0.8</i>	0.5 <i>0.6</i>	n/s <i>n/s</i>
Utah/Colo Stateline- Westwater Ranger Station, Utah Segment Length: 4.3 miles Miles Sampled: 8.6	6 <i>1</i>	1 <i>1</i>	2 <i>1</i>	n/s <i>n/s</i>	0.7 <i>0.1</i>	0.1 <i>0.1</i>	0.2 <i>0.1</i>	n/s <i>n/s</i>
Lower Gunnison River								
Redlands Div. Dam- Colo/Gunn Confl. Segment Length: 2.3 miles Miles Sampled: 4.6	15 <i>28</i>	42 <i>28</i>	32 <i>47</i>	^c 4 <i>^c 11</i>	3.3 <i>6.1</i>	9.1 <i>6.1</i>	6.7 <i>10.2</i>	1.7 <i>4.8</i>

^a 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.

^b One electrofishing craft was used; miles sampled=18.4 for Pass 4.

^c One electrofishing craft was used; miles sampled=2.3 for Pass 4.

Table 7. Comparison between the total number and overall catch/effort (fish/hr) for largemouth bass and smallmouth bass collected from main channel habitats in the Upper Colorado River from river mile 187.6 to 127.6 (Price-Stubb Dam to the Westwater Ranger Station, UT) and the Lower Gunnison River from river mile 3.0 to 0.7 (Redlands Diversion Dam to the Colorado/Gunnison River confluence) with electrofishing, April, May, and June 2005 during the spring (SPR) Colorado pikeminnow population monitoring and summer (SUM) smallmouth bass removal project. Passes within each project were combined. Note: totals for 2004 are provided for annual comparisons. See Figures 12 and 13 for an illustration of these data.

	<u>Largemouth Bass</u>				<u>Smallmouth Bass</u>				<u>Effort (hrs)</u>	
	<u>No.</u>		<u>Fish/hr</u>		<u>No.</u>		<u>Fish/hr</u>		<u>SPR</u>	<u>SUM</u>
	<u>SPR</u>	<u>SUM</u>	<u>SPR</u>	<u>SUM</u>	<u>SPR</u>	<u>SUM</u>	<u>SPR</u>	<u>SUM</u>	<u>SPR</u>	<u>SUM</u>
Colorado River										
Westwater-Loma Boat Landing	5	32	0.07	0.62	82	173	1.22	3.34	67.411	51.791
Loma Boat Landing-Price-Stubb Dam	1	548	0.01	4.95	63	1,100	0.75	9.93	84.183	110.749
Lower Gunnison River										
Redlands Dam-Colo/Gunn Confl.	0	9	0.00	0.75	6	93	1.08	7.74	5.547	12.020

Totals 2005	6	589	0.04	3.37	151	1,366	0.96	7.83	157.141	174.560
Totals 2004	3	304	0.03	2.77	322	1,165	2.84	6.91	113.249	168.665

Table 8. 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 12–15; 21, 2005.

Reach: Rifle Bridge–Rulison Bridge
 River Mile: 240.7–230.0; River Mile Length: 10.7
 Number of Electrofishing Crafts: 3
 Effort (hr): 12.368

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
187	41	435	199	13	<100	446	339	353	81	165	117	10	101	174	152	2	106	120	113

Reach: Rulison Bridge–Parachute Bridge
 River Mile: 229.9–223.0; River Mile Length: 6
 Number of Electrofishing Crafts: 2
 Effort (hr): 5.410

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
0	--	--	--	0	--	--	--	32	< 100	130	~ 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): 12.092

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
31	70	437	204	24	45	373	142	176	<100	175	122	0	--	--	--	0	--	--	--

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): 9.929

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
12	78	227	131	1	--	--	117	45	70	151	115	0	--	--	--	0	--	--	--

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

River	River Segment (river miles)	2004		2005	
		Catch/Effort ^a	Concentration Rating ^b	Catch/Effort ^a	Concentration Rating ^b
Upper Colorado River					
	Rifle-Beavertail Mtn (240.4-195.7)	1.06	Lowest	5.78	Moderately High
	Price Stubb Dam-GVIC Dam (187.7-185.5)	4.07	Medium	11.02	Highest
	GVIC Dam-Corn Lake (185.3-177.4)	7.05	Moderately High	8.97	Moderately High
	Corn Lake-Colo/Gunn River confluence (177.4-171.0)	11.88	Highest	16.36	Highest
	Colo/Gunn River confluence-Fruita State Park (171.0-157.2)	9.47	Highest	10.43	Highest
	Fruita State Park-Loma Boat Landing (157.2-152.6)	5.35	Moderately High	3.78	Medium
	Loma Boat Landing-Salt Creek (152.6-144.2)	3.19	Medium	6.21	Moderately High
	Salt Creek-Utah/Colo Stateline (144.2-131.9)	1.92	Lowest	1.60	Lowest
	Utah/Colo Stateline-Westwater, UT, Ranger Station (131.9-127.6)	0.47	Lowest	1.02	Lowest
Lower Gunnison River					
	Redlands Dam-Colo/Gunn River confluence (3.0-0.7)	9.21	Highest	7.44	Moderately High

^a All passes combined.

^b 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

**Colorado River
Westwater Ranger Station, UT--Loma Boat Landing
3 Passes**

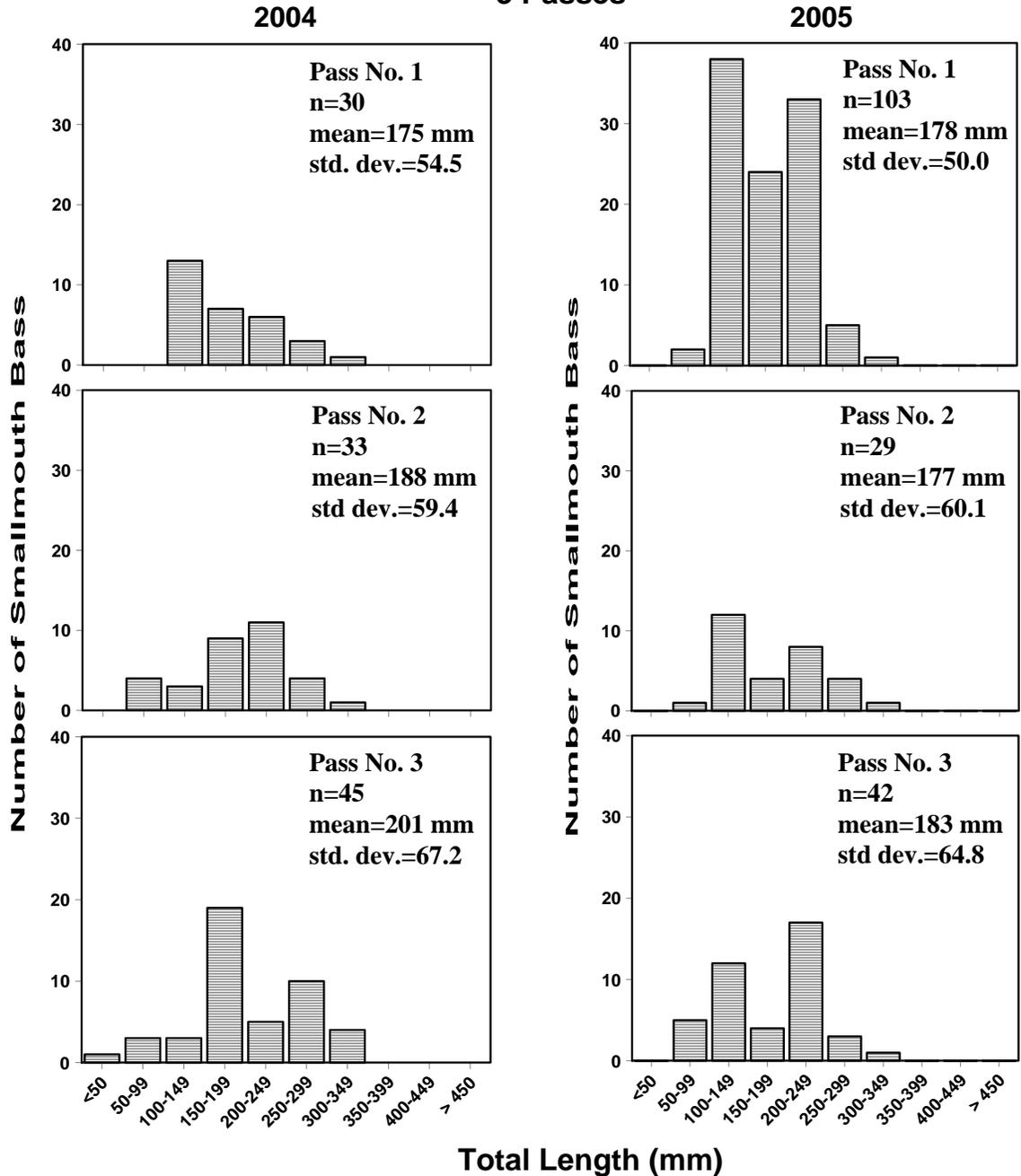


Figure 1. Total length frequency comparison of all smallmouth bass collected with electrofishing during three passes from Westwater Ranger Station, UT, to the Loma Boat Landing (river mile 127.6–152.6) in the Colorado River, July and August 2004 and July and August 2005.

**Colorado River
Loma Boat Landing--Colo/Gunn River Confluence
4 Passes**

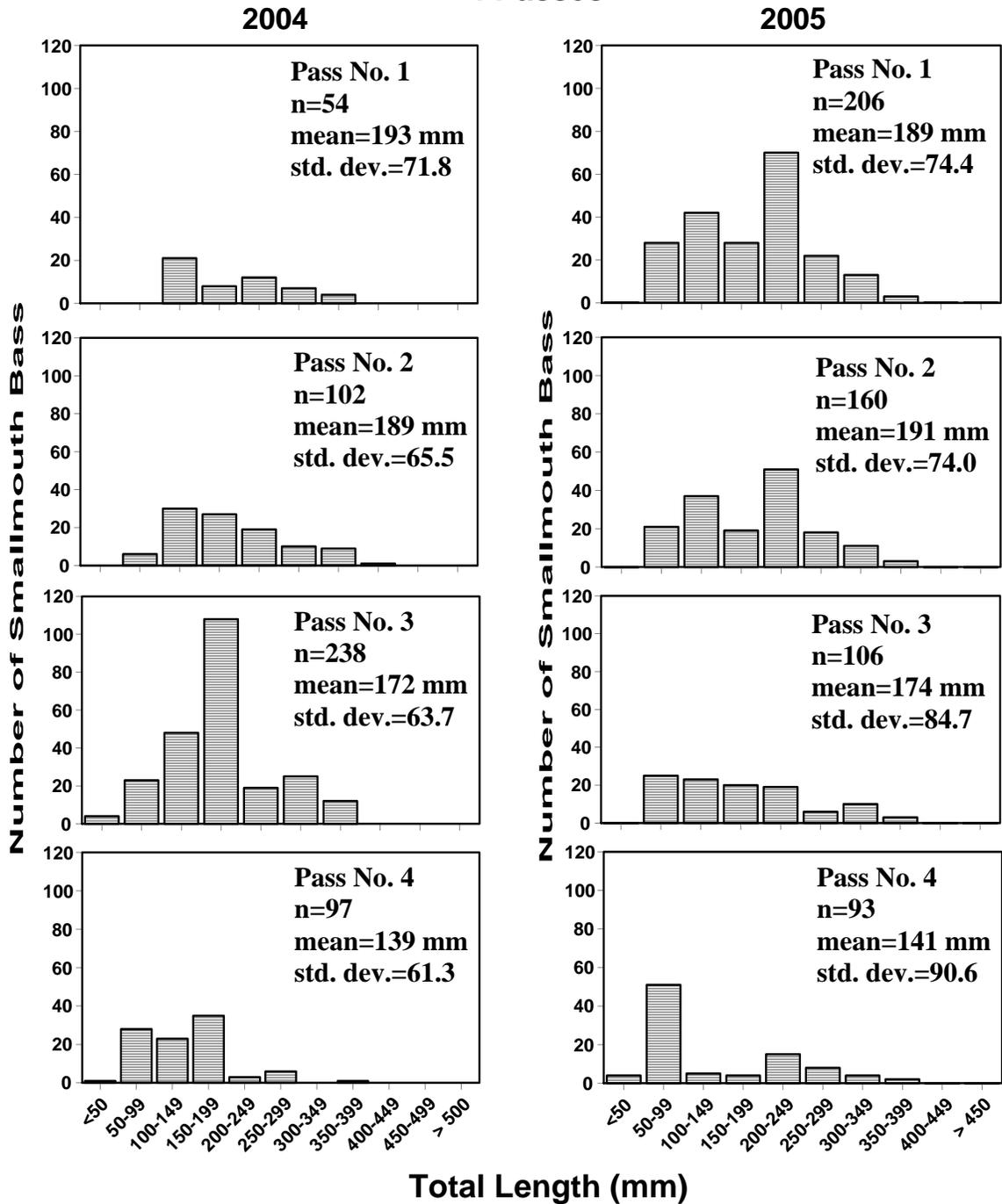


Figure 2. Total length frequency comparison of all smallmouth bass collected with electrofishing during four passes from the Loma Boat Landing to the Colorado/Gunnison River confluence (river mile 152.6–171.0) in the Colorado River, July and August 2004 and July and August 2005.

**Colorado River
Colo/Gunn River Confluence--Price Stubb Dam
4 Passes**

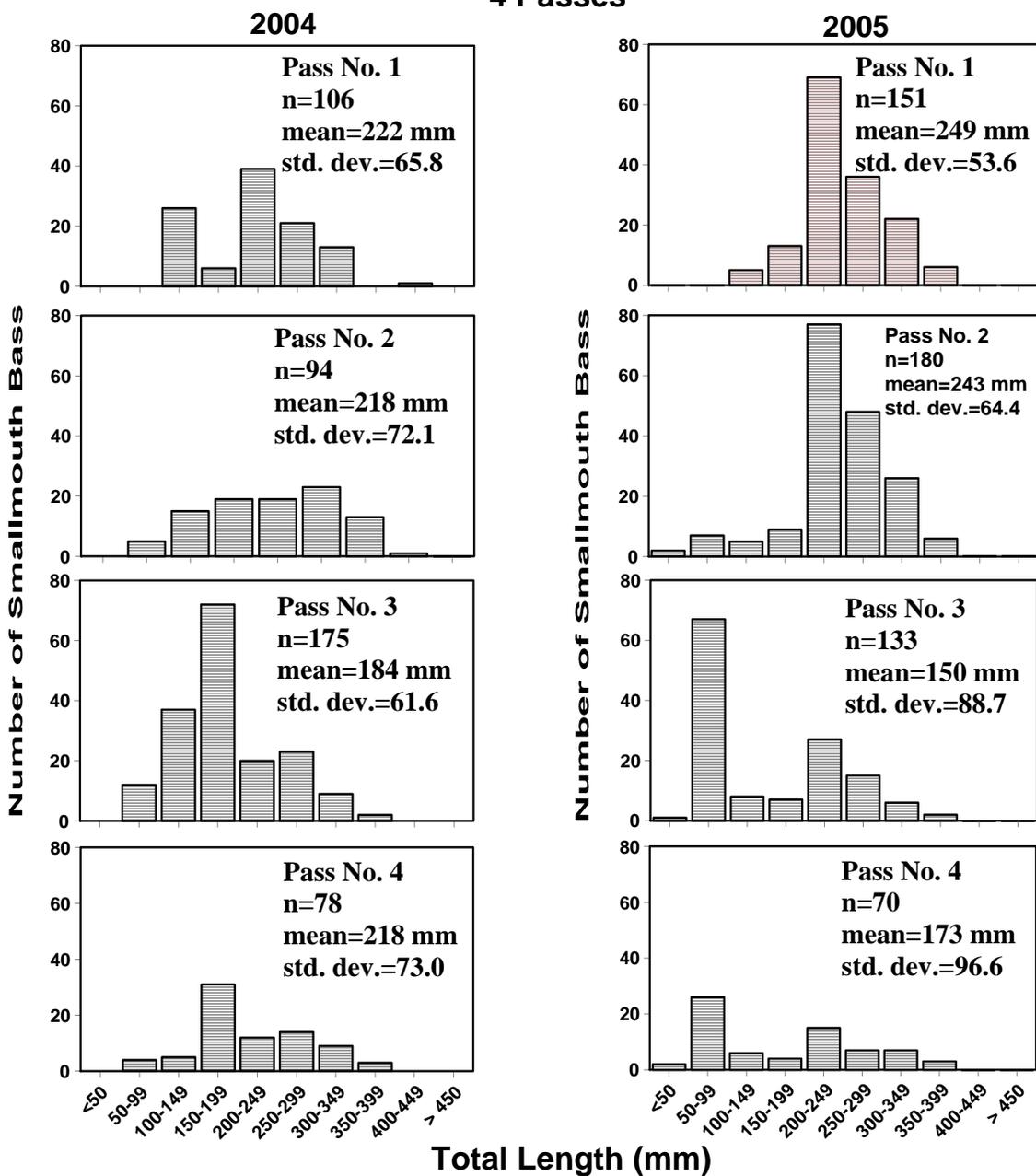


Figure 3. Total length frequency comparison of all smallmouth bass collected with electrofishing during four passes from the Colorado/Gunnison River confluence to immediately downstream from Price-Stubb Dam (river mile 171.0–187.7) in the Colorado River, July and August 2004 and July and August 2005.

**Lower Gunnison River
Redlands Dam to Colo/Gunn River Confluence
4 Passes**

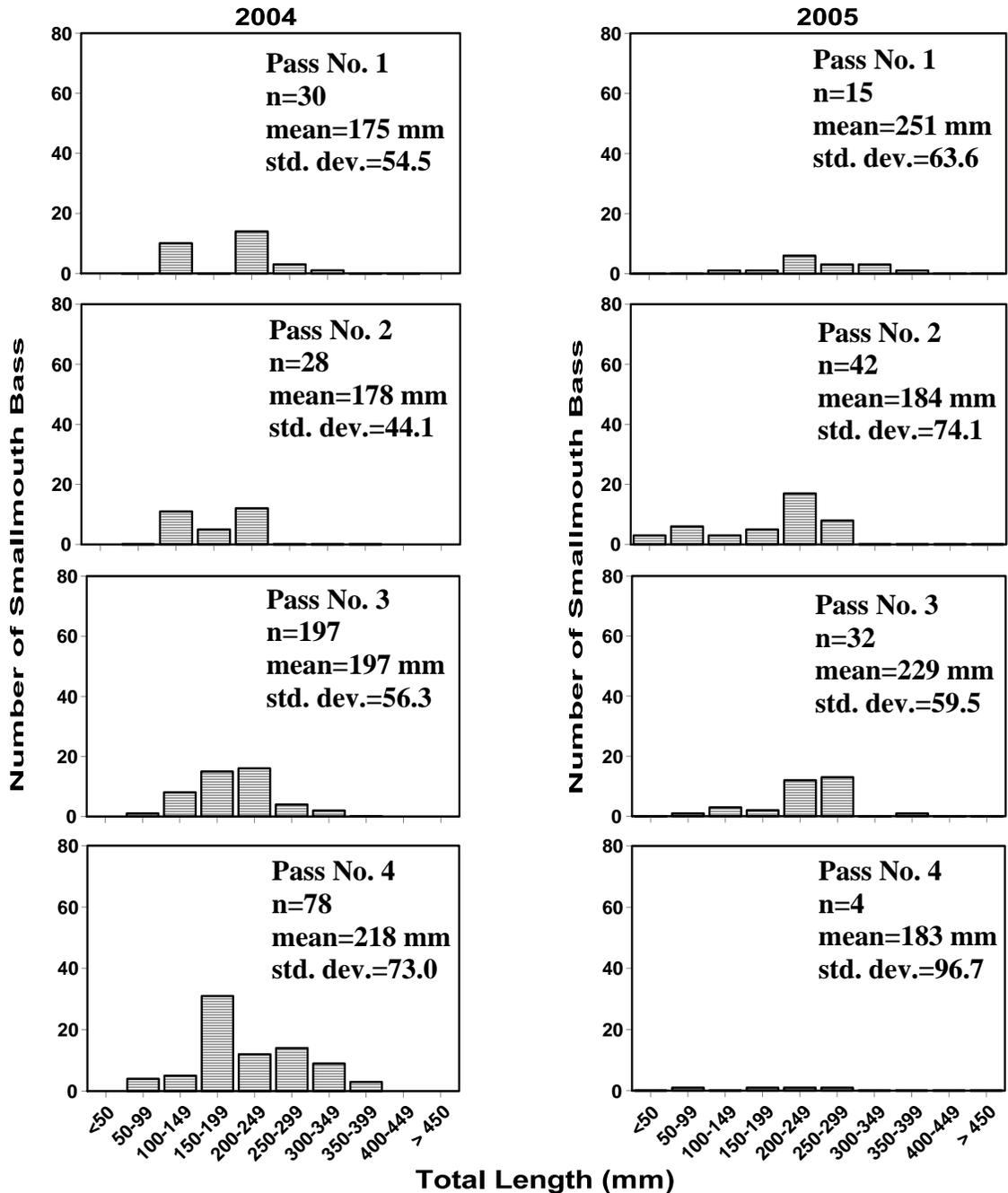
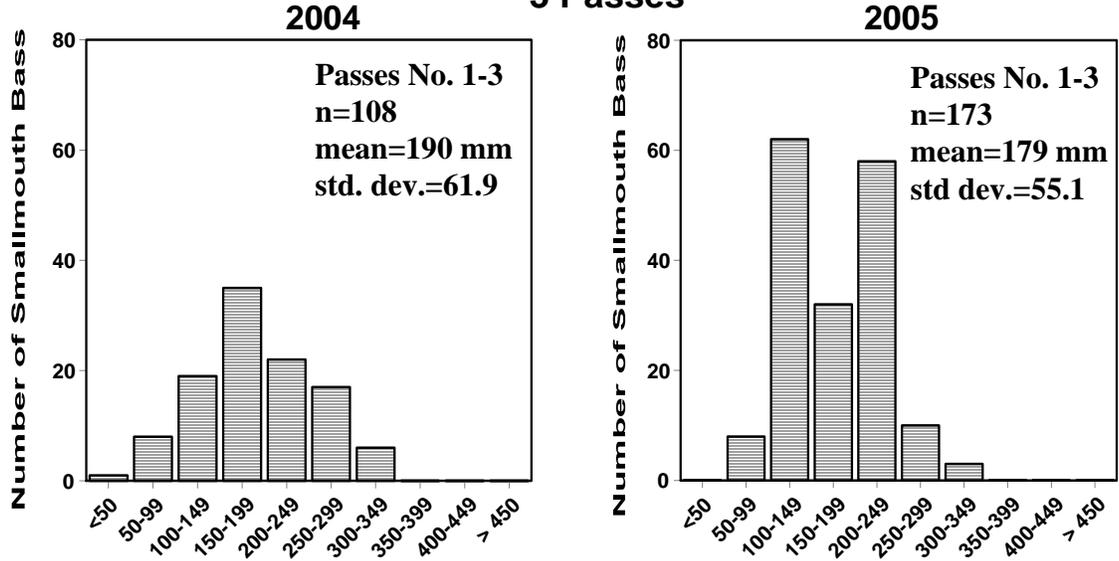


Figure 4. Total length frequency comparison of all smallmouth bass collected with electrofishing during four passes from the Redlands Diversion Dam to the Colorado/Gunnison River confluence (river mile 3.0–0.7) in the Lower Gunnison River, July and August 2004 and July and August 2005.

**Colorado River
Westwater Ranger Station, UT--Loma Boat Landing
3 Passes**



**Colorado River
Loma Boat Landing--Colo/Gunn River Confluence
4 Passes**

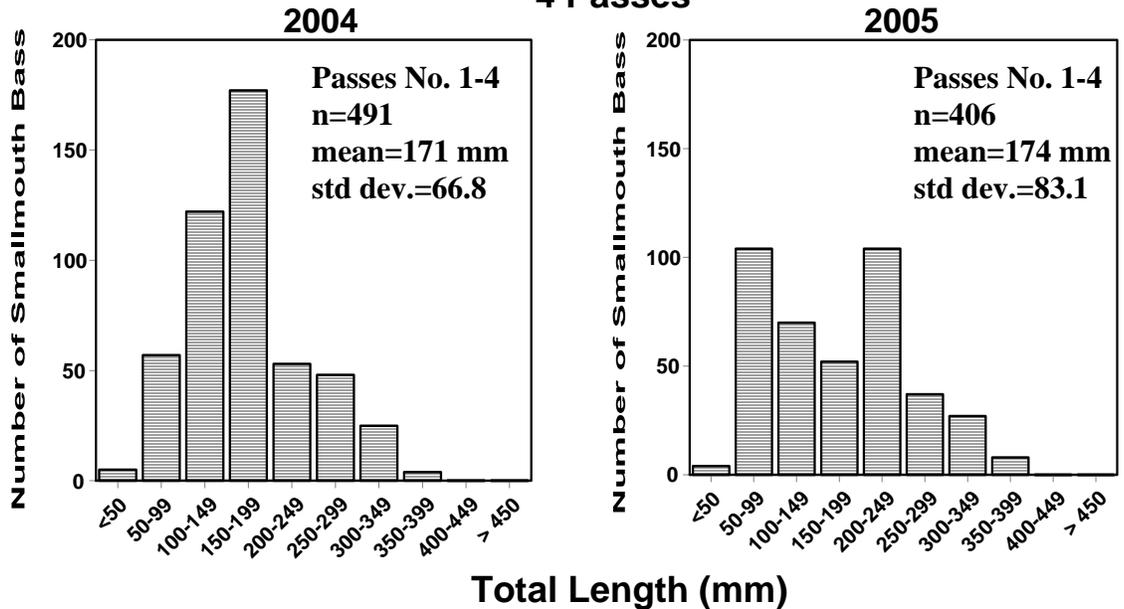
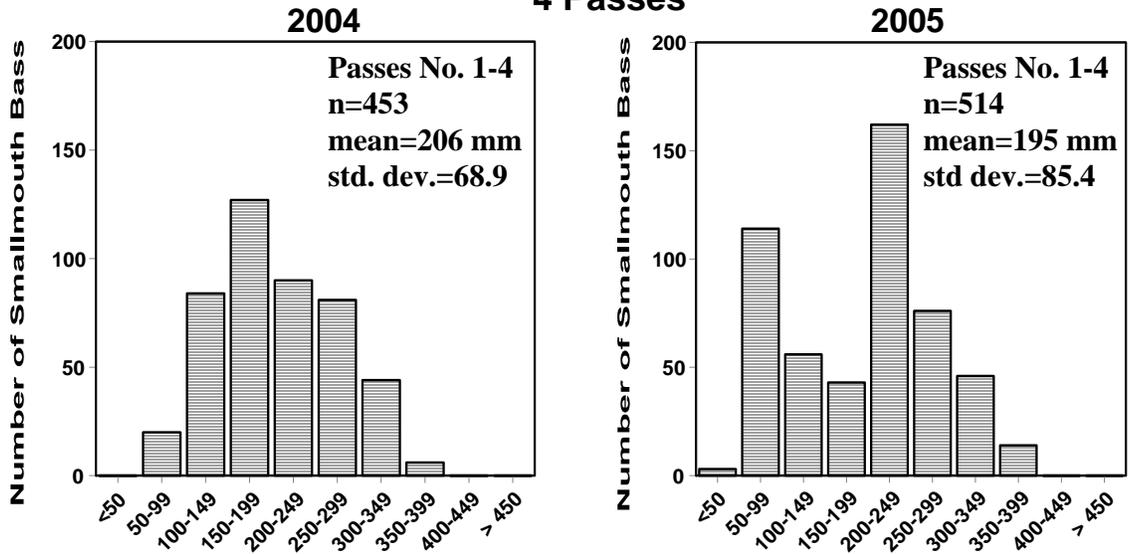
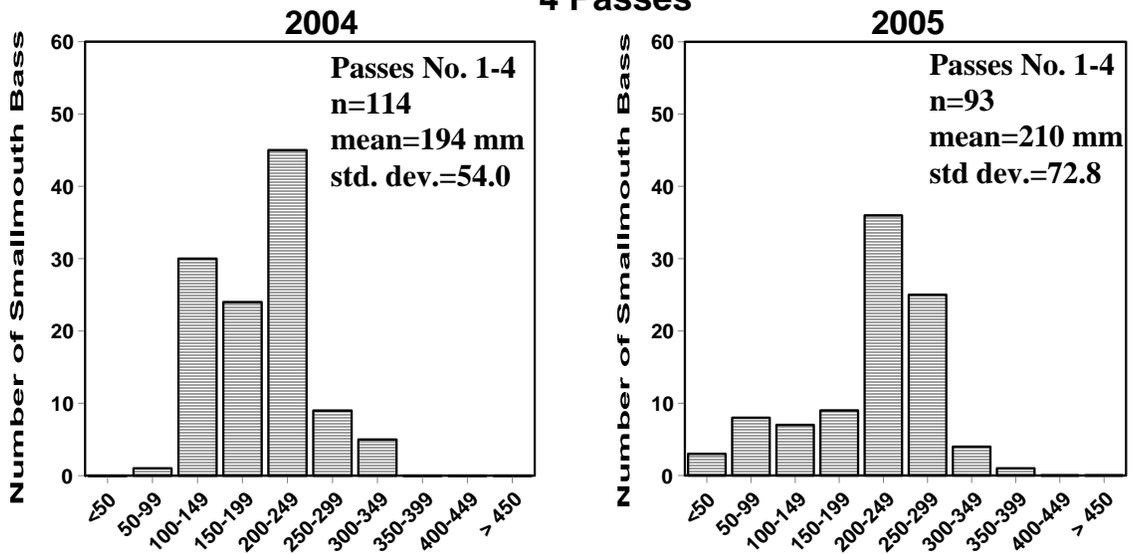


Figure 5. Total length frequency comparison of all smallmouth bass collected with electrofishing (passes combined) from Westwater Ranger Station, UT, to the Loma Boat Landing (river mile 127.6–152.6) and Loma Boat Landing to the Colorado/Gunnison River confluence (river mile 152.6–171.0) in the Colorado River, July and August 2004 and July and August 2005.

**Colorado River
Colo/Gunn River Confluence--Price Stubb Dam
4 Passes**



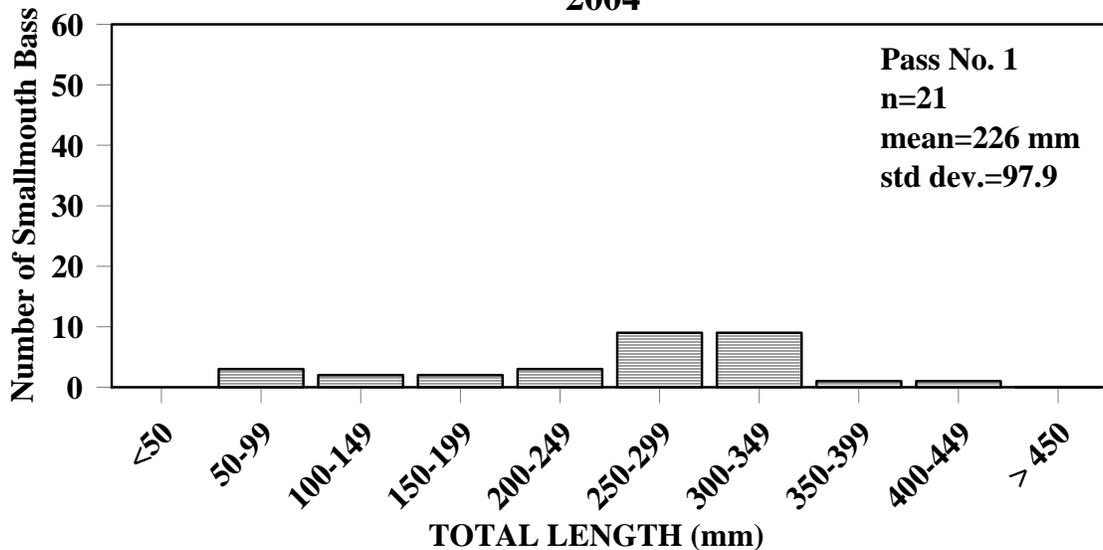
**Lower Gunnison River
Redlands Dam--Colo/Gunn River Confluence
4 Passes**



Total Length (mm)

Figure 6. Total length frequency comparison of all smallmouth bass collected with electrofishing (passes combined) from the Colorado/Gunnison River confluence to Price Stubb Dam (river mile 171.0–187.7) in the Colorado River and Redlands Dam to the Colorado/Gunnison River confluence (river mile 3.0–0.7) in the Lower Gunnison River during July and August 2004 and July and August 2005.

**Colorado River
Rifle Bridge-Beavertail Mountain (Debeque Canyon)
1 Pass
2004**



**Colorado River
Rifle Bridge-Beavertail Mountain (Debeque Canyon)
1 Pass
2005**

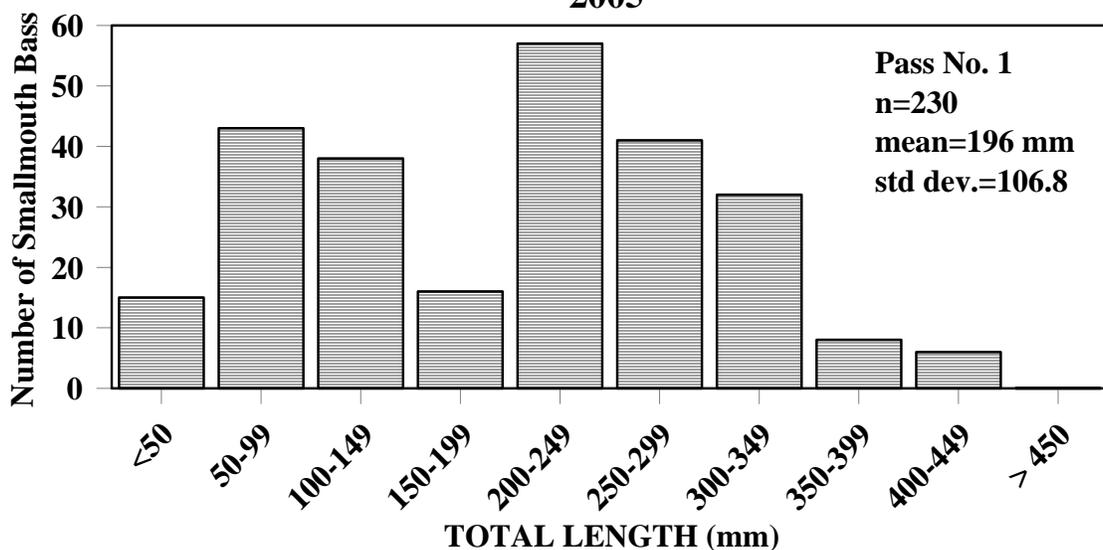


Figure 7. Total length frequency comparison of all smallmouth bass collected with electrofishing during one pass from the Rifle Bridge to Beavertail Mountain in Debeque Canyon (river mile 240.7–195.7) in the Upper Colorado River, late-August 2004 and mid-July 2005.

**Smallmouth Bass Length Comparison by River Reach
Colorado and Lower Gunnison Rivers
2004 vs. 2005**

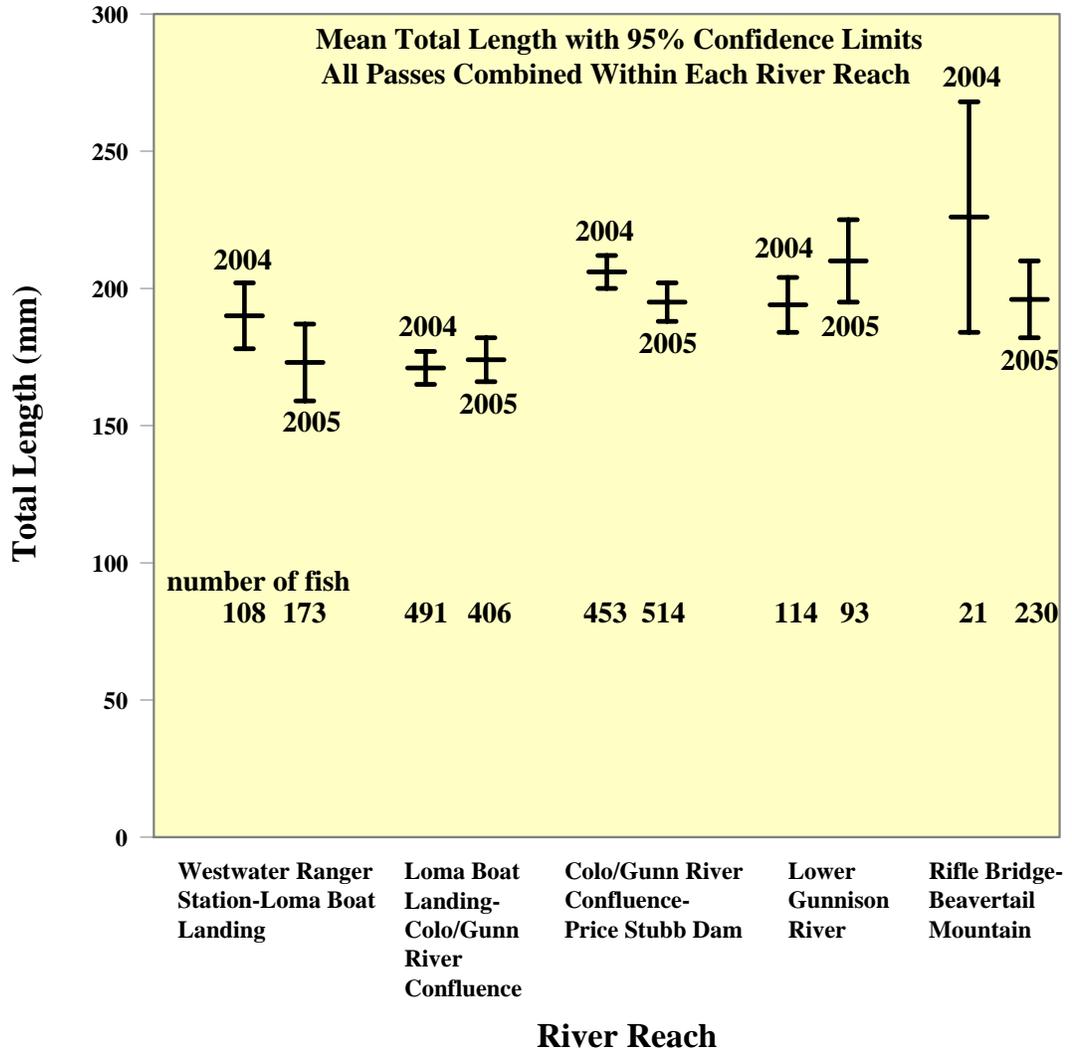
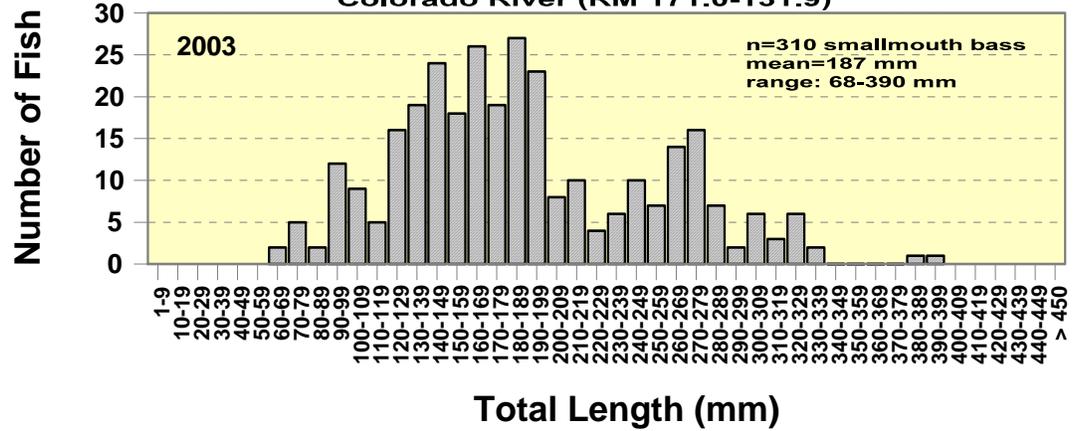
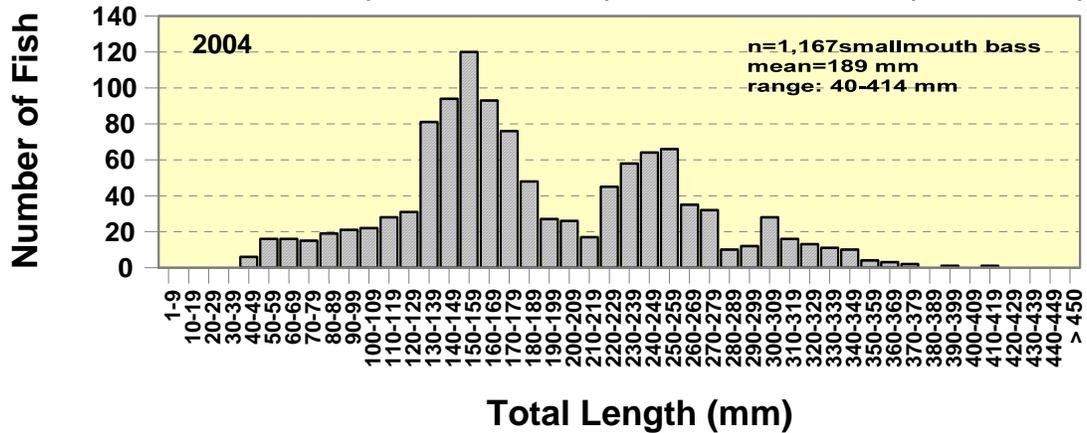


Figure 8. Comparison between the mean total length and 95% confidence interval for smallmouth bass collected with electrofishing from five major river segments on the Colorado and Gunnison rivers during the summer of 2004 and summer of 2005. The mean is the middle horizontal line; the 95% confidence intervals are represented by the error bars ($\tau \perp$).

**Smallmouth Bass Electrofishing Captures-July, August, Sept. 2003
Colorado River (RM 171.0-131.9)**



**Smallmouth Bass Electrofishing Captures-July & August 2004
Colorado River (RM 187.6-127.6) & Gunnison River (RM 3.0-0.7)**



**Smallmouth Bass Electrofishing Captures-July & August 2005
Colorado River (RM 187.6-127.6) & Gunnison River (RM 3.0-0.7)**

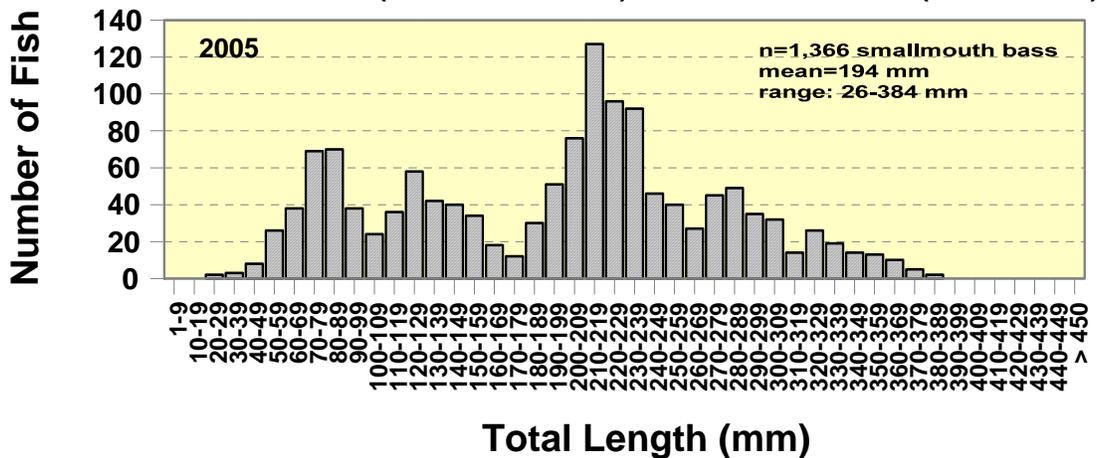


Figure 9. Length frequency comparison for all smallmouth bass collected during the summer of 2003, 2004, and 2005.

Smallmouth Bass--2004 & 2005 Colorado River

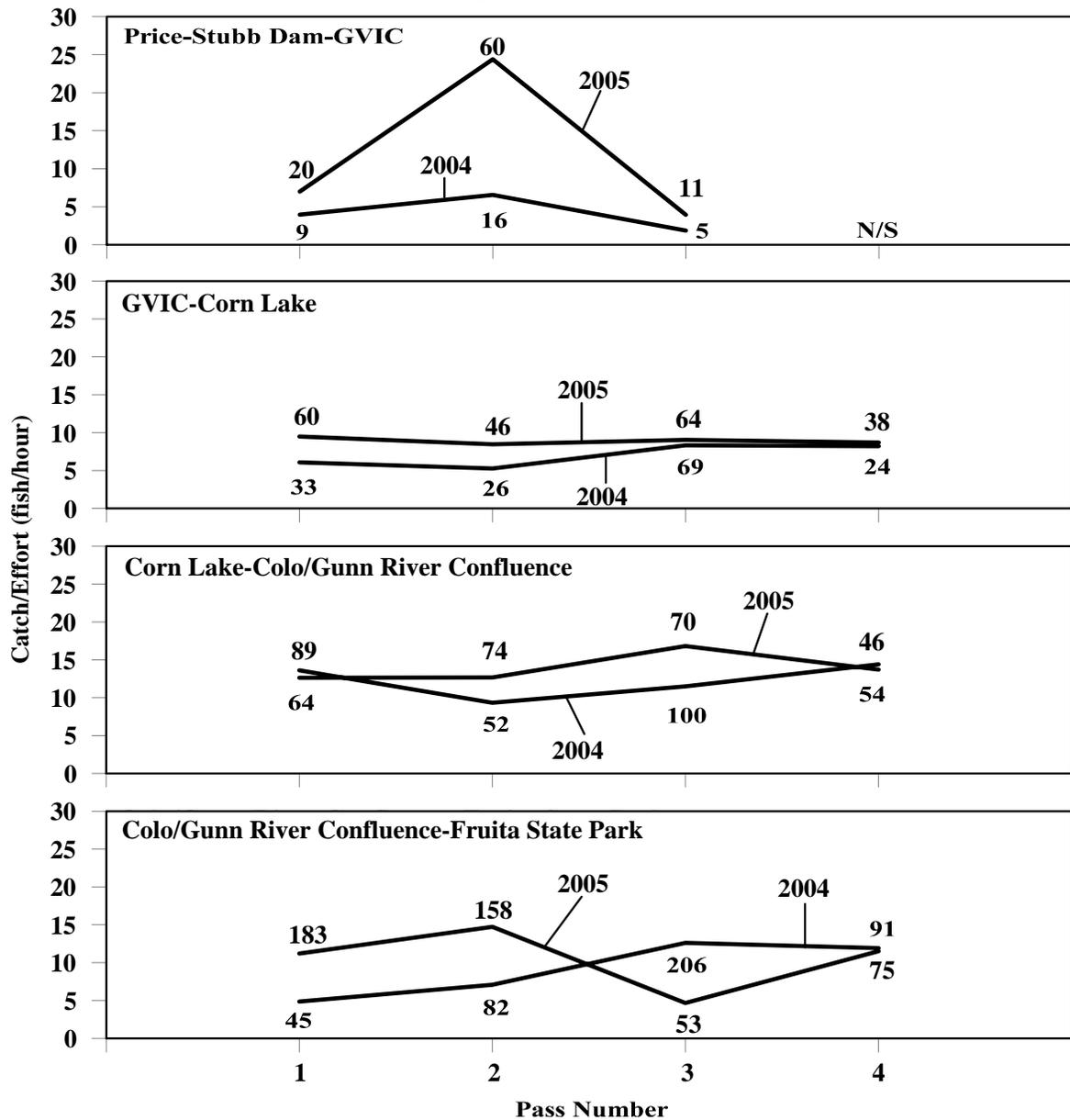


Figure 10. Comparison of catch/effort (fish/hr) by pass and by river segment for smallmouth bass collected from main channel habitats in the Upper Colorado River from river mile 187.7 to 127.6 (Price-Stubb Dam to the Westwater, UT, Ranger Station) and in the Lower Gunnison River from river mile 3.0–0.7 (Redlands Dam to the Colorado/Gunnison River confluence), July and August 2004 and July August 2005 with electrofishing. Note: The number immediately above the bar is the total number of fish collected; N/S=not sampled. See Tables 3, 4, and 5 for statistics regarding numbers of fish and catch/effort by sampling pass and river segment.

Smallmouth Bass--2004 & 2005 Colorado River

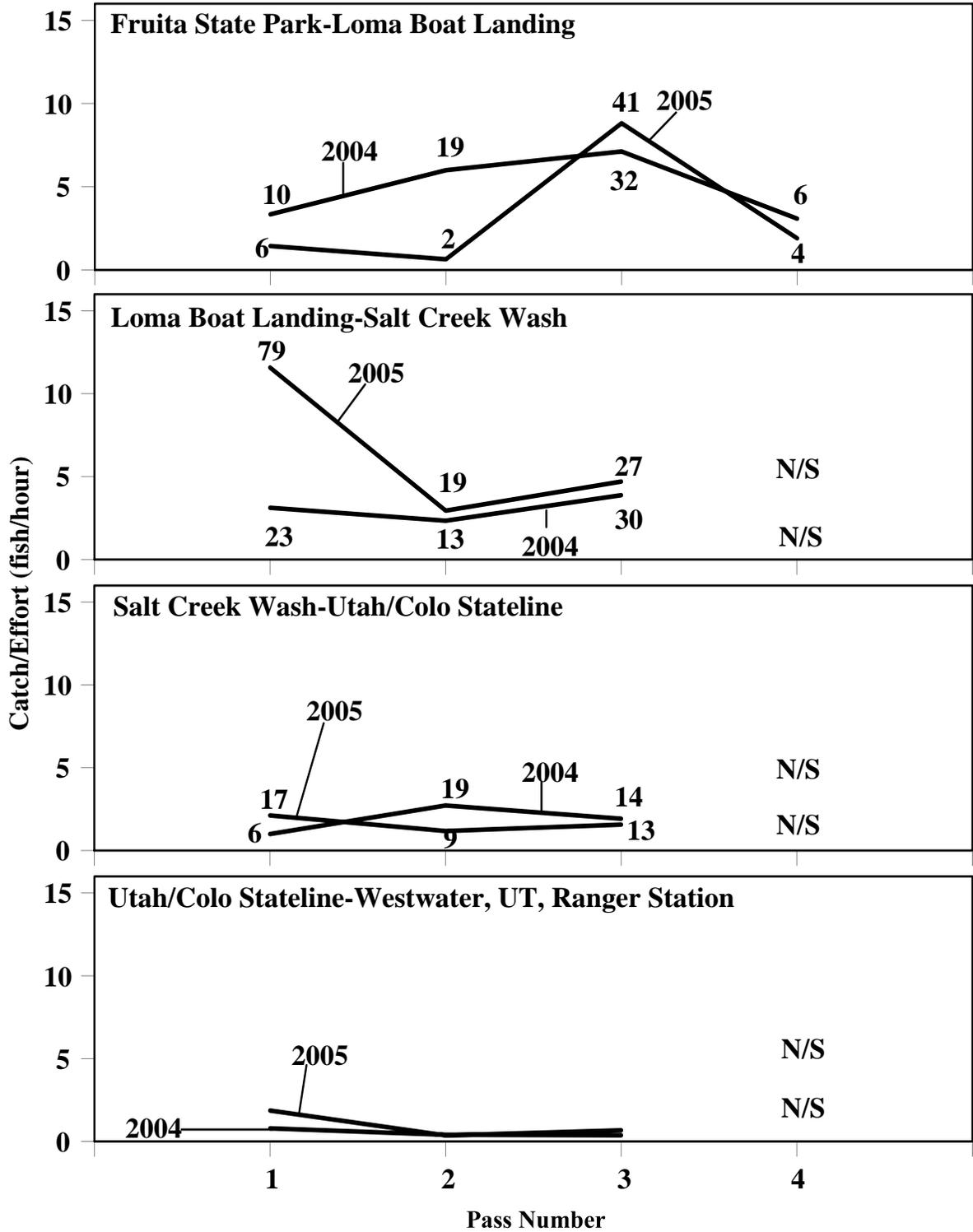


Figure 10. (cont'd)

Smallmouth Bass--2004 & 2005 Lower Gunnison River

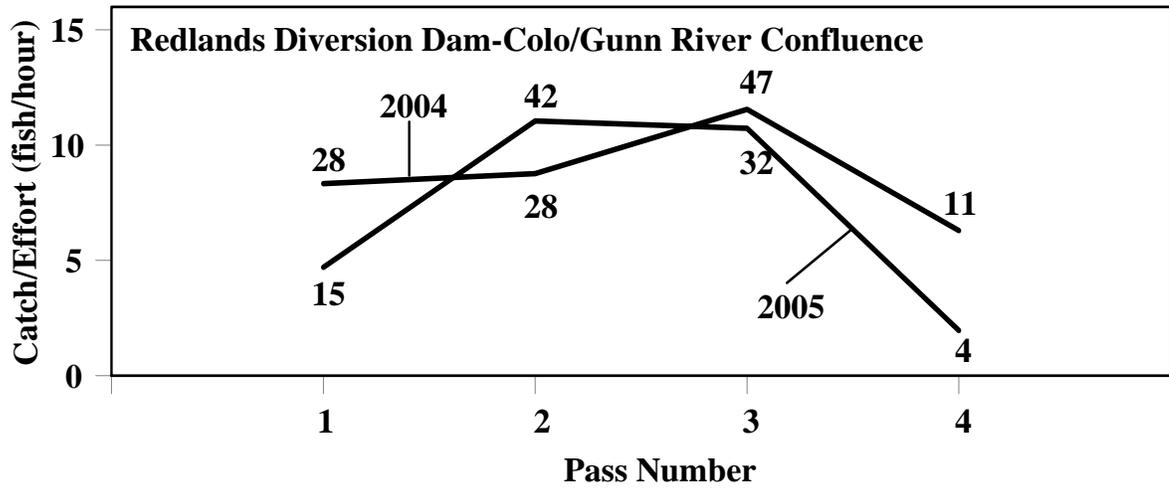


Figure 10. (cont'd)

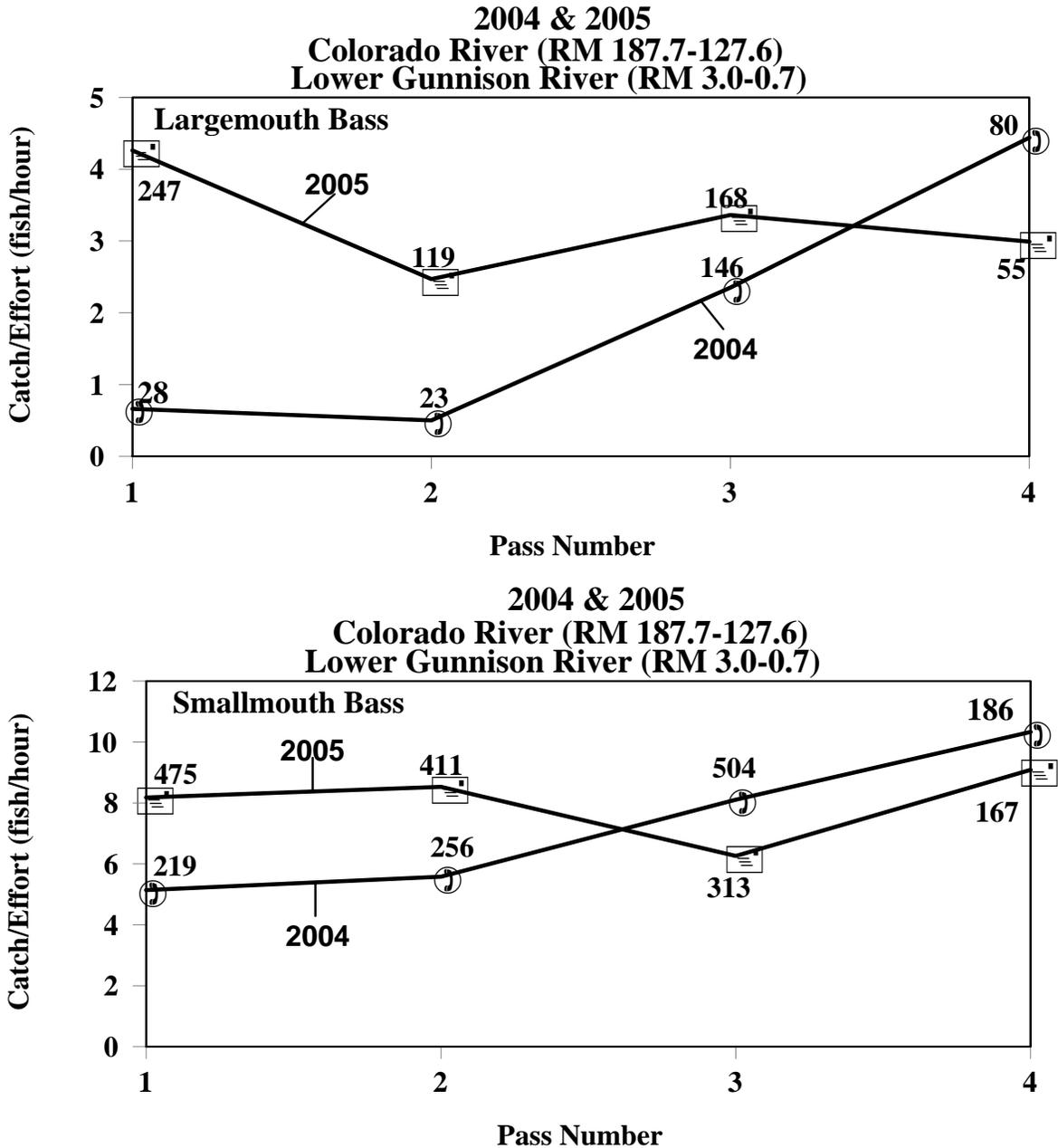


Figure 11. Comparison of overall catch/effort (fish/hr) between the summer of 2004 and summer of 2005 for largemouth bass (TOP) and smallmouth bass (LOWER) collected from main channel habitats in the Upper Colorado River with electrofishing from river mile 187.7 to 127.6 (Price-Stubb Dam to the Westwater, UT, Ranger Station) and in the Lower Gunnison River from river mile 3.0–0.7 (Redlands Dam to the Colorado/Gunnison River confluence) for four passes during the smallmouth bass removal project. Note: The number immediately above the bar is the total number of fish collected. See Tables 3 and 5 for statistics regarding overall numbers of fish and overall catch/effort.

**SMALLMOUTH BASS
Catch/Effort (fish/hr) Comparison**

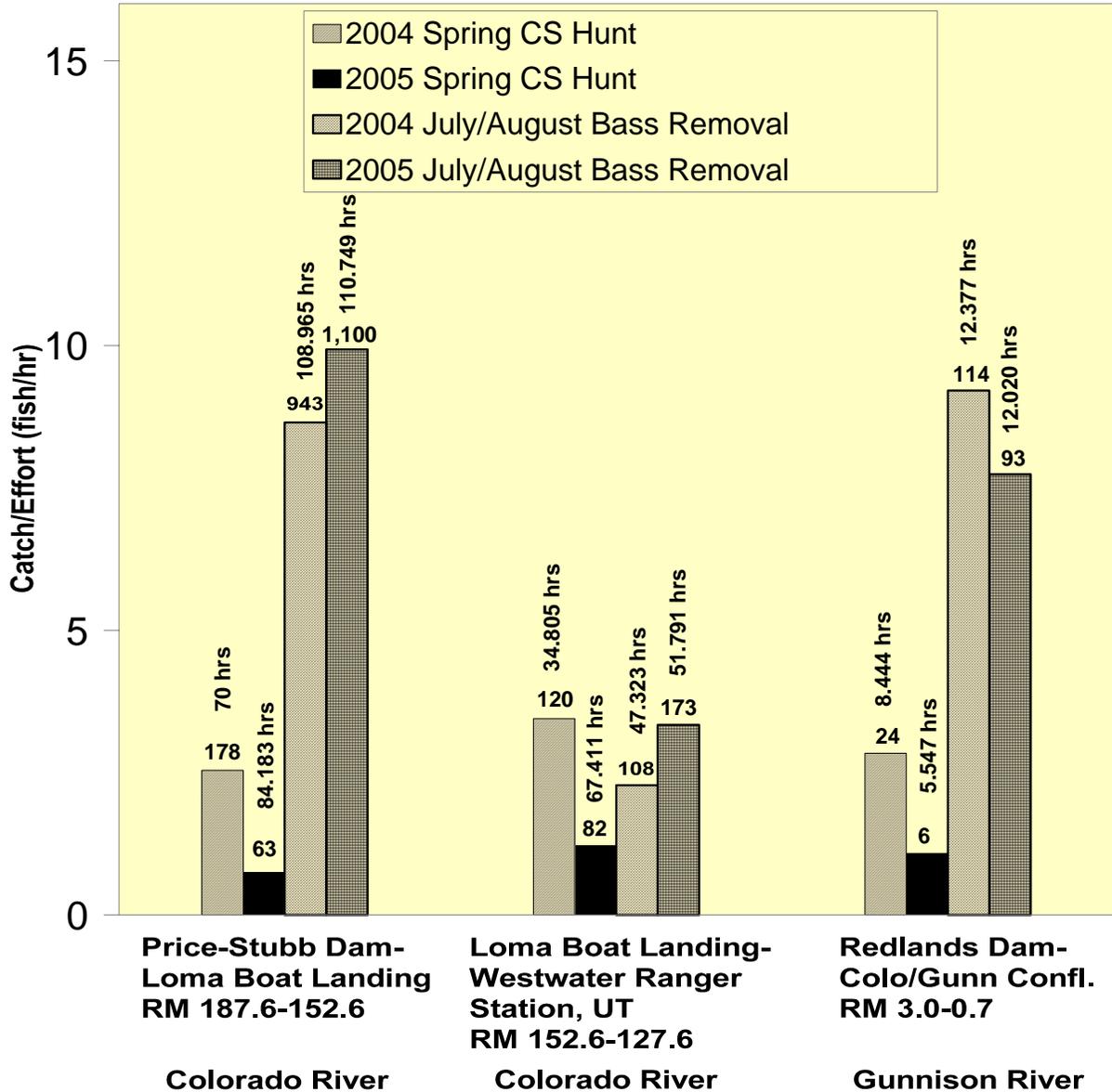


Figure 12. Overall catch/effort comparison (fish/hr) for smallmouth bass collected with boat-based electrofishing in main channel habitats in two different river segments in the Colorado River (Price-Stubb Dam to the Loma Boat Landing and Loma Boat Landing to the Westwater Ranger Station, UT) and one river segment in the Lower Gunnison River (Redlands Dam to the Colorado/Gunnison River confluence) during the 2004 and 2005 spring Colorado pikeminnow population monitoring and the 2004 and 2005 summer smallmouth bass removal project. Note: passes within project were combined. The number immediately above the bar is the total number of fish collected; effort is given in hours electrofished.

**LARGEMOUTH BASS
Catch/Effort (fish/hr) Comparison**

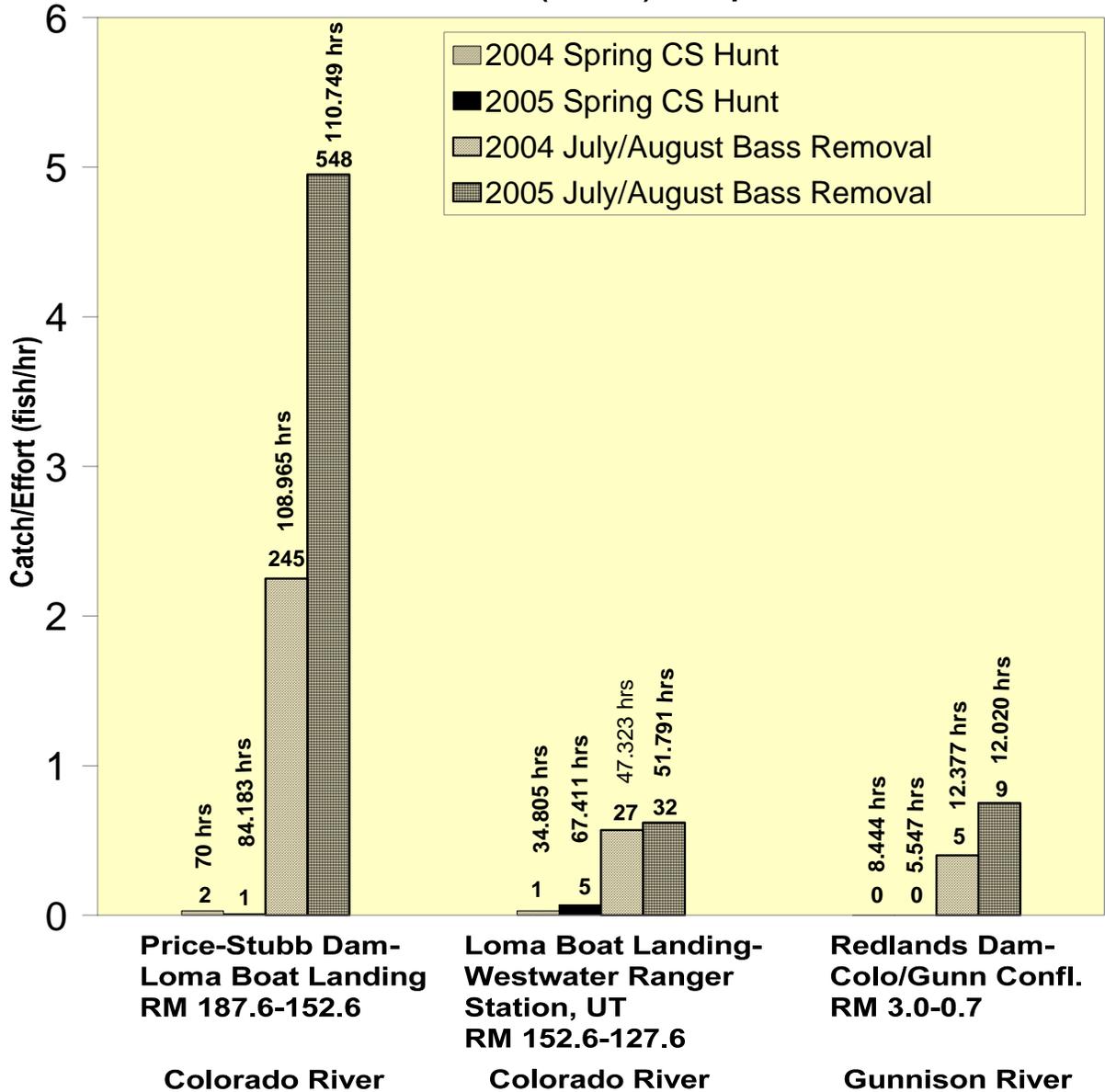


Figure 13. Overall catch/effort comparison (fish/hr) for largemouth bass collected with boat-based electrofishing in main channel habitats in two different river segments in the Colorado River (Price-Stubb Dam to the Loma Boat Landing and Loma Boat Landing to the Westwater Ranger Station, UT) and one river segment in the Lower Gunnison River (Redlands Dam to the Colorado/Gunnison River confluence) during the 2004 and 2005 spring Colorado pikeminnow population monitoring and the 2004 and 2005 summer smallmouth bass removal project. Note: passes within a project were combined. The number immediately above the bar is the total number of fish collected; effort is given in hours electrofished.