LONG TERM MONITORING OF SUB-ADULT AND ADULT LARGE-BODIED FISHES IN THE SAN JUAN RIVER: 2005

Interim Progress Report
(Final)

Submitted By:

Dale W. Ryden
Fishery Biologist

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U. S. Fish and Wildlife Service
Colorado River Fishery Project
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946

EXECUTIVE SUMMARY

Long-term monitoring of the sub-adult and adult large-bodied fish community (called "Adult Monitoring" for short) in the San Juan River began in 1999. This monitoring study annually samples RM 180.0-2.9 between mid-September and Mid-October via raft-borne electrofishing. The long-term monitoring program was based on the main channel adult fish community monitoring study which preceded it (i.e., 1991-1997). The sampling protocols for long-term monitoring were designed to allow for data comparisons between these two studies.

In 2005, Adult Monitoring took place between 19 September and 12 October. Total effort of was 85.95 hours of electrofishing and sampled covered RM 180.0 to RM 2.9. A total of 12,723 individual fish were collected during the fall 2005 Adult Monitoring trip. The mean daily flow (measured at the Shiprock, NM USGS gage) during sampling was 1,072 CFS. However, there were distinct differences in sampling flows between the first week of sampling, (19—23 September 2005) when sampling flows ranged from 322-605 CFS and the last ten days of sampling (3-12 October) when sampling flows ranged from 980-1,950 CFS).

On the fall 2005 Adult Monitoring trip, 75.85% of all fishes collected were native fishes (n = 9,650), while only 24.15% of all fish collected were nonnative fishes (n = 3,073). This represents a native to nonnative fish ratio of 3.14:1.

A total of 127 Colorado pikeminnow were collected during the fall 2005 Adult Monitoring trip. This was only the third time that > 100 Colorado pikeminnow were collected on an Adult Monitoring trip (n = 104 in 1998, n = 159 in 2004). All 127 of these fish had been stocked as juveniles between 2002 and 2004. The majority (n = 64; 50.4), however, were age-1 fish that were stocked in the fall of 2004. No wild Colorado pikeminnow were collected on the fall 2005 Adult Monitoring trip. The CPUE for Colorado pikeminnow on the fall 2005 Adult Monitoring trip (1.49 fish/hr of electrofishing) was the second highest value ever observed during Adult Monitoring collections. Collections of Colorado pikeminnow ranged from RM 178.0-5.0, with the large majority (n = 94; 74.0%) occurring upstream of the canyon-bound reaches of the river (i.e., upstream of RM 68.0). It appears as if Colorado pikeminnow stocked as age-0 fish in the fall of 2003 and 2004 are surviving relatively well through the first one to two years post-stocking. However, the Colorado pikeminnow stocked as age-0 fish in the fall of 2002 do not appear to have had nearly as good of survival/retention as their counterparts stocked in 2003 and 2004. A few older stocked fish are occasionally collected, but not in very large numbers. The Colorado pikeminnow augmentation plan anticipates that repeatedly stocking large numbers of Colorado pikeminnow over a long enough time period will help to establish a healthy, multiple year-class population. However, given the highly variable survival/retention rates observed among different stockings, this may take numerous years to accomplish, or conversely, may not happen at all. Therefore, trying to understand and address the factors responsible for low long-term retention of stocked fish will be crucial in trying to shorten the duration of, and insure the success of, the Colorado pikeminnow augmentation effort.

A total of 52 razorback sucker were collected during the fall 2005 Adult Monitoring trip. This was only the second time that > 50 razorback sucker had ever been collected on an Adult Monitoring trip (n = 117 in 2004). All 52 razorback sucker collected on the fall 2005 Adult Monitoring trip were stocked fish. Collections ranged from RM 160.0-4.0. On the fall 2005 Adult Monitoring trip, total CPUE for razorback sucker (0.62 fish/hr of electrofishing) was the second highest value ever observed on an Adult

Monitoring trip. Despite the high relatively CPUE observed for razorback sucker in both 2004 and 2005, there is still a need for caution when interpreting results. The majority of recaptured razorback sucker are fish that have been in the river for less than five years post-stocking, although a few older fish that have been in the river as long as nine years post-stocking are still being collected. In addition, although larval razorback sucker have been collected for eight consecutive years, the number of larval fish being collected has dwindled for the last several years and numbers of wild-produced juvenile fish that are being collected continue to remain low. The razorback sucker augmentation plan anticipates that repeatedly stocking large numbers of razorback sucker over a long enough time period will help to establish a healthy, multiple year-class population. However, given the relatively low densities at which these fish are currently being stocked and the highly variable survival/retention rates observed among different stockings, this may take several years to accomplish, or again, may not happen at all. Therefore, trying to understand and address the factors responsible for low long-term retention of stocked fish will be crucial in trying to shorten the duration of, and insure the success of, the razorback sucker augmentation effort.

No roundtail chub were collected during the fall 2005 Adult Monitoring trip. Roundtail chub continue to be extremely rare (or completely absent) in Adult Monitoring collections. The few roundtail chub that are collected in the San Juan River are likely transient members of the fish community that enter the river from one of its upstream tributaries that have resident roundtail chub populations.

Flannelmouth sucker continues to be the most commonly-collected species during fall Adult Monitoring trips. During the fall 2005 Adult Monitoring trip, flannelmouth sucker accounted for 46.3% (n = 5,895 individuals) of all fish collected. Despite some fluctuation in riverwide CPUE, the San Juan River flannelmouth sucker population has remained relatively stable over the last ten years (1996-2005). However, data collected in Reaches 5-3 from 1991-1995 appear to indicate that while this population has been stable at its current level for the last ten years, flannelmouth sucker are probably less abundant riverwide now than they were in the early 1990’s.

Bluehead sucker were the second most-commonly collected species during the fall 2005 Adult Monitoring trip. Bluehead sucker accounted for 23.2% (n = 2,945 individuals) of all fish collected in 20054. The bluehead sucker population within our study area is still largely centered in Reach 6. However, the distribution of bluehead sucker is becoming more widespread in the San Juan River. In 2005, bluehead sucker were present in 83.33% of all electrofishing collections riverwide. Riverwide CPUE for bluehead sucker has shown an increasing trend over the last nine years, with the riverwide increases between 1996 and 2005 being significant for both juvenile CPUE and total CPUE ($p < 0.000$ and $p < 0.000$, respectively). As was the case in most previous years (with the exception of only 2003 and 2004), no bluehead sucker were collected in Reach 1, adjacent to Lake Powell in 2005.

Channel catfish were the third most-commonly collected species during the fall 2005 Adult Monitoring trip. Channel catfish accounted for 18.1% (n = 2,307 individuals) of all fish collected in 2005. Unfortunately, CPUE for both juvenile and adult channel catfish increased between 2004 and 2005. The increase in adult CPUE riverwide was almost completely based upon a cohort of young fish that are just beginning to enter the adult population. However, even with the increase in adult channel catfish CPUE observed between 2004 and 2005, the long-term trend in CPUE among adult fish over the last ten years is declining. The riverwide increase in both juvenile and adult channel catfish CPUE was representative of increases in CPUE occurring in Reaches 5-2 and more specifically between RM's 147.9 and 52.9 (i.e., the area of the San Juan River that lies in between the two intensive nonnative fish removal sections). This middle section of the river harbors a large reservoir of channel catfish that helps keep this species numerous and robust in the San Juan River and acts as a point from which channel catfish can reinvade the intensive nonnative fish removal sections (RM 166.6-147.9 and RM 52.9-2.9).

Despite the observed increases in channel catfish CPUE riverwide between 2004 and 2005, channel catfish distribution has become somewhat reduced over the last ten years. On the fall 2005 Adult Monitoring trip, channel catfish were collected in only 81.00% of all electrofishing collections riverwide. This contrasts to 2001, when channel catfish were collected in 94.38% of all electrofishing collections riverwide. The San Juan River has also become heavily dominated by juvenile fish (i.e., < 300 mm TL). The relative percentage of juvenile fish in the San Juan River channel catfish population, riverwide, was 63.59% in 2005. The increasing numeric dominance of juvenile channel catfish coupled with the long-term declining trend among adult fish riverwide should, hopefully, have a negative effect on the reproductive potential of this species in the San Juan River. In the river reaches where intensive nonnative fish removal efforts are ongoing, markedly declining numbers of adult channel catfish, coupled with an increasing numeric dominance of juvenile fish would argue that these removal efforts are having a measurable impact on this population. It is my recommendation that nonnative fish removal efforts be expanded to cover the middle section of the San Juan River (between RM 147.9 and 52.9), an area from which nonnative fishes are currently only being removed opportunistically on a few, single-pass sampling trips per year. At the very least, I recommend that nonnative fish removal efforts be continued at current levels for the foreseeable future.

Common carp fell to being the sixth most commonly-collected species during the fall 2005 Adult Monitoring trip (speckled dace and red shiner, both small-bodied fish species, were the fourth and fifth most commonly-collected species). Common carp accounted for only 2.3% (n = 297 individuals) of all fish collected in 2005. As a point of comparison, on an Adult Monitoring trip in 1998, 77 individual common carp were collected in a single electrofishing sample (from RM 163-162 = 1.0 total RM's of electrofishing). On the fall 2005 Adult Monitoring trip, less than four times that number were collected in 210 electrofishing samples (210.4 total RM's of electrofishing). Like channel catfish, the distribution of common carp has become considerably recuced since 2001. Common carp were collected in only 54.76% of all electrofishing collection riverwide in 2005 (as compared to 89.14% in 2001). In the last ten years, common carp adult and total CPUE has shown a significant declining trend riverwide. In 2005, common carp adult CPUE fell to the lowest value ever observed, 2.95 fish/hr of electrofishing. Over the last several years, juvenile common carp have had semi-regular spikes in CPUE. However, these spikes in juvenile CPUE do not seem to carry over from one year to the next. Additionally, several observed spikes in juvenile common carp CPUE since 2000 have not led to a corresponding increases in adult common carp CPUE. Despite the observed spikes in juvenile common cap CPUE since 2000, the majority of common carp collected on Adult Monitoring trips are still adult fish. As with channel catfish, the markedly declining numbers of adult common carp would argue that nonnative fish removal efforts are having a measurable effect on this population. It is recommended that nonnative fish removal efforts be, at least, continued at current levels, or possibly even expanded (especially between RM 147.9 and 52.9) for the foreseeable future.

Collections of other large-bodied nonnative fishes of concern were either negligible or absent in 2005. Only nine largemouth bass (all juveniles) were collected in 2005. Likewise only two white sucker and three white sucker X native sucker hybrids were collected in 2005. Again all of these fish were juveniles. No walleye or striped bass were collected in 2005. The presence of three distinct waterfalls downstream of Clay Hills boat launch appear to be effectively precluding the upstream movement of fish from Lake Powell into the San Juan River.

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INTRODUCTION

Research performed between 1991 and 1997 led to the initiation of several major management actions by the San Juan River Recovery Implementation Program (SJRIP) that are intended to have long-term positive impacts on the native fish community. These included the development of flow recommendations for the reoperation of Navajo Reservoir, the initiation of a mechanical removal program for nonnative fishes, modification or removal of several instream water diversion structures to provide fish passage and minimize entrainment, and augmentation efforts for both federally-listed endangered fish species (i.e. Colorado pikeminnow and razorback sucker). To assess the effects of these management actions over the duration of the SJRIP, a long-term monitoring program (Propst et al. 2000) was initiated. Standardized data collection following long-term monitoring protocols began in 1999 and will continue at least until the termination of the SJRIP.

One component of the long-term monitoring program, the ***Sub-Adult And Adult Large-Bodied Fish Community Monitoring*** (referred to hereafter as "Adult Monitoring" for short), is the primary responsibility of the U. S. Fish and Wildlife Service's (USFWS) Colorado River Fishery Project (CRFP) office in Grand Junction, CO. However, numerous other state and federal agencies supply manpower, equipment, and logistical support for these monitoring efforts.

The objectives of the Adult Monitoring study are as follows:

1) Monitor the San Juan River's main channel fish community, specifically the large-bodied fish species, to identify shifts in fish community structure, species abundance and distribution, and length/weight frequencies that are occurring corresponding to management actions that are being implemented by the San Juan River Recovery Implementation Program. These include:
   a) reoperation of Navajo Reservoir
   b) mechanical removal of nonnative fishes
   c) modification or removal of instream water diversion structures to provide fish passage and minimize entrainment
   d) augmentation efforts for both federally-listed endangered fish species (i.e., Colorado pikeminnow and razorback sucker)

2) Monitor population trends (e.g., distribution and abundance, habitat use, staging and spawning areas, growth rates, recruitment) of the rare San Juan River fish species -- Colorado pikeminnow, razorback sucker, and roundtail chub.

The study area for Adult Monitoring begins just downstream of the Animas River confluence (river mile {RM} 180.0) and continues downstream to Clay Hills boat landing (RM 2.9) just upstream of Lake Powell. This study area encompasses six of the eight major geomorphic reaches identified (by Bliesner and Lamarra 2000) in the San Juan River between Navajo Reservoir and Lake Powell. The six geomorphic reaches in our study area are: Reach 6 (RM 180.0-155.0); Reach 5 (RM 155.0-131.0); Reach 4 (RM 131.0-106.0); Reach 3 (RM 106.0-68.0); Reach 2 (RM 68.0-17.0); and Reach 1 (RM 17.0-0.0). Although our study area actually ends 2.9 RM short of the end of Reach 1, it is assumed herein that the data collected from RM 17.0-2.9 are representative of the entirety of Reach 1.

METHODS

Sampling conducted in 2005 followed the protocols for long-term monitoring set forth in Propst et al. (2000). The entire study area was sampled between mid-September and the end of October. Electrofishing was performed in a continuous downstream direction from put-in to take-out. One electrofishing raft sampled each shoreline. Electrofishing crews consisted of one rower and one netter. Rafts shocked perpendicular to the shoreline at a fairly constant rate of speed. The netter attempted to net all fishes (regardless of species, fish's body size, or life-stage) stunned by the electrofishing equipment. Electrofishing was done in one-RM increments, with two of every three RM being sampled. At the end of each sampled RM, all fish were identified and enumerated by species and life stage. At the end of every fourth sampled RM (known as a designated mile, or "DM" for short), all fish were weighed (± 5 grams {g}) and measured (± 1 mm total length {TL} and standard length {SL}). All nonnative fishes were then removed from the river. All common native fishes were returned alive to the river. Rare native fishes (Colorado pikeminnow, razorback sucker, and roundtail chub) were weighed, measured, had distinguishing characteristics noted (e.g., sex, external parasites), and were scanned for PIT tags. If no PIT tag was found, one was implanted before the fish was returned to the river. Sampling effort was recorded as elapsed time (in seconds) fished by each raft in each sampled RM.

The descriptions of the analyses that follow apply only to the four most common large-bodied fish species collected during Adult Monitoring trips. These species are flannelmouth sucker (Catostomus latipinnis), bluehead sucker (Catostomus discobolus), channel catfish (Ictalurus punctatus), and common carp (Cyprinus carpio). These are the only four fish species present in the San Juan River in large enough numbers to yield sufficient sample sizes (via electrofishing) from which statistically valid conclusions can be drawn (on both a riverwide and by-reach basis) annually over numerous consecutive years.

Electrofishing data were pooled for both rafts to obtain total catch numbers for each sampling trip. Numbers of fish (juvenile and adult life stages) collected by all rafts were combined to obtain total catch for each species. Numbers of fish collected for each species were then divided by the number of seconds (converted to hours) fished by all rafts combined to obtain "riverwide" (i.e., Reaches 6-1 {RM 180.0-0.0} combined) catch per unit effort (CPUE) values for juvenile and adult life stages and for all life stages combined (i.e., juvenile + adult; referred to hereafter as "total" CPUE). CPUE values for each of the four most common large-bodied fish species collected was then partitioned by whole geomorphic reach and compared to 1991-2004 electrofishing data to evaluate long-term trends.

Length data obtained from fish measured at DM's were used to examine changes in mean TL for all life stages of a species in a reach, combined. As with CPUE data, mean TL data were compared to 1991-2004 data to evaluate long-term trends. TL data were also used to develop riverwide length frequency histograms for the four most common large-bodied fish species from 1996-2005.

A few notes of explanation about 1991-1998 data sets are warranted here. Adult Monitoring studies performed from 1991-1998 followed protocols (detailed in Ryden 2000) very similar to those in Propst et al. (2000). The only two differences between these two sets of sampling protocols were: 1) from 1991-1998, electrofishing was done every RM (instead of two out of every three RM); and 2) DM's were done every fifth sampled RM (instead of every fourth sampled RM). However, from 1991-1998 Adult Monitoring studies did not always sample the entirety of the study area (Reaches 6-1) contiguously in a given year. It was only from 1996 on that the entire study area was sampled contiguously during similar time-frames (i.e., late-summer through late-October) and flow conditions to allow for valid riverwide comparisons of data sets between years. Data collected prior to 1996 were only included in comparative analyses for this report if data were available from an entire geomorphic reach. Therefore, appropriate comparative data sets were available for Reach 6 from 1996-2005, for Reaches 5-3 from 1991-2005, and for Reaches 2-1 from 1993 and 1995-2005.

Additionally, it was not until 1994 that fish species collected in non-DM samples were characterized by life stage (i.e., juvenile or adult). Before 1994, fishes collected in non-DM samples were enumerated only by the total numbers collected per species. Therefore, juvenile and adult CPUE comparisons can only be made from 1994 on, while CPUE comparisons for all life stages combined (i.e., total CPUE) can be made for all years in which data are available for a given geomorphic reach, since total CPUE is based on data from all fish of a given species, regardless of age, collected in an electrofishing sample. Therefore, in this report, no juvenile or adult CPUE data are presented for Reaches 5-3 from 1991-1993 or for Reaches 2 or 1 in 1993, but total CPUE data are presented for these reaches in these years.

RESULTS

Mean river flows (as determined from the Shiprock USGS gage #09368000) for the entire 2005 Adult Monitoring trip were well within the range of sampling flows observed over the last ten years (1996-2005) of riverwide sampling (Table 1). As has been observed during several previous years, there were noticeable differences in sampling flows between the first week of sampling, (i.e., 19—23 September 2005; during which RM 180.0-119.2 were sampled) when sampling flows ranged from 322-605 CFS and the last ten days of sampling (i.e., 3-12 October; during which RM 119.2-2.9 were sampled) when sampling flows ranged from 980-1,950 CFS).

Nineteen different fish species and hybrid forms were collected from the San Juan River during the 2005 Adult Monitoring trip (Table 2). This included five native species and two native sucker X native sucker hybrids, as well as ten nonnative species and two native sucker X nonnative sucker hybrids (Tables 2 and 3). Flannelmouth sucker was the most commonly-collected species (n = 5,895 individuals), followed in descending order by bluehead sucker (n = 2,945), channel catfish (n = 2,307), speckled dace (n = 595), red shiner (n = 405), common carp (n = 297), Colorado pikeminnow (n = 127), and razorback sucker (n = 52; Table 3). These eight species accounted for 99.21% (12,623 individuals) of the total catch during the 2005 Adult Monitoring trip. The other seven species (and four hybrids) contributed only 100 individuals, or 0.79%, to the total catch in 2005 (Table 3). This was only the second year, since Adult Monitoring trips began in 1991 (2004 being the other year), that common carp were not among the four most commonly-collected fish species.

Native fishes accounted for 9,650 specimens or 75.85% of the total catch in 2005 (among 210 individual electrofishing collections riverwide). Non-native fishes accounted for 3,073 specimens or 24.15% of the total catch in 2005 (among 210 individual electrofishing collections riverwide). The overall native to nonnative fish ratio riverwide was 3.14:1 in 2005 (Figure 1).

Although the two federally-listed endangered fishes continue to be comparitively rare during Adult Monitoring collections, 2005 was the second consecutive year during which > 100 Colorado pikeminnow (n = 127 in 2005; n = 159 in 2004) and > 50 razorback sucker (n = 52 in 2005; n = 117 in 2004) were collected during the same fall Adult Monitoring trip. 2005 was also only the third time that > 100 Colorado pikeminnow had been collected on any Adult

Table 1. Summary of dates, river miles (RM) sampled, and mean flow during riverwide Adult Monitoring trips in the San Juan River in New Mexico, Colorado, and Utah, 1996-2005.

Beginning Date Of Sampling	Ending Date Of Sampling	River Miles Sampled	Mean Trip Flow At The Shiprock, New Mexico USGS Gage (#09368000) In CFS And (Cubic Meters/Second)
17 June 1996	25 October 1996	RM 180.0-2.9	1,531 CFS ($43.3\ m^3/sec$)
11 August 1997	9 October 1997	RM 180.0-2.9	1,753 CFS ($49.6\ m^3/sec$)
10 August 1998	7 October 1998	RM 180.0-2.9	767 CFS ($21.7\ m^3/sec$)
20 September 1999	7 October 1999	RM 180.0-2.9	2,177 CFS ($61.6\ m^3/sec$)
18 September 2000	10 October 2000	RM 180.0-2.9	657 CFS ($18.6\ m^3/sec$)
25 September 2001	19 October 2001	RM 180.0-2.9	611 CFS ($17.3\ m^3/sec$)
20 September 2002	7 October 2002	RM 180.0-2.9	458 CFS ($12.9\ m^3/sec$)
22 September 2003	14 October 2003	RM 180.0-2.9	450 CFS ($12.7\ m^3/sec$)
20 September 2004	13 October 2004	RM 180.0-2.9	1,432 CFS ($40.5\ m^3/sec$)
19 September 2005	12 October 2005	RM 180.0-2.9	1,072 CFS ($30.3\ m^3/sec$)

Monitoring trip (n = 104 in 1998). The 2005 totals for these two federally-listed endangered fishes were second only to their 2004 totals. In addition, 2005 was the second consecutive year during which both of the endangered fishes were among the eight most commonly-collected fishes during the same year's fall Adult Monitoring trip.

In contrast to the encouraging trends being observed among the two federally-listed endangered fishes, are the numbers of the state-listed endangered roundtail chub being collected during riverwide fall Adult Monitoring trips. Once again in 2005, no roundtail chub were collected during the fall Adult Monitoring trip. Over the last ten years (1996-2005), only seven total roundtail chub have been collected during Adult Monitoring trips, and only one of those has been collected in the last six years (n = 1 in 2002).

Table 2. Scientific and common names, status, and database codes for fish species collected from the San Juan River during the 2005 adult monitoring trip (following Nelson et al. 2004).

SCIENTIFIC NAME	COMMON NAME	STATUS	CODE
Class Actinopterygii			
Order Cypriniformes			
Family Catostomidae-suckers			
Catostomus discobolus	bluehead sucker	native	Catdis
Catostomus commersoni	white sucker	introduced	Catcom
C.commersoni X C.discobolus	hybrid	introduced	comXdis
C.commersoni X C.latipinnis	hybrid	introduced	comXlat
Catostomus latipinnis	flannelmouth sucker	native	Catlat
C.latipinnis X C.discobolus	hybrid	native	latXdis
Xyrauchen texanus	razorback sucker	native	Xyrtex
X.texanus X C.latipinnis	hybrid	native	texXlat
Family Cyprinidae-carps and minnows			
Cyprinella lutrensis	red shiner	introduced	Cyplut
Cyprinus carpio	common carp	introduced	Cypcar
Pimephales promelas	fathead minnow	introduced	Pimpro
Ptychocheilus lucius	Colorado pikeminnow	native	Ptyluc
Rhinichthys osculus	speckled dace	native	Rhiosc
Order Perciformes			
Family Centrarchidae-sunfishes			
Lepomis cyanellus	green sunfish	introduced	Lepcya
Micropterus dolomieu	smallmouth bass	introduced	Micdol
Micropterus salmoides	largemouth bass	introduced	Micsal
Order Salmoniformes			
Family Salmonidae-trouts			
Salmo trutta	brown trout	introduced	Saltru
Order Siluriformes			
Family Ictaluridae-bullhead catfishes			
Ameiurus melas	black bullhead	introduced	Amemel
Ictalurus punctatus	channel catfish	introduced	Ictpun

Table 3. Total number of fish collected during the 2005 Adult Monitoring trip (in 85.95 total hours of electrofishing).

Species (Status)[a]	Total number of specimens	Percent of total[b]	Rank	Frequency of occurrence
flannelmouth sucker(N)	5,895	46.33	1	209
bluehead sucker(N)	2,945	23.15	2	175
channel catfish(I)	2,307	18.13	3	170
speckled dace(N)	595	4.68	4	117
red shiner(I)	405	3.18	5	60
common carp(I)	297	2.33	6	115
Colorado pikeminnow(N)	127	1.00	7	80
razorback sucker(N)	52	0.41	8	28
bluehead sucker X flannelmouth sucker(H,N)	35	0.28	9	28
brown trout(I)	24	0.19	10	14
fathead minnow(I)	20	0.16	11	16
largemouth bass(I)	9	----	12	9
black bullhead(I)	4	----	13	4
white sucker(I)	2	----	14	2
white sucker X bluehead sucker(H,I)	2	----	14	1
green sunfish(I)	1	----	15	1
smallmouth bass(I)	1	----	15	1
razorback sucker X flannelmouth sucker(H,N)	1	----	15	1
white sucker X flannelmouth sucker(H,I)	1	----	15	1
GRAND TOTAL	12,723		2005 collections = 210	

2005 Native Fishes 9,650 (75.85% of total catch)
2005 Introduced Fishes 3,073 (24.15% of total catch)
2005 Native:Introduced Fishes Ratio = 3.14:1

a: (N) = Native species; (I) = Introduced species; (H,N) = A hybrid of two species, considered to be a native fish; (H,I) = A hybrid of two species, considered to be an introduced fish

b: ---- = less than 0.1%

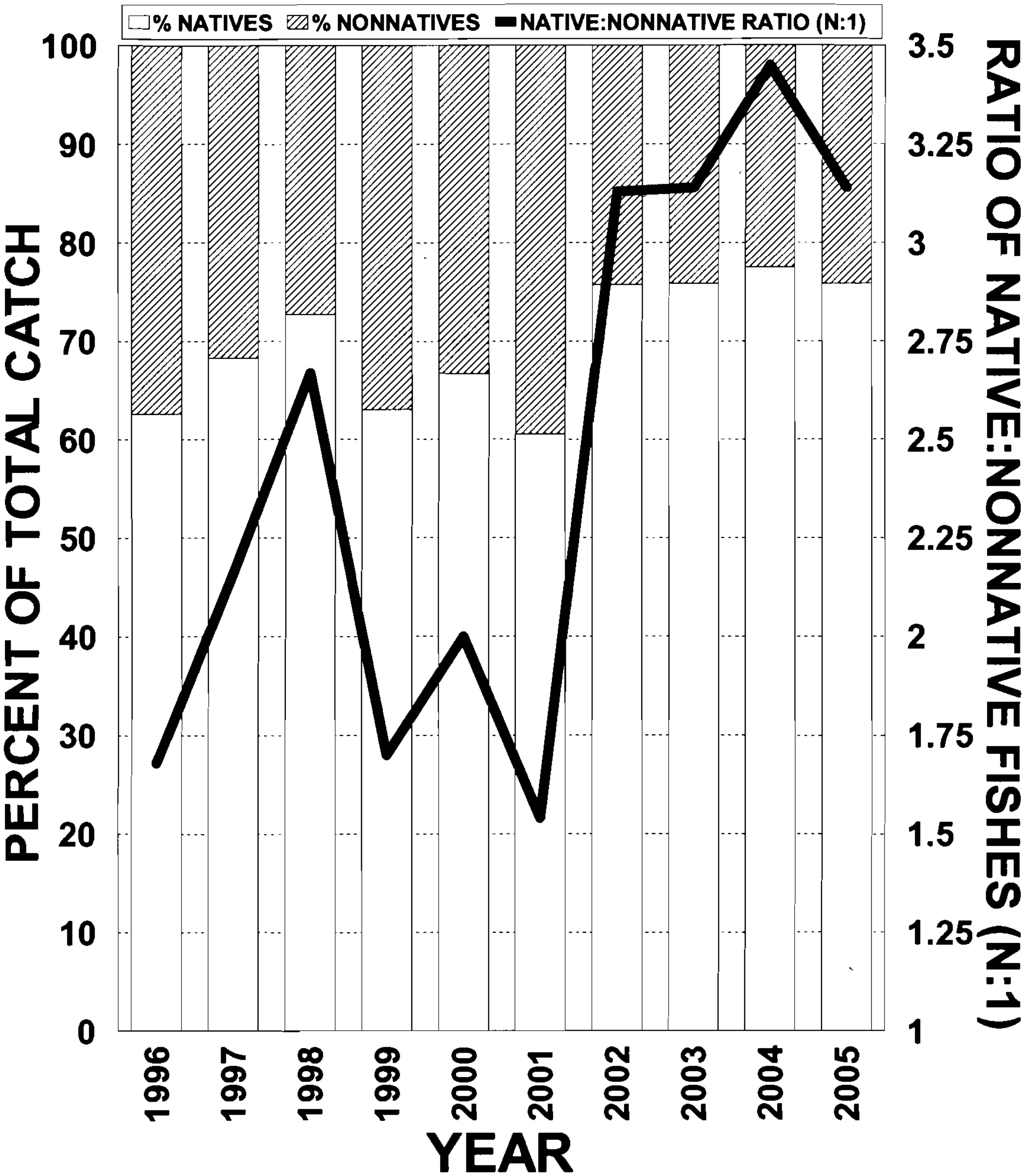

Figure 1. The bars represent the percent of the total catch accounted for by native fishes (white bars) versus nonnative fishes (shaded bars), riverwide (RM 180.0-0.0), on Adult Monitoring trips, 1996-2005. The line represents the ratio of native to nonnative fishes (N:1) collected on the same trips.

Rare Native Fishes

Colorado Pikeminnow

Fish Stocked As Part Of An Augmentation Effort

A total of 306,811 age-0, age-1, and age-2 Colorado pikeminnow were stocked into the San Juan River in 2005 (Table 4). These fish were stocked in several distinct groups.

The first two groups, consisting of 500 age-1 fish from the Dexter National Fish Hatchery and Technology Center in Dexter, NM (hereafter referred to as "Dexter") and 1,491 age-2 fish from the J. W. Mumma Native Species Hatchery in Alamosa, CO (hereafter referred to as "Mumma"), were stocked en masse at RM 180.2 on 7 July 2005 (Table 4). All of these fish, though reared at different facilities, were either 2003 or 2004 year-class progeny of the "1991 broodstock" being held at Dexter NFH. All of these age-1 and age-2 fish were individually PIT-tagged before being released into the river.

The third group, consisting of approximately 20,000 age-0 Colorado pikeminnow were stocked by crews from BIO-WEST, Inc. into three low-velocity habitats at RM 175.8 (n = 6,000) and RM's 167.5 and 167.4 (n = 14,000) on 20 October 2005 (Table 4). The habitats these 20,000 age-0 fish were stocked into were blocked off using holding pens prior to introducing fish into them. This was done as part of an acclimation study aimed at improving retention of stocked age-0 pikeminnow in upstream sections of the San Juan River. The premise of the study was that if age-0 Colorado pikeminnow were allowed to acclimate for a period in the river after stocking, then once allowed free access to the river, they would be less likely to exhibit the long downstream displacements typically observed among newly-stocked age-0 Colorado pikeminnow. These age-0 fish all came from Dexter and were all 2005 year-class progeny of the "1991 broodstock" being held at Dexter. None of these fish were PIT-tagged before release.

The fourth group, consisting of approximately 282,270 age-0 Colorado pikeminnow were stocked by crews from USFWS-CRFP (Table 4). Stocking took place on two separate days, 20 October and 3 November 2005. Upon arrival at the river, these fish were subdivided into two smaller groups. Each of these two sub-groups were transported downstream by raft in aerated live wells and stocked into numerous backwaters and other low-velocity habitats. The first sub-group was stocked between RM 180.2 and 170.5 (i.e., immediately downstream of Farmington, NM; n = 133,150) while the second sub-group was stocked between RM 158.6 and 148.5 (i.e. between Hogback Diversion and Shiprock, NM; n = 149,120). These age-0 fish came from Dexter. All of these fish were 2004 year-class progeny of the "1991 broodstock" being held at Dexter NFH. None of these fish were PIT-tagged or otherwise individually-marked before release.

The fifth and last group, consisting of approximately 2,550 age-2 Colorado pikeminnow from Mumma, were stocked en masse at RM 180.2 on 10 November 2005 (Table 4). All of these fish, though reared at Mumma, were 2003 year-class progeny of the "1991 broodstock" being held at Dexter NFH. All of these age-2 fish were individually PIT-tagged before being released into the river.

Table 4. Stockings of Colorado pikeminnow in the San Juan River, 1996-2005.

Dates	Number Stocked	River Miles Stocked At	Mean Total Length (in mm)	Range Of Total Lengths (in mm)	Responsible Agency[a]
Experimental Stocking Period (1996-2001):					
11/04/1996	~50,000	148.0	55	25-85	UDWR-Moab
11/04/1996	~50,000	52.0	55	25-85	UDWR-Moab
08/15/1997	62,578	148.0	45	35-55	UDWR-Moab
08/15/1997	54,300	52.0	45	35-55	UDWR-Moab
09/23/1997	49	180.2	644	550-753	USFWS-CRFP
07/02/1998	10,571	148.0	24	18-28	UDWR-Moab
07/07/1999	~500,000	158.6	"Larvae"	Not Specified	UDWR-Moab
06/11/2000	~105,000	141.9	"Larvae"	Not Specified	UDWR-Moab
04/11/2001	148	180.2	540	442-641	USFWS-CRFP
Beginning Of Eight-Year Augmentation Period (2002-2009):					
10/24/2002	105,209	180.2	51	32-127	USFWS-CRFP
10/24/2002	105,209	158.6	51	32-127	USFWS-CRFP
11/06/2003	155,764	180.2-170.5 and 158.6-148.5	58	38-100	USFWS-CRFP
11/06/2003	20,164	188.4-180.7 and 163.7-159.2	58	Unknown	BIO-WEST
11/06/2003	1,005	180.2	180	125-280	CDOW-Mumma
06/09/2004	1,219	180.2	218	144-278	CDOW-Mumma
10/21/2004	30,000	178.6-169.5 and 163.7-159.2	50	Unknown	BIO-WEST
10/21/2004 & 10/28/2004	250,000	180.2-170.5 and 158.6-148.5	50	35-116	USFWS-CRFP (assisted by BIO-WEST)
07/07/2005	500	180.2	201	114-256	USFWS-Dexter
07/07/2005	1,491	180.2	204	121-281	CDOW-Mumma
10/20/2005	20,000	175.8, 167.5 and 167.4	55	Unknown	BIO-WEST
10/20/2005	282,270	180.2-170.5 and 158.6-148.5	55	Unknown	USFWS-CRFP
11/10/2005	2,550	180.2	167	115-252	CDOW-Mumma

[a] UDWR-Moab = Utah Division of Wildlife Resources, Moab Field Station, Moab, Utah; USFWS-CRFP = U. S. Fish and Wildlife Service, Colorado River Fishery Project, Grand Junction, Colorado; BIO-WEST = BIO-WEST, Inc., Logan, Utah; CDOW-Mumma = Colorado Division of Wildlife, J.W. Mumma Native Species Hatchery, Alamosa, Colorado; USFWS-Dexter = U. S. Fish and Wildlife Service, Dexter National Fish Hatchery and Technology Center, Dexter NM

2005 Collections

There were a total of 127 recapture events with stocked juvenile Colorado pikeminnow during the 2005 Adult Monitoring trip (Table 5). This marked only the third time since Adult Monitoring began in 1991 that > 100 Colorado pikeminnow had been collected during a single Adult Monitoring trip (n = 104 in 1998; n = 159 in 2004). In addition, several hundred more Colorado pikeminnow collections occurred during other field studies in calendar year 2005 (H. Brandenburg pers. comm., J. Davis pers. comm., M. Golden pers. comm., J. Jackson pers. comm., A. Lapahie pers. comm., Y. Paroz pers. comm. S. Platania pers. comm.). Colorado pikeminnow collections were made via raft-mounted electrofishing and seining, in the PNM Fish Ladder, and using cast nets during calendar year 2005. Several Colorado pikeminnow were collected in the Hogback and Fruitland Irrigation canals in 2005 (S. Platania and L. Renfro pers. comm.) and two individuals were collected downstream of the waterfalls that separate the lower San Juan River from Lake Powell (J. Jackson pers. comm.). However, no wild adult or larval Colorado pikeminnow were collected in 2005, during any study effort.

The 127 Colorado pikeminnow recaptures that occurred during the fall 2005 Adult Monitoring trip ranged from RM 178.0-5.0. Of these 127 collections, 94 (74.0%) occurred upstream of the canyon-bound reaches of the river (i.e., RM 68.0-0.0). In addition, 22 (17.3%) of these collections occurred upstream of the Hogback Diversion (RM 158.6). Expansion of the Colorado pikeminnow's range into the river section upstream of RM 158.6 was listed as a criteria necessary to determine a 'Positive Population Response' for the San Juan River's Colorado pikeminnow population (U. S. Bureau of Reclamation 2001).

During the 2005 Adult Monitoring trip, there were numerous year-classes and size-classes of Colorado pikeminnow that had been stocked into the San Juan River that had the potential to be recaptured (Table 4). Of the 127 recaptures on the 2005 Adult Monitoring trip, 75 were age-1 fish, 50 were age-2 fish and 2 were age-2 fish (Table 5).

The largest group of recaptured Colorado pikeminnow in 2005 (n = 64; 50.4%), were age-1 Dexter fish that were stocked (as age-0 fish)in the fall of 2004. These age-1 fish were collected from RM 178.0-7.0 (Table 5). Another 11 (8.7%) recaptures were also with age-1 fish, but these were fish from Dexter that had been stocked as age-1 fish on 7 July 2005 (and thus had been in the river only about three months, all of which was after high spring flows) at RM 180.2. These 11 age-1 Dexter fish were collected from RM 169.0-47.0, with 10 of the 11 being collected upstream of RM 115.0 (Table 5).

The second largest group of recaptured Colorado pikeminnow (n = 39; 30.7%) were age-2 Dexter fish that were stocked (as age-0 fish) in the fall of 2003. These age-2 fish were collected from RM 178.0-16.0 (Table 5). Another 11 (8.7%) recaptures were also with age-2 fish, but these were fish from Mumma that had been stocked as age-2 fish on 7 July 2005 (and thus had been in the river only about three months, all of which was after high spring flows) at RM 180.2. These 11 age-2 Mumma fish were collected from RM 178.0-124.0 (Table 5).

The smallest group were the age-3 fish. Only two age-3 Colorado pikeminnow recaptured in 2005. One of these (recaptured at RM 50.0) had been stocked in the fall of 2002 as an age-0 fish, while the other (recaptured at RM 59.3) had been stocked on 9 June 2004 as an age 2 fish from Mumma (Table 5).

Although the widespread distribution of stocked Colorado pikeminnow from different stocking dates in the San Juan River is encouraging, the recent collections of numerous Colorado pikeminnow from both the Hogback and Fruitland irrigation canals (UNM unpublished data) point to a potentially

Table 5. Colorado pikeminnow collected from the San Juan River on the fall 2005 Adult Monitoring trip (n = 127).

SPECIES	DATE	PIT TAG (400 KHZ)	PIT TAG (134 KHZ)	TOTAL LENGTH (IN mm)	WEIGHT (IN g)	SEX	CAPTURE RIVER MILE
COLORADO PIKEMINNOW	09/19/2005	NONE	3D91BF18D7F12	170	33	UNKNOWN	154
COLORADO PIKEMINNOW	09/19/2005	NONE	3D91BF18D81BE	157	29	UNKNOWN	151
COLORADO PIKEMINNOW	09/19/2005	4344685844	3D91BF1D6EF87	242	115	UNKNOWN	151
COLORADO PIKEMINNOW	09/19/2005	NONE	3D91BF18D109C	166	32	UNKNOWN	149
COLORADO PIKEMINNOW	09/19/2005	NONE	3D91BF1D6E130	172	35	UNKNOWN	149
COLORADO PIKEMINNOW	09/19/2005	NONE	3D91BF1D6E0ED	275	148	UNKNOWN	149
COLORADO PIKEMINNOW	09/19/2005	NONE	3D91BF18CFC59	305	130	UNKNOWN	149
COLORADO PIKEMINNOW	09/19/2005	NONE	3D91BF1D8AC5F	336	175	UNKNOWN	149
COLORADO PIKEMINNOW	09/20/2005	NONE	3D91BF1D6EE89	126	14	UNKNOWN	145
COLORADO PIKEMINNOW	09/20/2005	NONE	NONE	146	23	UNKNOWN	145
COLORADO PIKEMINNOW	09/20/2005	NONE	3D91BF1D6E92C	273	190	UNKNOWN	145
COLORADO PIKEMINNOW	09/20/2005	NONE	3D91BF1D6D8FB	168	34	UNKNOWN	142
COLORADO PIKEMINNOW	09/20/2005	NONE	3D91BF1D4E8CA	283	205	UNKNOWN	142
COLORADO PIKEMINNOW	09/20/2005	NONE	NONE	145	22	UNKNOWN	140
COLORADO PIKEMINNOW	09/20/2005	NONE	3D91BF18DD50A	160	140	UNKNOWN	140
COLORADO PIKEMINNOW	09/20/2005	NONE	3D91BF1D6E0FA	247	125	UNKNOWN	140
COLORADO PIKEMINNOW	09/20/2005	4344743661	3D91BF18CF899	255	90	UNKNOWN	140
COLORADO PIKEMINNOW	09/20/2005	NONE	3D91BF1D70D92	171	40	UNKNOWN	139
COLORADO PIKEMINNOW	09/20/2005	NONE	3D91BF1D6DE3D	286	180	UNKNOWN	139
COLORADO PIKEMINNOW	09/20/2005	NONE	NONE	135	15	UNKNOWN	136
COLORADO PIKEMINNOW	09/20/2005	NONE	3D91BF18D6925	160	25	UNKNOWN	136
COLORADO PIKEMINNOW	09/20/2005	NONE	NONE	192	40	UNKNOWN	136
COLORADO PIKEMINNOW	09/20/2005	NONE	3D91BF18B95EC	196	60	UNKNOWN	136
COLORADO PIKEMINNOW	09/20/2005	NONE	3D91BF1D6E7C6	159	28	UNKNOWN	134
COLORADO PIKEMINNOW	09/20/2005	NONE	3D91BF1D4E9DD	268	120	UNKNOWN	134
COLORADO PIKEMINNOW	09/20/2005	5342686F32	3D91BF18D74D7	271	150	UNKNOWN	134
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF18D8F2E	166	31	UNKNOWN	131
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF1D6D5FB	179	46	UNKNOWN	131
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF18B9EFE	183	47	UNKNOWN	131
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF1D4F389	295	225	UNKNOWN	131
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF1D6F37A	335	329	UNKNOWN	131
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF1D7051D	188	45	UNKNOWN	130
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF1D6D5B1	255	115	UNKNOWN	130
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF1D6E8F9	162	28	UNKNOWN	127

Table 5. Continued.

SPECIES	DATE	PIT TAG (400 KHZ)	PIT TAG (134 KHZ)	TOTAL LENGTH (IN mm)	WEIGHT (IN g)	SEX	CAPTURE RIVER MILE
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF18D24DD	174	41	UNKNOWN	127
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF1D6E779	177	40	UNKNOWN	127
COLORADO PIKEMINNOW	09/21/2005	434228516B	3D91BF18CFB31	277	150	UNKNOWN	127
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF18D7DEF	279	155	UNKNOWN	127
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF1D6C382	297	190	UNKNOWN	127
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF1D4DC56	373	140	UNKNOWN	127
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF18D0179	143	21	UNKNOWN	124
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF1D6E557	291	190	UNKNOWN	124
COLORADO PIKEMINNOW	09/21/2005	53400F4127	3D91BF1D6D9E4	296	180	UNKNOWN	124
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF18D377E	354	385	UNKNOWN	122
COLORADO PIKEMINNOW	09/21/2005	NONE	3D91BF18D80D1	259	150	UNKNOWN	121
COLORADO PIKEMINNOW	09/22/2005	NONE	3D91BF18D1D32	146	27	UNKNOWN	178
COLORADO PIKEMINNOW	09/22/2005	NONE	3D91BF18D7ABD	165	53	UNKNOWN	178
COLORADO PIKEMINNOW	09/22/2005	4363024F4D	3D91BF18D2DC4	228	105	UNKNOWN	178
COLORADO PIKEMINNOW	09/22/2005	4515506B4B	3D91BF18BA765	260	145	UNKNOWN	178
COLORADO PIKEMINNOW	09/22/2005	534008407B	3D91BF18D6AD0	287	150	UNKNOWN	178
COLORADO PIKEMINNOW	09/22/2005	NONE	3D91BF18D80E2	125	34	UNKNOWN	175
COLORADO PIKEMINNOW	09/22/2005	NONE	3D91BF18D0288	157	32	UNKNOWN	175
COLORADO PIKEMINNOW	09/22/2005	NONE	3D91BF18D674F	175	40	UNKNOWN	175
COLORADO PIKEMINNOW	09/22/2005	436258126C	3D91BF1D4F7E6	219	75	UNKNOWN	175
COLORADO PIKEMINNOW	09/22/2005	447850347F	3D91BF1D6FABD	289	170	UNKNOWN	175
COLORADO PIKEMINNOW	09/22/2005	NONE	3D91BF18D1344	140	20	UNKNOWN	172
COLORADO PIKEMINNOW	09/22/2005	NONE	3D91BF1D6CBEB	184	45	UNKNOWN	172
COLORADO PIKEMINNOW	09/22/2005	53311D5B48	3D91BF19EB9EB	263	140	UNKNOWN	172
COLORADO PIKEMINNOW	09/22/2005	43444D296C	3D91BF18CFAFA	275	160	UNKNOWN	172
COLORADO PIKEMINNOW	09/22/2005	NONE	3D91BF1D6E4CE	137	20	UNKNOWN	170
COLORADO PIKEMINNOW	09/22/2005	4363576C4C	3D91BF1D6EDDA	242	115	UNKNOWN	170
COLORADO PIKEMINNOW	09/22/2005	43627F2663	3D91BF1D6DE70	256	145	UNKNOWN	170
COLORADO PIKEMINNOW	09/22/2005	NONE	3D91BF1D6D665	136	20	UNKNOWN	169
COLORADO PIKEMINNOW	09/22/2005	NONE	3D91BF1D6E178	274	190	UNKNOWN	169
COLORADO PIKEMINNOW	09/23/2005	NONE	3D91BF18BAA23	155	25	UNKNOWN	166
COLORADO PIKEMINNOW	09/23/2005	NONE	3D91BF18D10E1	159	29	UNKNOWN	163
COLORADO PIKEMINNOW	09/23/2005	NONE	3D91BF1D6D9F2	284	175	UNKNOWN	163
COLORADO PIKEMINNOW	10/03/2005	NONE	3D91BF1D8635B	158	29	UNKNOWN	115

Table 5. Continued.

SPECIES	DATE	PIT TAG (400 KHZ)	PIT TAG (134 KHZ)	TOTAL LENGTH (IN mm)	WEIGHT (IN g)	SEX	CAPTURE RIVER MILE
COLORADO PIKEMINNOW	10/03/2005	NONE	NONE	186	46	UNKNOWN	115
COLORADO PIKEMINNOW	10/03/2005	NONE	3D91BF1D6B5BB	250	125	UNKNOWN	115
COLORADO PIKEMINNOW	10/03/2005	NONE	3D91BF18D3125	166	40	UNKNOWN	113
COLORADO PIKEMINNOW	10/03/2005	NONE	3D91BF18D29AC	186	61	UNKNOWN	113
COLORADO PIKEMINNOW	10/03/2005	NONE	3D91BF18D63F6	186	62	UNKNOWN	113
COLORADO PIKEMINNOW	10/03/2005	NONE	3D91BF1CD3C09	188	48	UNKNOWN	113
COLORADO PIKEMINNOW	10/03/2005	NONE	3D91BF18D2A2C	190	45	UNKNOWN	112
COLORADO PIKEMINNOW	10/03/2005	NONE	3D91BF18BA058	305	234	UNKNOWN	109
COLORADO PIKEMINNOW	10/04/2005	NONE	3D91BF18D716A	219	75	UNKNOWN	107
COLORADO PIKEMINNOW	10/04/2005	NONE	3D91BF18D1F35	337	280	UNKNOWN	107
COLORADO PIKEMINNOW	10/04/2005	NONE	3D91BF1AF9142	200	50	UNKNOWN	104
COLORADO PIKEMINNOW	10/05/2005	NONE	3D91BF18D33CA	185	41	UNKNOWN	91
COLORADO PIKEMINNOW	10/06/2005	NONE	3D91BF18D20F8	180	30	UNKNOWN	79
COLORADO PIKEMINNOW	10/06/2005	NONE	3D91BF18D34AB	199	50	UNKNOWN	79
COLORADO PIKEMINNOW	10/06/2005	NONE	3D91BF18CFD98	210	70	UNKNOWN	79
COLORADO PIKEMINNOW	10/06/2005	NONE	3D91BF18D6C50	213	75	UNKNOWN	79
COLORADO PIKEMINNOW	10/06/2005	NONE	3D91BF18D19B5	190	50	UNKNOWN	74
COLORADO PIKEMINNOW	10/06/2005	NONE	3D91BF18B9E24	180	35	UNKNOWN	73
COLORADO PIKEMINNOW	10/06/2005	NONE	3D91BF18D1E26	190	45	UNKNOWN	73
COLORADO PIKEMINNOW	10/06/2005	NONE	3D91BF18D3881	200	45	UNKNOWN	73
COLORADO PIKEMINNOW	10/07/2005	NONE	3D91BF1A0A0E5	232	87	UNKNOWN	71
COLORADO PIKEMINNOW	10/07/2005	NONE	3D91BF1CD3895	269	115	UNKNOWN	71
COLORADO PIKEMINNOW	10/07/2005	NONE	3D91BF1AF83F9	296	180	UNKNOWN	71
COLORADO PIKEMINNOW	10/07/2005	NONE	3D91BF18BAAA9	299	180	UNKNOWN	71
COLORADO PIKEMINNOW	10/07/2005	NONE	3D91BF1CD2966	306	220	UNKNOWN	70
COLORADO PIKEMINNOW	10/07/2005	NONE	3D91BF1A050E0	236	75	UNKNOWN	68
COLORADO PIKEMINNOW	10/07/2005	NONE	3D91BF18D25D6	289	168	UNKNOWN	67
COLORADO PIKEMINNOW	10/07/2005	NONE	3D91BF1CD255A	325	225	UNKNOWN	59.3
COLORADO PIKEMINNOW	10/07/2005	441E3B6A43	3D91BF1CD3496	405	460	UNKNOWN	59.3
COLORADO PIKEMINNOW	10/08/2005	NONE	3D91BF1E99439	172	40	UNKNOWN	58
COLORADO PIKEMINNOW	10/08/2005	NONE	3D91BF1A0407E	320	240	UNKNOWN	58
COLORADO PIKEMINNOW	10/08/2005	NONE	3D91BF18D0617	320	230	UNKNOWN	58
COLORADO PIKEMINNOW	10/08/2005	NONE	3D91BF1CD21FE	260	140	UNKNOWN	56
COLORADO PIKEMINNOW	10/08/2005	NONE	3D91BF18D6EA8	196	45	UNKNOWN	55

Table 5. Continued.

SPECIES	DATE	PIT TAG (400 KHZ)	PIT TAG (134 KHZ)	TOTAL LENGTH (IN mm)	WEIGHT (IN g)	SEX	CAPTURE RIVER MILE
COLORADO PIKEMINNOW	10/08/2005	NONE	3D91BF1CD2FDC	300	190	UNKNOWN	50
COLORADO PIKEMINNOW	10/08/2005	NONE	3D91BF1E8FFED	419	440	UNKNOWN	50
COLORADO PIKEMINNOW	10/08/2005	NONE	3D91BF18CE390	278	120	UNKNOWN	49
COLORADO PIKEMINNOW	10/08/2005	NONE	3D91BF1CD303E	290	160	UNKNOWN	47
COLORADO PIKEMINNOW	10/08/2005	NONE	3D91BF1D6B326	310	155	UNKNOWN	47
COLORADO PIKEMINNOW	10/09/2005	NONE	3D91BF1A0A46D	187	40	UNKNOWN	44
COLORADO PIKEMINNOW	10/09/2005	NONE	3D91BF1A0331F	274	150	UNKNOWN	43
COLORADO PIKEMINNOW	10/09/2005	NONE	3D91BF1A0C6AA	289	165	UNKNOWN	43
COLORADO PIKEMINNOW	10/09/2005	NONE	3D91BF1CD35A8	292	160	UNKNOWN	43
COLORADO PIKEMINNOW	10/09/2005	NONE	3D91BF1CD0843	291	150	UNKNOWN	41
COLORADO PIKEMINNOW	10/09/2005	NONE	3D91BF18CFF19	330	260	UNKNOWN	40
COLORADO PIKEMINNOW	10/09/2005	NONE	3D91BF18B9766	231	81	UNKNOWN	38
COLORADO PIKEMINNOW	10/09/2005	NONE	3D91BF1CD257E	214	60	UNKNOWN	37
COLORADO PIKEMINNOW	10/09/2005	NONE	3D91BF1D8B00F	281	155	UNKNOWN	35
COLORADO PIKEMINNOW	10/10/2005	NONE	3D91BF18CFC25	180	140	UNKNOWN	32
COLORADO PIKEMINNOW	10/10/2005	NONE	3D91BF18D1ACA	350	290	UNKNOWN	26
COLORADO PIKEMINNOW	10/11/2005	NONE	3D91BF1A0562C	160	25	UNKNOWN	19
COLORADO PIKEMINNOW	10/11/2005	NONE	3D91BF18CF34E	169	30	UNKNOWN	19
COLORADO PIKEMINNOW	10/11/2005	NONE	3D91BF1A0546A	195	46	UNKNOWN	19
COLORADO PIKEMINNOW	10/11/2005	NONE	3D91BF18D12DB	299	180	UNKNOWN	19
COLORADO PIKEMINNOW	10/11/2005	NONE	3D91BF18D1B34	267	130	UNKNOWN	16
COLORADO PIKEMINNOW	10/11/2005	NONE	3D91BF18D2B2A	173	30	UNKNOWN	13
COLORADO PIKEMINNOW	10/12/2005	NONE	3D91BF18D26C5	169	21	UNKNOWN	8
COLORADO PIKEMINNOW	10/12/2005	NONE	NONE	141	17	UNKNOWN	7
COLORADO PIKEMINNOW	10/12/2005	NONE	3D91BF18D8124	173	35	UNKNOWN	5

significant source of loss for fish that are stocked upstream of RM 158.6 and then move downstream following stocking.

Survival of stocked Colorado pikeminnow in the San Juan River may be adversely impacted by the presence of nonnative ictalurids, either through direct predation by larger channel catfish, by aggression, or by Colorado pikeminnow attempting to consume smaller channel catfish and subsequently choking on them. Direct predation of channel catfish upon stocked juvenile Colorado pikeminnow was documented in 2004 (Jackson 2005), while the choking of stocked juvenile Colorado pikeminnow upon ictalurids (both channel catfish and black bullhead) has also been documented in the San Juan River (Ryden and Smith 2002, Lapahie 2003, Ryden 2004). On 21 September 2005, a juvenile Colorado pikeminnow (296 mm TL) was collected between RM 125 and RM 124 with a channel catfish "bite mark" on its back, completely encircling the dorsal fin (see picture in Appendix A). This same type of channel catfish bite mark has been observed on the dorsal regions of razorback sucker, flannelmouth sucker, and bluehead sucker over the past several years in the San Juan River (Ryden 2005a, pers. obs.).

Population Trends

Collections of wild Colorado pikeminnow continue to be extremely rare. No wild adult Colorado pikeminnow were collected in 2005. The last wild adult Colorado pikeminnow to be collected in the San Juan River was an 846 mm TL female that was captured on 25 July 2000 at RM 138.9. This fish had been captured in each of the previous two years - at RM 131.5 on 23 March 1999 and at RM 137.6 on 29 September 1998. Two wild larval Colorado pikeminnow were collected in 2004 (Brandenburg et al. 2005). These were the first wild Colorado pikeminnow larvae collected since 1991 (Brandenburg et al. 2005). No wild larval Colorado pikeminnow were collected in 2005 (H. Brandenburg, pers. comm.).

To my knowledge, only two stocked adult Colorado pikeminnow were collected in 2005, and neither of these was collected during the 2005 Adult Monitoring trip. One (TL = 538 mm; PIT tag # 7F7B1B0B31) was collected during nonnative fish removal efforts at RM 161.6 on 33 March 2005 (J. Davis, pers. comm.). This was the tenth recapture of this fish since it was stocked on 11 April 2001. The second stocked adult (TL = 650 mm; PIT tag # 7F7D11472D) was recaptured in the PNM Fish Ladder (RM 166.6) on 2 August 2005 (A. Lapahie, pers. comm.). This was the fifth recapture of this fish since it was stocked on 11 April 2001 and its third time through the fish ladder.

A third adult Colorado pikeminnow was collected in 2005 (J. Davis, pers. comm.) by nonnative fish removal crews. It is unknown if this was a stocked fish or a wild fish. Its size (603 mm TL) at recapture (28 July 2005) would indicate that this fish was likely between 9-11 years old (8-16 years old at the outside; M. Trammel, pers. comm.). This would mean it was likely spawned between 1994 and 1996 (1989-1997 at the outside; M. Trammel, pers. comm.) and was very probably a long-term survivor of either the 1996 or 1997 experimental stockings of age-0 Colorado pikeminnow by UDWR (Table 4). However, this could have also been a wild-produced fish. This fish was implanted with a new (134 khz) PIT tag (# 3D91BF18D723B) before being released (J. Davis, pers. comm.).

Riverwide, Colorado pikeminnow total CPUE (CPUE for all life stages combined) in 2005 was the second highest we've observed (1.49 fish/hr of electrofishing; 2004 was the highest at 1.78 fish/hr of electrofishing) since riverwide sampling began in 1996 (Figure 2). As stated above, this was based completely on recaptures of stocked juvenile fish, the majority of which were age-1 fish that had been stocked in the fall of 2004. The observed decline from 2004 to 2005 is likely related to the comparatively high spring discharge that occurred in 2005 (peaked at 13,200 CFS on 25 May 2005 at Shiprock USGS gage 09368000), an event that has not been duplicated or matched in the last several years.

A length-frequency histogram showed that while the majority (n = 75 fish; 59.1%) of the 127 Colorado pikeminnow collected during the fall 2005 Adult Monitoring trip were age-1 fish, there was also a second distinct group of age-2 fish present in collections (n = 50 fish; 39.4%; Figure 3). This distribution of year-classes very closely mirrors that observed in 1998 when both the 1996 and 1997 year-classes of fish were clearly discernable in a length-frequency histogram (Figure 3). The other thing that is apparent in the 2005 Colorado length-frequency histogram is that there are very few age-3 fish from the fall 2002 stockings of age-0 fish (Figure 3). It appears as if the fall 2002 stockings of age-0 fish had comparatively poor survival and/or retention when compared to the 2003 and 2004 stockings of age-0 fish. Data from other studies (e.g., Mike Golden pers. comm.) seems to support this as well.

The other thing that is relatively apparent in Figure 3 is that age-1 Colorado pikeminnow collected during the fall 2004 Adult Monitoring trip were noticeably larger than their age-1 counterparts in either 1998 or 2005. This

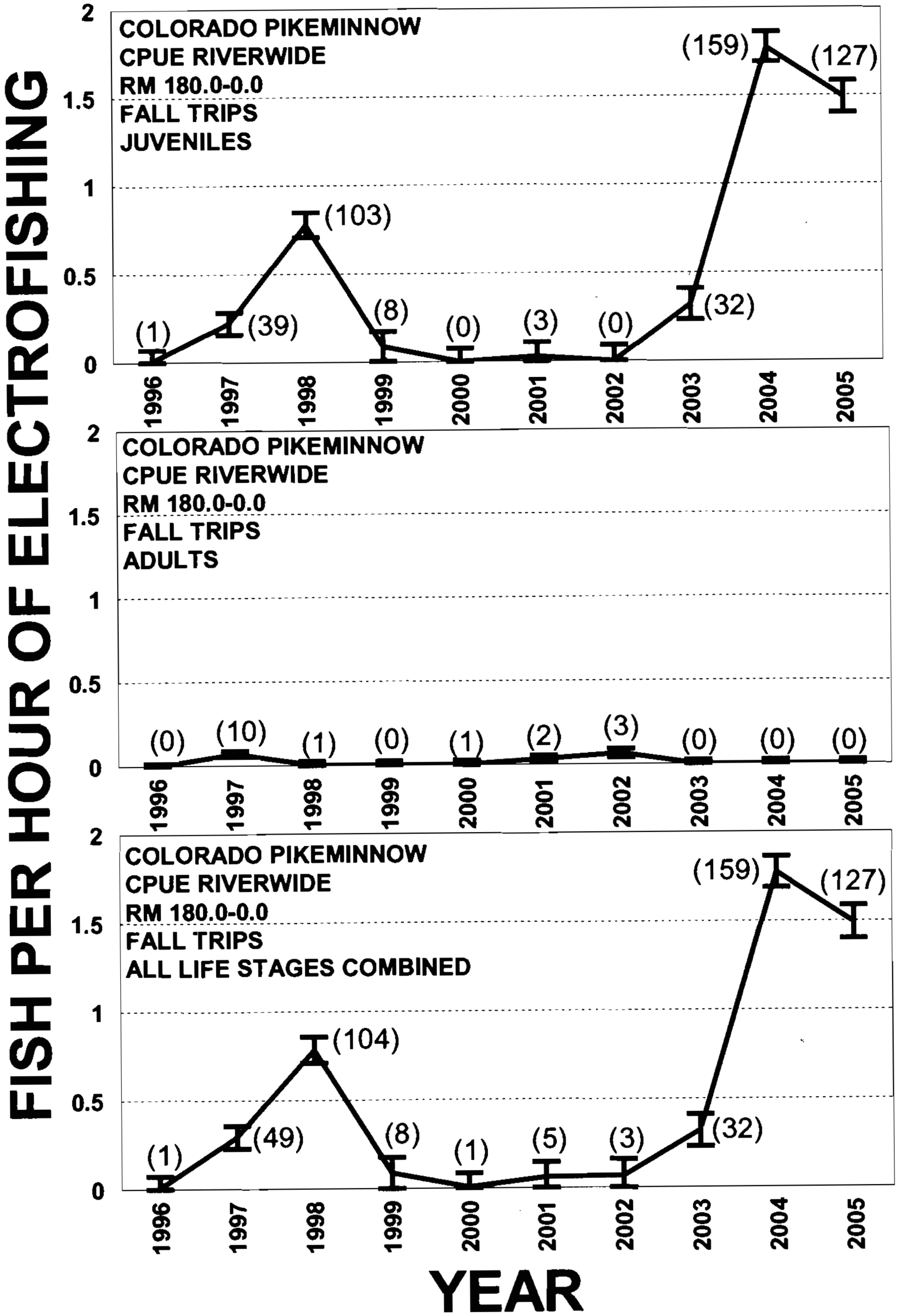

Figure 2. Colorado pikeminnow catch per unit effort (CPUE) riverwide (RM 180.0-0.0) on fall Adult Monitoring trips, for juvenile fish (< 450 mm TL; top), adult fish (≥ 450 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Parenthetic numbers above or beside the error bars indicate the sample size.

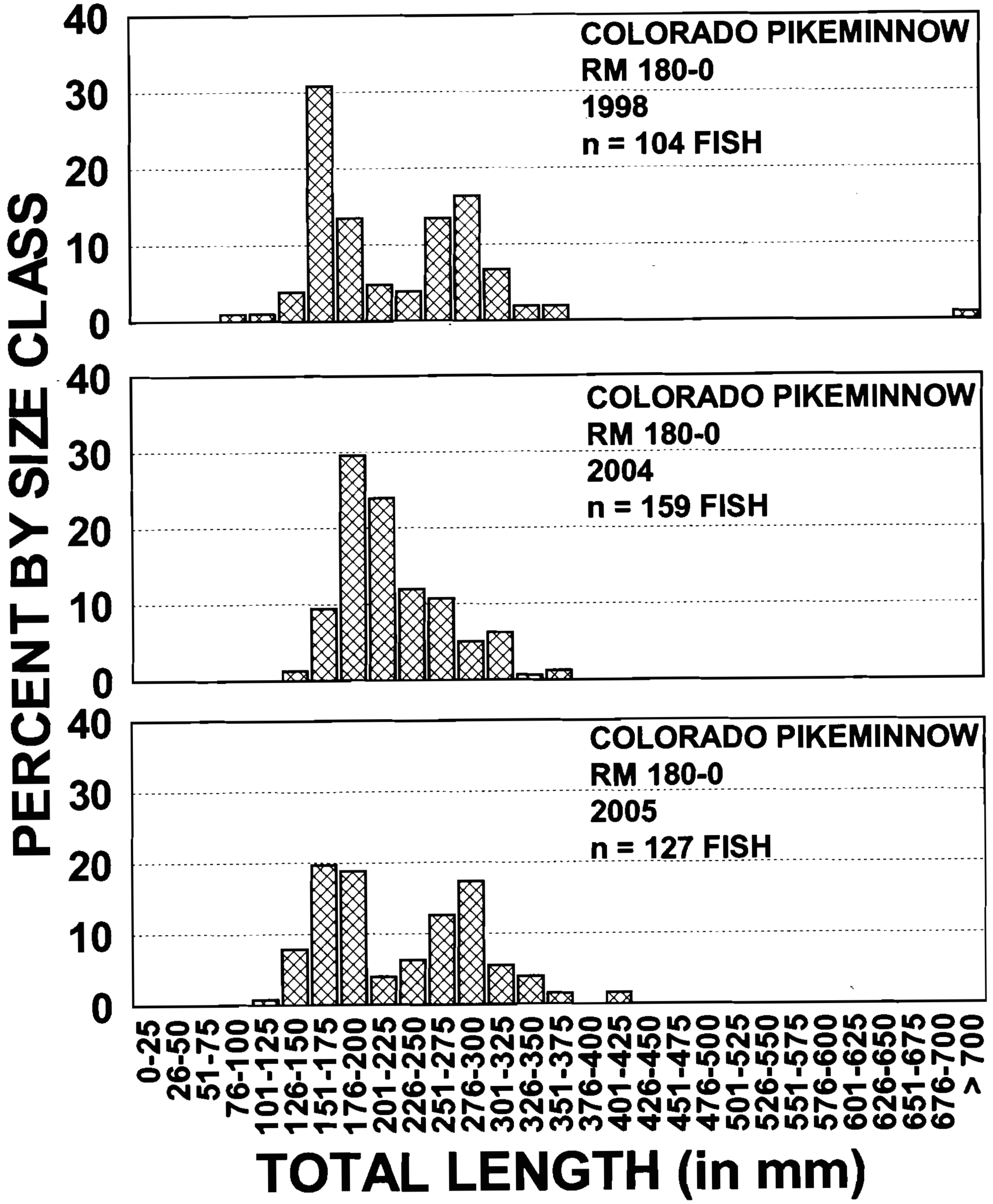

Figure 3. Length-frequency histograms for Colorado pikeminnow recaptured during the fall 1998, fall 2004, and fall 2005 Adult Monitoring trips. Large numbers of age-0 Colorado pikeminnow had been stocked in the fall for two or more consecutive years prior to each of these Adult Monitoring trips (i.e., 1996-1997, 2002-2003, and 2002-2004). These are the only three Adult Monitoring trips (Adult Monitoring trips began in 1991) during which > 100 Colorado pikeminnow were recaptured.

is likely due to the spring discharge regimes of those particular years. Both 1998 (peaked at 7,610 CFS on 4 June 1998 at Shiprock USGS gage 09368000) and 2005 (peaked at 13,200 CFS on 25 May 2005 at Shiprock USGS gage 09368000) had comparatively higher and later spring runoff flows than did 2004 (peaked at 4,760 CFS on 5 April 2004 at Shiprock USGS gage 09368000) which peaked at a much lower level and considerably earlier in the calendar year. The higher, later spring flows in 1998 and 2005 would act to suppress water temperatures later into the summer in both of those years, almost certainly causing the age-1 Colorado pikeminnow in the river at those times to grow more slowly. However, in 2004, flows stayed comparatively low and peaked very early, causing the river to achieve higher water temperatures earlier in the year, thus increasing the growing season for age-1 fish during 2004, which in turn led to larger age-1 fish being collected on the fall 2004 Adult Monitoring trip.

There now appear to be two relatively strong year-classes of Colorado pikeminnow in the San Juan River. The Colorado pikeminnow augmentation plan (Ryden 2003a) anticipates that repeatedly stocking large numbers of Colorado pikeminnow over a long enough period of time will help to establish a healthy, multiple year-class population. However, given the relatively low observed retention rates among some stockings (i.e., 2002), this may take numerous years to accomplish, or conversely, may not happen at all. Therefore, trying to understand and address the factors responsible for low long-term retention of stocked fish will be crucial in trying to shorten the duration of, and insure the success of, the Colorado pikeminnow augmentation effort.

Razorback Sucker

Fish Stocked As Part Of An Augmentation Effort

Between March 1994 and August 2005, a total of 12,843 razorback sucker were stocked into the San Juan River (Table 6). All of the 12,843 fish were individually-implanted with PIT tags before being released into the wild. That total includes 1,996 razorback that were stocked into the San Juan during four separate stocking efforts in 2005. This was the third largest number of razorback sucker stocked in any single year since augmentation efforts began for this species in 1994 (Table 6).

The first of the four harvest and stocking efforts occurred between 28 and 31 March 2005 (Table 6), when a total of 80 razorback sucker were harvested from 6-Pack ponds number 1 and 2 and stocked into the river just downstream of Hogback Diversion (RM 158.6). The mean TL of these fish was 319 mm (range = 240-402 mm TL).

The second harvest and stocking effort occurred between 16 and 19 May 2005 (Table 6), when a total of 554 razorback sucker were harvested from 6-Pack ponds number 3 and 4 and stocked into the river just downstream of Hogback Diversion (RM 158.6). The mean TL of these fish was 341 mm (range = 265-435 mm TL).

The third harvest and stocking effort occurred between 7 and 11 August 2005 (Table 6), when a total of 868 razorback sucker were harvested from 6-Pack ponds number 5 and 6 and stocked into the river just downstream of Hogback Diversion (RM 158.6). The mean TL of these fish was 370 mm (range = 233-463 mm TL).

The last harvest and stocking effort occurred between 29 August and 1 September 2005 (Table 6), when a total of 494 razorback sucker were harvested from East Avocet Pond and stocked into the river just down-stream of Hogback Diversion (RM 158.6). The mean TL was 351 mm (range = 223-534 mm TL).

Table 6. All known stockings (intentional or otherwise) of razorback sucker into either the San Juan River or the San Juan River arm of Lake Powell, 1994-2005.

Date(s) Stocked	River Miles Fish Were Stocked At	Number Of Fish Stocked	Mean Total Length (Range Of TL's)
Experimental Stocking Study, 1994-1996 (n = 942 Fish Stocked):			
29-30 March 1994	136.6-79.6	15	277 (251-316)
27 October 1994	136.6-79.6	16	403 (384-435)
16-17 November 1994	158.6-79.6	478	190 (100-374)
18 November 1994	158.6-79.6	179	400 (330-446)
27 September 1995	158.6	16	424 (397-482)
3 October 1996	158.6	238	335 (204-434)
Five-Year Augmentation Effort, 1997-2001 (n = 5,890 Fish Stocked):			
3 September 1997	158.6	1,028	193 (193-240)
17 September 1997	158.6	227	229
19 September 1997	158.6	1,628	185 (104-412)
22 April 1998	158.6	57	420 (380-460)
28 May 1998	158.6	67	417 (341-470)
14-15 October 1998	158.6	1,151	232 (185-315)
3 August 1999	170.8	Unknown[a]	Unknown[a]
17-20 October 2000	158.6	1,044	214 (111-523)
30 October to 1 November 2001	158.6	688	409 (288-560)
Interim Period Between "Official" Augmentation Efforts[b] In The San Juan River (n = 6,011 Fish Stocked):			
11 April 2002	178.2	13	137 (110-170)
22 April 2002	158.6	102	335 (240-470)
5-6 November 2002	158.6	25	351 (295-456)
14 April 2003	158.6	121	413 (341-491)
14-18 April 2003	158.6	70	380 (255-495)
19 May 2003	178.2	11	124 (100-150)
27-31 October 2003	158.6	685	309 (253-396)
12-16 April 2004	158.6	969	326 (280-480)
26 April 2004	158.6	310	366 (225-559)
12-16 July 2004	158.6	983	379 (295-540)
23-27 August 2004	158.6	726	350 (235-510)
28-31 March 2005	158.6	80	319 (240-402)
16-19 May 2005	158.6	554	341 (265-435)
7-11 August 2005	158.6	868	370 (233-463)
29 Aug.–1 Sept. 2005	158.6	494	351 (223-534)
Known Stockings Of Razorback Sucker By Other Agencies Into The San Juan River Arm Of Lake Powell, 1995 (n = 164 Fish Stocked):			
8 August 1995	Piute Farms	65	405 (348-428)
15 August 1995	Piute Farms	65	409 (369-437)
1 November 1995	Lake Powell	34	446 (419-495)

a This was an unintentional stocking that occurred when unseasonably heavy rains caused the dike at Ojo Pond to wash out. The entire pond drained into Ojo Wash, with some fish eventually reaching the San Juan River, several miles downstream.

b "Official" augmentation efforts are those that are guided by approved razorback sucker augmentation plans. The first of these took place from 1997-2001. The second (scheduled to be eight years in duration) will likely begin in 2006 or 2007.

For the first time in several years, there were no razorback sucker from sources other than the NAPI grow-out ponds stocked into the San Juan River in 2005. In past years, the SJRIP has received, on average, about a dozen razorback sucker that were reared as part of an information and education (I&E) outreach effort by the CDOW at Ignacio (CO) High School. Likewise, the SJRIP has regularly received several hundred razorback sucker that have been reared at golf course ponds near Page, AZ by the UDWR as part of an I&E outreach effort through Page High School. Neither of these sources had fish available to stock into the San Juan River in 2005.

2005 Collections

Three juvenile razorback sucker, suspected to be wild-spawned progeny of stocked razorback sucker, were collected in 2005 (J. Jackson pers. comm.). The first was collected at RM 14.2 on 19 May 2005 (TL = 174 mm), the second was collected at RM 22.5 on 16 June 2005 (TL = 180 mm), and the third was collected at RM 34.5 on 19 July 2005 (TL = 221 mm). All three of these suspected wild juveniles were collected during nonnative fish removal efforts being performed by UDWR (J. Jackson, pers. comm.). No suspected wild juveniles were collected during the fall 2005 Adult Monitoring trip. This is the third year during which wild-produced, post-larval razorback sucker were collected in the San Juan River. In addition, wild-produced, larval razorback sucker were collected for the eighth consecutive year (1998-2005) in 2005 (H. Brandenburg, pers. comm.).

A total of 52 razorback sucker were collected on the fall 2005 Adult Monitoring trip (Table 7). As was observed among Colorado pikeminnow in 2005, numbers of razorback sucker collected on the 2005 Adult Monitoring trip were down when compared to 2004 (n = 52 in 2005 versus 117 in 2004). However, the totals for 2005 were still more than twice as high as any other previous year (e.g., n = 19 fish on the fall 2003 Adult Monitoring trip). Like Colorado pikeminnow, the observed decline from 2004 to 2005 is likely related to the comparatively high spring discharge that occurred in 2005 (peaked at 13,200 CFS on 25 May 2005 at Shiprock USGS gage 09368000), an event that has not been duplicated or matched in the last several years. This high flow event likely caused some fish to either die or to be displaced downstream into Lake Powell.

The 52 razorback sucker collected on the fall 2005 Adult Monitoring trip ranged from RM 160.0-4.0 (Table 7). Razorback sucker recaptures from other 2005 studies ranged from as far upstream as the PNM Fish Ladder (RM 166.6; J. Davis, pers. comm., A. Lapahie pers. comm.) downstream to Lake Powell, just below the waterfalls (J. Jackson, pers. comm.).

Of the 52 recaptures with stocked razorback sucker, original stocking dates could be determined for 44. Of those 44 fish, three were originally stocked in 2000, six were stocked in 2001, one was stocked in 2003, 15 were stocked in 2004, and 19 were stocked in 2005. Among the other eight fish, the original PIT-tagging and/or stocking information could not be located. Among the 52 razorback sucker captures on the fall 2005 Adult Monitoring trip, 9 were known males (3 of which were ripe), 3 were known females (none of which were ripe), and 40 were of indeterminate sex.

As with Colorado pikeminnow, survival of stocked razorback sucker in the San Juan River may be adversely impacted by the presence of nonnative ictalurids, either through direct predation by larger channel catfish or by channel catfish aggression. Direct predation of channel catfish upon stocked razorback sucker was documented in 2004 (Jackson 2005). On 21 September 2005, a juvenile razorback sucker (380 mm TL) was collected between RM 123 and RM 122 with a channel catfish "bite mark" on its back, straddling the dorsal keel, immediately anterior to the dorsal fin (see picture in Appendix A).

Table 7. Razorback sucker collected from the San Juan River on the fall 2005 Adult Monitoring trip (n = 52).

SPECIES	DATE	PIT TAG (400 KHZ)	PIT TAG (134 KHZ)	TOTAL LENGTH (IN mm)	WEIGHT (IN g)	SEX	CAPTURE RIVER MILE
RAZORBACK SUCKER	09/19/2005	NONE	3D91BF1A02582	281	180	UNKNOWN	158
RAZORBACK SUCKER	09/19/2005	NONE	3D91BF1CD4AE5	324	300	UNKNOWN	158
RAZORBACK SUCKER	09/19/2005	NONE	3D91BF1A07333	383	450	UNKNOWN	158
RAZORBACK SUCKER	09/19/2005	447971431 1	3D91BF1A048B1	397	670	UNKNOWN	158
RAZORBACK SUCKER	09/19/2005	426A25314 7	3D91BF1D8C0EF	434	1000	UNKNOWN	158
RAZORBACK SUCKER	09/19/2005	NONE	3D91BF1CD4FD6	455	900	UNKNOWN	158
RAZORBACK SUCKER	09/19/2005	53241E2D0 F	3D91BF1D7042A	494	1220	UNKNOWN	158
RAZORBACK SUCKER	09/19/2005	424231296 6	3D91BF19EC029	502	1148	UNKNOWN	158
RAZORBACK SUCKER	09/19/2005	NONE	3D91BF1E931A9	540	710	MALE	157
RAZORBACK SUCKER	09/19/2005	NONE	3D91BF1CD2E15	466	1020	UNKNOWN	157
RAZORBACK SUCKER	09/19/2005	NONE	3D91BF1D85B49	414	600	MALE	154
RAZORBACK SUCKER	09/19/2005	NONE	3D91BF1A03AE4	405	570	UNKNOWN	154
RAZORBACK SUCKER	09/19/2005	NONE	3D91BF1D8BF05	417	640	UNKNOWN	154
RAZORBACK SUCKER	09/19/2005	44796D5F0 4	3D91BF18CE87B	444	785	UNKNOWN	151
RAZORBACK SUCKER	09/19/2005	NONE	3D91BF1A0819C	361	335	UNKNOWN	149
RAZORBACK SUCKER	09/19/2005	NONE	3D91BF18D6E8C	442	660	UNKNOWN	149
RAZORBACK SUCKER	09/19/2005	NONE	3D91BF1CD4118	383	495	UNKNOWN	148.2
RAZORBACK SUCKER	09/20/2005	44147C6B0 3	3D91BF18D630E	440	670	MALE	145
RAZORBACK SUCKER	09/20/2005	NONE	3D91BF1CD5F66	363	560	UNKNOWN	145
RAZORBACK SUCKER	09/20/2005	423D167B7 4	3D91BF19ED228	445	990	MALE	142
RAZORBACK SUCKER	09/20/2005	447353736 1	3D91BF18D64FD	439	670	UNKNOWN	142
RAZORBACK SUCKER	09/20/2005	NONE	3D91BF1A03B5A	440	835	UNKNOWN	142
RAZORBACK SUCKER	09/20/2005	NONE	3D91BF1A03B32	465	760	UNKNOWN	142
RAZORBACK SUCKER	09/20/2005	NONE	3D91BF1A0BAB1	357	245	UNKNOWN	140
RAZORBACK SUCKER	09/20/2005	NONE	3D91BF1CD2A33	386	630	MALE	140
RAZORBACK SUCKER	09/20/2005	4364454A2 5	3D91BF1D4F3D5	432	915	UNKNOWN	140
RAZORBACK SUCKER	09/20/2005	441D48157 6	3D91BF1D6D62D	443	890	UNKNOWN	140
RAZORBACK SUCKER	09/20/2005	NONE	3D91BF18D7CEF	450	810	UNKNOWN	140
RAZORBACK SUCKER	09/20/2005	532406574 2	3D91BF18D7A6E	510	1430	UNKNOWN	140
RAZORBACK SUCKER	09/20/2005	447D0A1A1 1	3D91BF1D6DF72	462	960	UNKNOWN	139
RAZORBACK SUCKER	09/20/2005	45066A797 F	3D91BF1D70C7D	420	635	UNKNOWN	134
RAZORBACK SUCKER	09/20/2005	426865646 F	3D91BF1D6DA5F	483	950	FEMALE	134

Table 7. Continued.

SPECIES	DATE	PIT TAG (400 KHZ)	PIT TAG (134 KHZ)	TOTAL LENGTH (IN mm)	WEIGHT (IN g)	SEX	CAPTURE RIVER MILE
RAZORBACK SUCKER	09/21/2005	NONE	3D91BF1A640A6	385	560	UNKNOWN	131
RAZORBACK SUCKER	09/21/2005	423F0E4303	3D91BF18CD4F1	414	590	UNKNOWN	124
RAZORBACK SUCKER	09/21/2005	436439640F	3D91BF18CFBD5	380	420	UNKNOWN	122
RAZORBACK SUCKER	09/21/2005	42421B7D5C	3D91BF18D7E5D	455	870	UNKNOWN	122
RAZORBACK SUCKER	09/21/2005	425C0B1D4D	3D91BF18D6441	415	630	UNKNOWN	119.2
RAZORBACK SUCKER	09/21/2005	531C373312	3D91BF18D6B63	443	860	UNKNOWN	119.2
RAZORBACK SUCKER	09/23/2005	423F5D406A	3D91BF18B9AD1	471	1100	FEMALE	160
RAZORBACK SUCKER	10/03/2005	4240055F4C	3D91BF1CD6EB2	448	725	MALE	109
RAZORBACK SUCKER	10/04/2005	NONE	3D91BF1A02902	388	480	UNKNOWN	107
RAZORBACK SUCKER	10/04/2005	NONE	3D91BF1D87E52	425	670	UNKNOWN	107
RAZORBACK SUCKER	10/04/2005	NONE	3D91BF1D87234	528	1300	FEMALE	106
RAZORBACK SUCKER	10/04/2005	45095B0F7F	3D91BF1A0952F	415	680	MALE	106
RAZORBACK SUCKER	10/04/2005	NONE	3D91BF1E92EB0	397	560	UNKNOWN	106
RAZORBACK SUCKER	10/04/2005	NONE	3D91BF1CD5C03	426	810	MALE	103
RAZORBACK SUCKER	10/08/2005	NONE	3D91BF1AF8B68	375	390	MALE	58
RAZORBACK SUCKER	10/08/2005	52290F1213	3D91BF18D7F9D	408	600	UNKNOWN	58
RAZORBACK SUCKER	10/08/2005	426A3F6C63	3D91BF18D7C14	426	650	UNKNOWN	58
RAZORBACK SUCKER	10/08/2005	4479736824	3D91BF18CF360	490	775	UNKNOWN	58
RAZORBACK SUCKER	10/12/2005	4268541713	3D91BF1CD735D	406	610	UNKNOWN	5
RAZORBACK SUCKER	10/12/2005	NONE	3D91BF1CD6D7C	370	460	UNKNOWN	4

Later in the trip, on 12 October 2005, an adult razorback sucker (406 mm TL) was collected between RM 6 and RM 5 with a "big" channel catfish bite mark on its back, also straddling the dorsal keel. Unfortunately, no pictures were taken of this specimen. These same types of channel catfish bite marks have been observed on the dorsal regions of Colorado pikeminnow, flannelmouth sucker, and bluehead sucker over the past several years in the San Juan River (Ryden 2005a, pers. obs.).

Population Trends

In contrast to the marked increases in total CPUE observed for stocked Colorado pikeminnow in 1997 and 1998 (Figure 2), total CPUE for stocked razorback sucker remained fairly low, but steady between 1996 and 2000 (Figure 4). Then, between 2000 and 2002, razorback sucker total CPUE increased slightly on fall Adult Monitoring trips. Between the fall 2002 and fall 2003 Adult Monitoring trips, razorback sucker CPUE showed a slight decline (Figure 4). This decline may have been linked to a large volume (but short duration), storm-induced flow spike that occurred in September 2003, just prior to the fall 2003 Adult Monitoring trip. On the fall 2004 Adult Monitoring trip, total CPUE for razorback sucker (1.44 fish/hr of electrofishing) was considerably higher than it had been in any previous year (Figure 4). Total CPUE for razorback sucker on the fall 2004 Adult Monitoring trip was 1.44 fish/hr of electrofishing from RM 180.0-2.9. This value was over five times higher than any previously observed value on an Adult Monitoring trip. This upswing in CPUE was almost equally split between collections of juvenile and adult fish (Figure 4). This large upward trend in razorback sucker total CPUE was immediately preceded by and was almost certainly a direct result of the most successful stocking year (n = 2,988 fish stocked) since razorback sucker augmentation began in 1994 (Table 4).

Between the fall 2004 and fall 2005 Adult Monitoring trips, razorback sucker total CPUE dropped from 1.44 fish/hr (n = 117 fish) to 0.62 fish/hr (n = 52 fish) of electrofishing (Figure 4). This drop in razorback sucker total CPUE from 2004 to 2005 was very reminiscent of the drop observed in Colorado pikeminnow total CPUE (discussed earlier) and is very likely also associated with the relatively high spring flows (peaked at 13,200 CFS on 25 May 2005 at Shiprock USGS gage 09368000) in 2005. The decline in CPUE between 2004 and 2005 seems to have been more prominent among stocked sub-adult fish (< 400 mm TL) than it was among stocked adult fish (Figure 4). However, even with the drop in total CPUE between 2004 and 2005, the fall 2005 total CPUE value was the second highest ever observed and over twice as high as any previous year, with the exception of 2004 (Figure 4).

In order to examine post-stocking retention among stocked razorback sucker, recaptures from not only our studies but from cooperating agencies as well were examined to determine the length of time recaptured fish had been in the river since stocking. Examination of 167 separate recapture events showed that in 2005 the large majority (n = 65; 98.8%) of razorback sucker being collected had been in the river less than five years (i.e., ≤ 1800 days; Figure 5). Further, 133 (79.6%) of the 167 recapture events occurred with fish that had been in the river less than two years (i.e., ≤ 600 days; Figure 5). Only two fish (1.2%) out of the 167 recapture events examined had been in the river longer than five years (Figure 5). This trend among recaptured razorback sucker can be at least partially explained by the fact that over the last two years (2004-2005) 4,984 razorback sucker have been stocked -- 38.8% of all fish stocked since 1994 (Table 6). Likewise, over the last five years (2001-2005) 6,699 razorback sucker have been stocked – 52.2% of all fish stocked since 1994 (Table 6). The fact that some razorback sucker that have been in the river as long as nine years post-stocking are still being recaptured is encouraging. In light of this information, it appears that the increases in razorback sucker total CPUE observed in 2004 and 2005 (Figure 4) are based almost completely on recently-stocked fish (Figure 5).

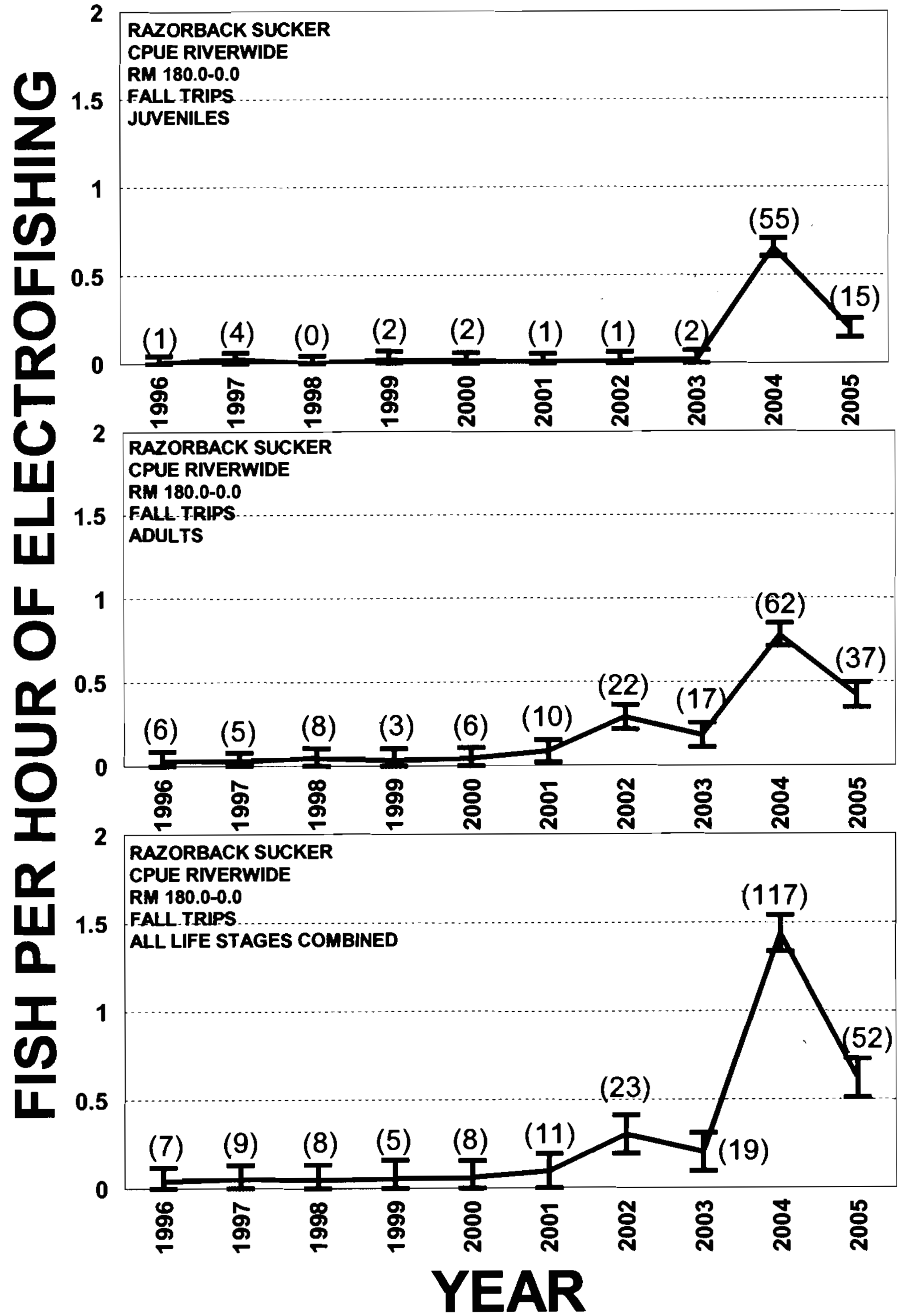

Figure 4. Razorback sucker catch per unit effort (CPUE) riverwide (RM 180.0-0.0) on fall Adult Monitoring trips, for juvenile fish (< 400 mm TL; top), adult fish (≥ 400 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Parenthetic numbers above or beside the error bars indicate the sample size.

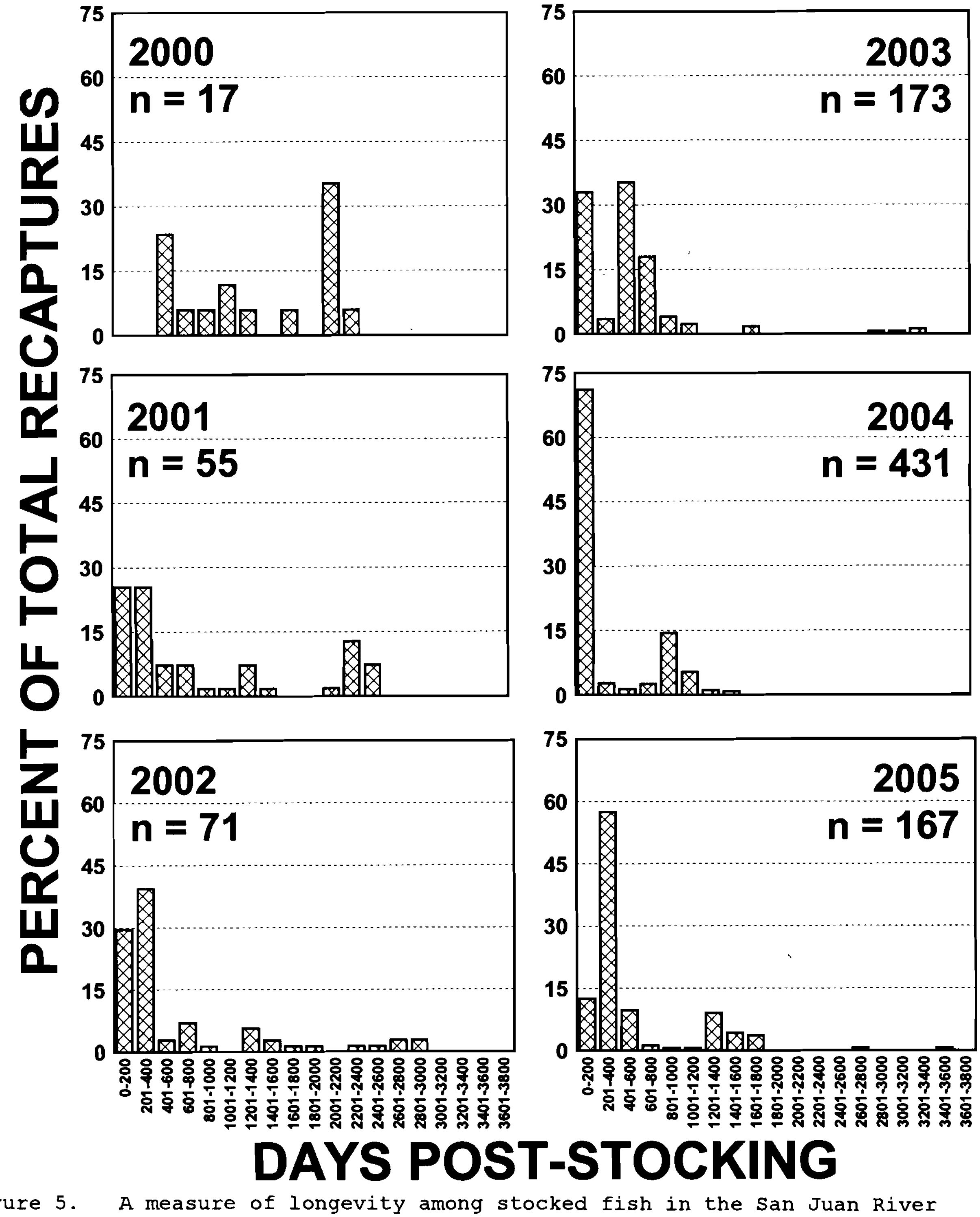

Figure 5. A measure of longevity among stocked fish in the San Juan River razorback sucker population, expressed as the number of days in the river since stocking versus the percent of total recaptures represented by recaptured fish, 2000-2005. Some recaptures could not be used in this analysis due to lack of a detectable PIT tag at the time of recapture. The 'n =' number indicates the total number of recapture events examined for that year and includes recapture events from several different studies.

Spawning Aggregations

No known spawning aggregations of adult razorback sucker were identified in 2005. However, despite the lack of identified aggregations of spawning adults, larval razorback sucker were collected again in 2005, for the eighth consecutive year (1998-2005; H. Brandenburg, pers. comm.).

Roundtail Chub

2005 Collections

No roundtail chub were collected on the fall 2005 Adult Monitoring trip.

Population Trends

Roundtail chub, a state-listed endangered species in both New Mexico and Utah, continue to be the most rarely-collected of the three rare fish species in the San Juan River. Collections of roundtail chub in the San Juan River, when they do occur, tend to be concentrated mostly in areas downstream of the LaPlata and Mancos river confluences (Ryden 2004). These two small rivers, along with the Animas River, are the only three tributaries of the San Juan River that are known to have resident populations of roundtail chub (Miller and Rees 2000). The large majority of the roundtail chub collections between 1987 and 2003 consisted of subadult fish (Ryden 2004).

Between 1991 and 2003, a total of 25 roundtail chub (TL range = 116-414 mm) were implanted with PIT tags (SJRIP Integrated Database). Of these 25, only three individuals were recaptured a second time after their initial capture and release (Ryden 2004).

The dearth of adult roundtail chub in the San Juan River, combined with a lack of recaptures among PIT-tagged fish over time, and the fact that most roundtail chub captures in the mainstem San Juan River occur downstream of major tributaries known to have resident populations of roundtail chub, would seem to suggest that the roundtail chub being collected in the mainstem San Juan are only transient members of the mainstem river's fish community. It seems very plausible that roundtail chub collected in the mainstem San Juan River get flushed out of tributaries during high flow events and either perish or move up- or downstream out of the mainstem river fairly quickly after entering it.

Common Native Fishes

Flannelmouth Sucker

Catch Per Unit Effort (CPUE)

Flannelmouth sucker continue to be the most common large-bodied fish collected riverwide during Adult Monitoring trips (Table 3, Figure 6; Ryden 2000, 2001, 2003b, 2004, 2005). While numbers for this species have

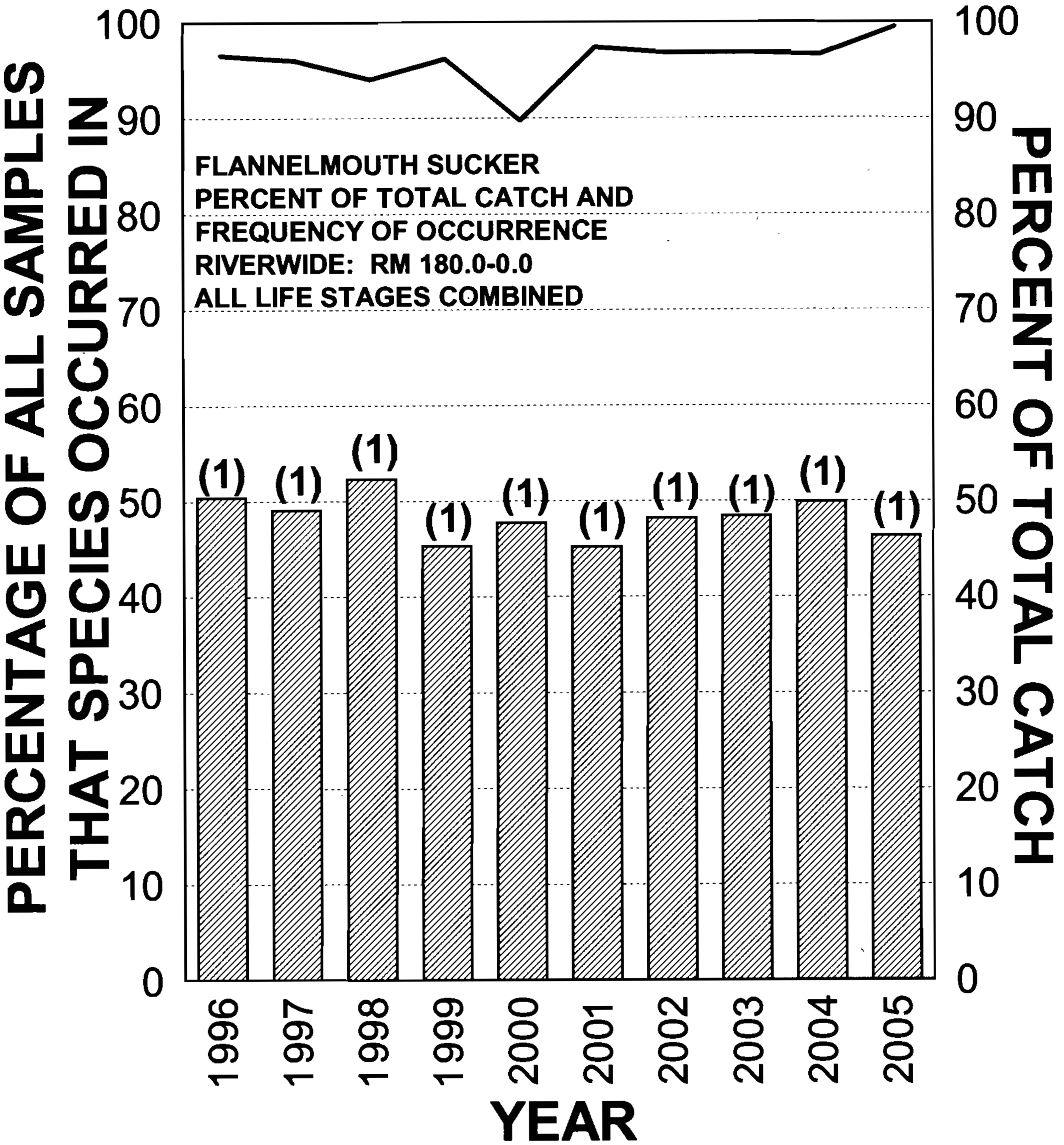

Figure 6. A summary of flannelmouth sucker relative abundance in riverwide Adult Monitoring collections, 1996-2005. The solid black line represents the percentage of all electrofishing samples on a given Adult Monitoring trip in which this species occurred (i.e., frequency of occurrence). The shaded bars represent the percent of the total catch that this species composed in a given year. The parenthetic numbers indicate the numeric rank for this species in a given year relative to all other fish species collected.

fluctuated both riverwide and in individual geomorphic reaches over the years, flannelmouth sucker have remained numerically dominant in both overall numbers of specimens collected and in frequency of occurrence in electrofishing samples (Table 3, Figure 6; Ryden 2000, 2001, 2003b, 2004, 2005).

Riverwide (RM 180.0-0.0) CPUE for juvenile flannelmouth sucker almost doubled between 2003 and 2005 (Figure 7). Riverwide CPUE for juvenile flannelmouth sucker was 43.78 fish/hr in 2005. This was the highest observed riverwide CPUE among juvenile flannelmouth sucker in the last ten years (Figure 7). The long-term trend line for juvenile flannelmouth sucker riverwide CPUE over the last nine years showed a slight upward (but not statistivcally significant) trend, indicating that despite year-to-year fluctuations, this portion of the flannelmouth sucker population has remained relatively stable over that ten-year period. Riverwide CPUE for adult flannelmouth sucker was almost identical in 2004 and 2005 (Figure 7). The long-term trend line for riverwide CPUE among adult flannelmouth sucker remained essentially flat over the last ten years (Figure 7). As among juvenile flannelmouth sucker CPUE riverwide, the long-term trend line for flannelmouth sucker total CPUE riverwide showed a slightly upward (but not statistically significant) trend over the last ten-year period (Figure 7). So, it would appear that riverwide the flannelmouth sucker population has remained relatively stable for the period 1996-2005.

Flannelmouth sucker total CPUE increased in five of six geomorphic Reaches from 2004-2005 (Figures 8-10), with Reach 3 being the exception. However, none of the increases between 2004 and 2005 was significant. Finding meaningful trends in CPUE among flannelmouth sucker becomes difficult when data are partitioned at the geomorphic reach level. However, two general pieces of information are evident. First, flannelmouth sucker are most abundant in Reach 6 (followed closely by adjacent Reach 5) and CPUE values generally drop in each subsequent downstream reach until, in Reach 1, very few flannelmouth sucker are collected (Figures 8-10). Second, flannelmouth sucker CPUE values from reaches that were sampled in their entirety from 1991-2004 (i.e., Reaches 5, 4, and 3) would seem to indicate that riverwide CPUE values for this species were apparently higher in the early 1990’s (i.e., 1991-1993) than they have been over the last 11-year period (1994-2004; Figures 8-10). The lack of early 1990’s data in Reaches 6, 2, and 1 likely is giving us a somewhat skewed interpretation of the longer-term (1991-2004) trends among the San Juan River flannelmouth sucker population. While it is evident that overall numbers of fish in the San Juan River flannelmouth sucker population have been relatively stable riverwide since 1996 (Figure 7), it also appears that this population is stable at a lower overall population size than what was present in the early 1990’s (1991-1993; Figures 8-10).

Length Frequency And Mean Total Length

Riverwide length-frequency histograms show that the two distinct year-classes of young flannelmouth sucker that were present in the fall 2004 Adult Monitoring collections have continued to grow and recruit towards adulthood (Figure 12). One group (age-1 fish; 2004 year-class) is now centered around 151-175 mm TL (Figure 12). The second group (age-2 fish; 2003 year-class) is centered around 226-275 mm TL (Figure 12). In addition, a group of larger sub-adult flannelmouth sucker, centered around 376-400 mm TL, appear to on the brink of entering the adult population (Figure 12). During 2005 Adult Monitoring collections, very few age-0 flannelmouth sucker (≤ 125 mm TL) were collected (Figure 12). In 1999, the San Juan River flannelmouth sucker population was heavily dominated by adult fish with a relatively low percentage of younger fish (< 350 mm TL) being collected (Figure 11).

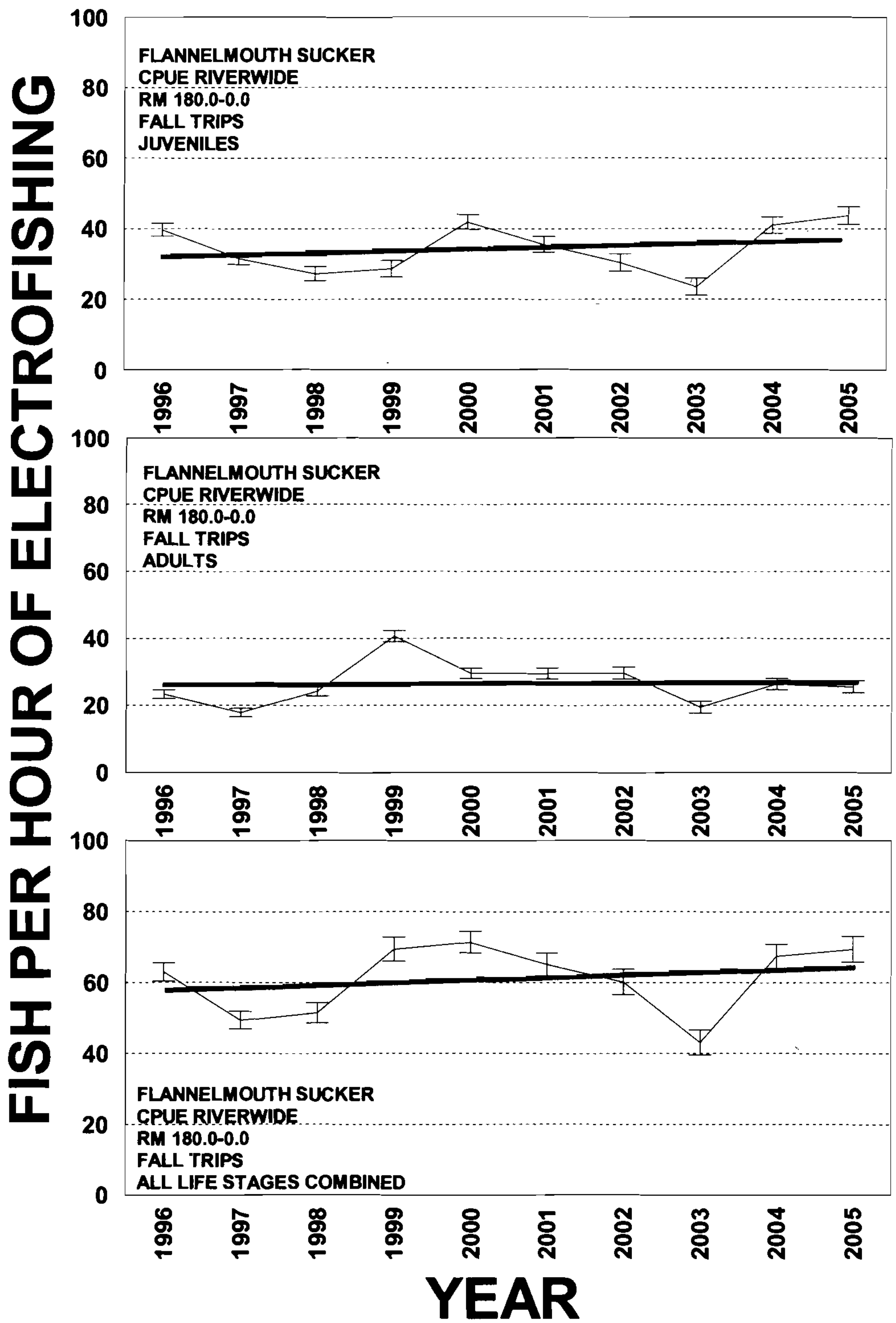

Figure 7. Flannelmouth sucker catch per unit effort (CPUE) riverwide (RM 180.0-0.0) on fall Adult Monitoring trips, for juvenile fish (< 410 mm TL; top), adult fish (≥ 410 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

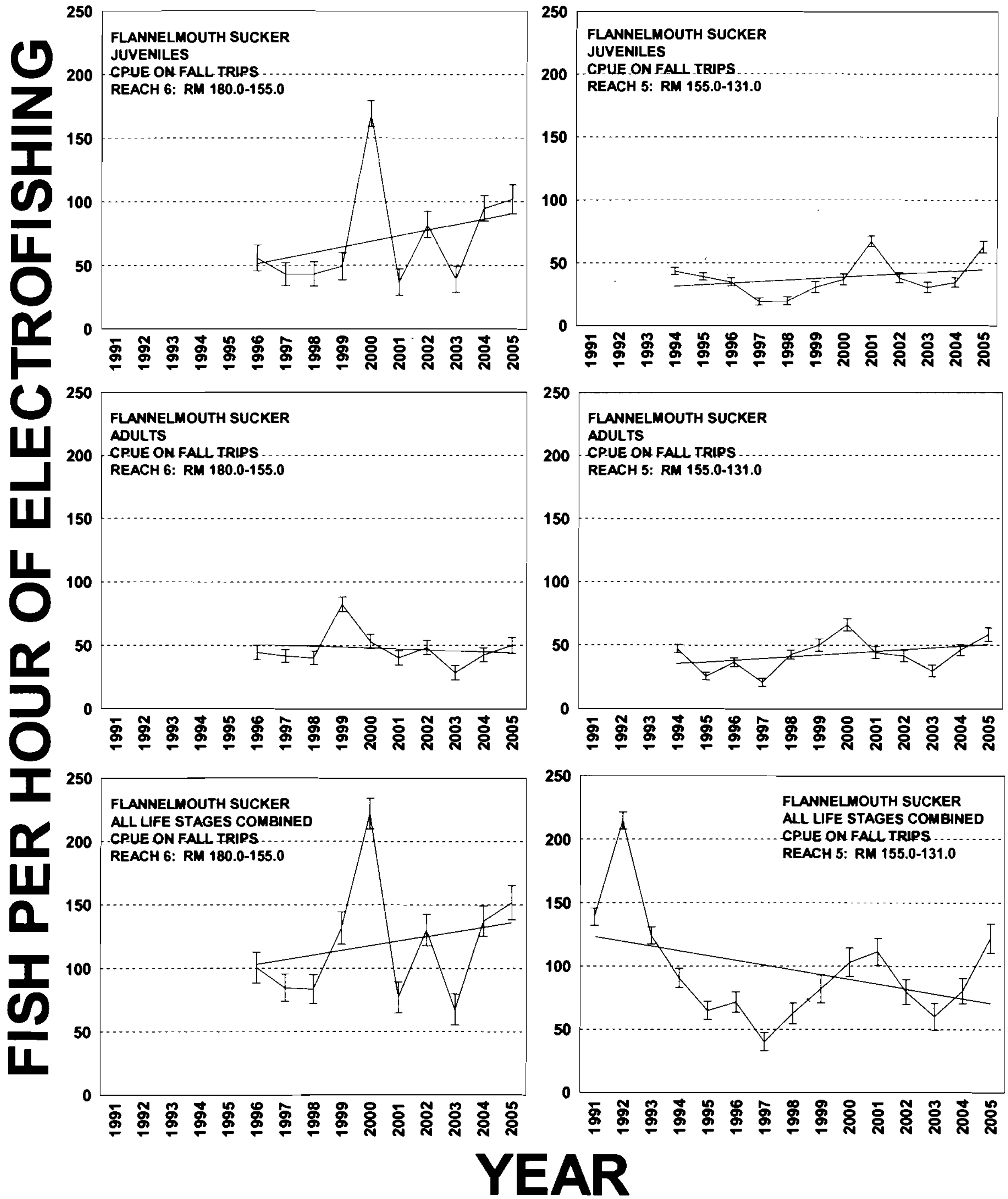

Figure 8. Flannelmouth sucker catch per unit effort (CPUE) in Reach 6 and Reach 5 on fall Adult Monitoring trips for juvenile fish (< 410 mm TL; top), adult fish ($\geq$ 410 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

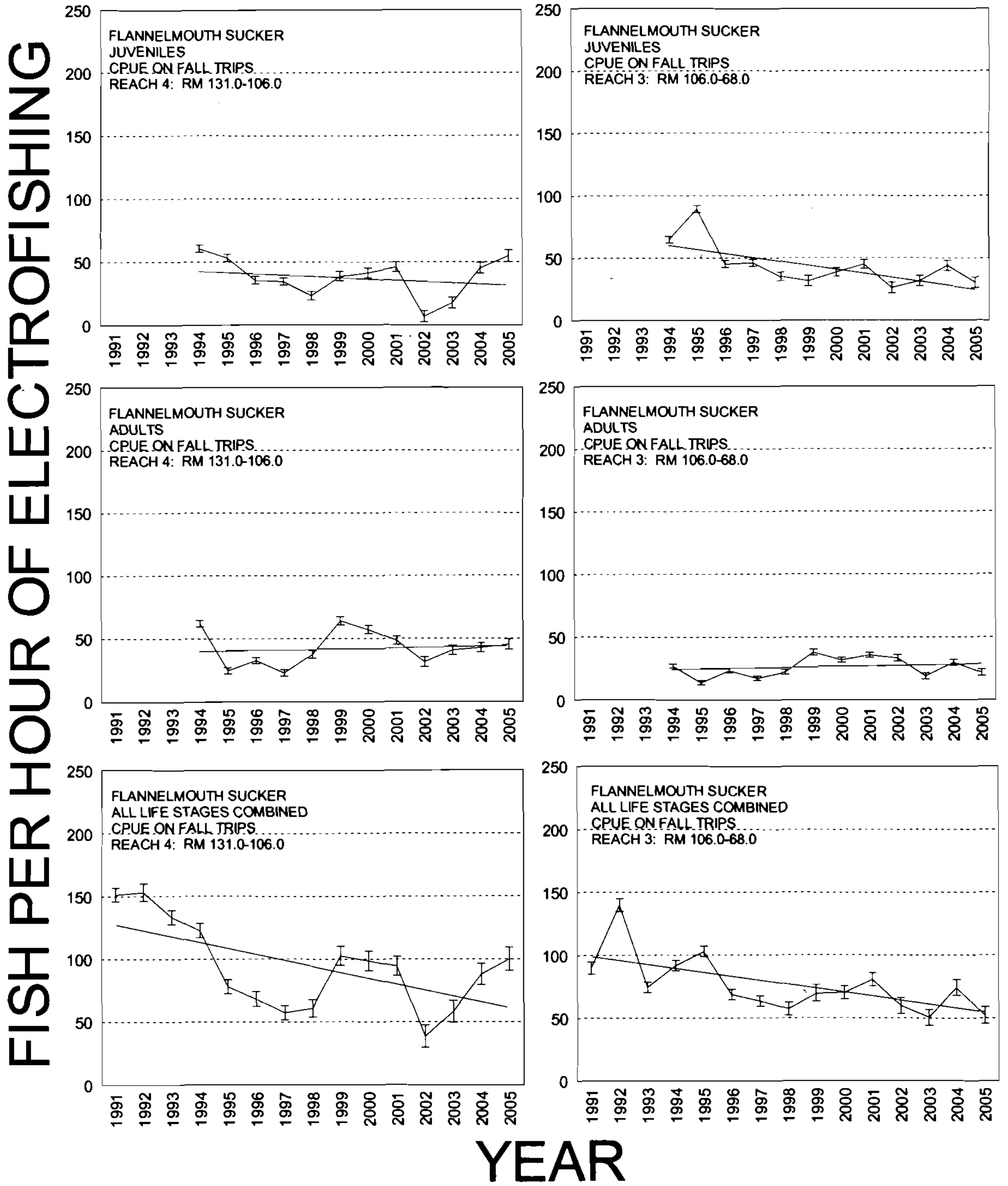

Figure 9. Flannelmouth sucker catch per unit effort (CPUE) in Reach 4 and Reach 3 on fall Adult Monitoring trips for juvenile fish (< 410 mm TL; top), adult fish (≥ 410 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

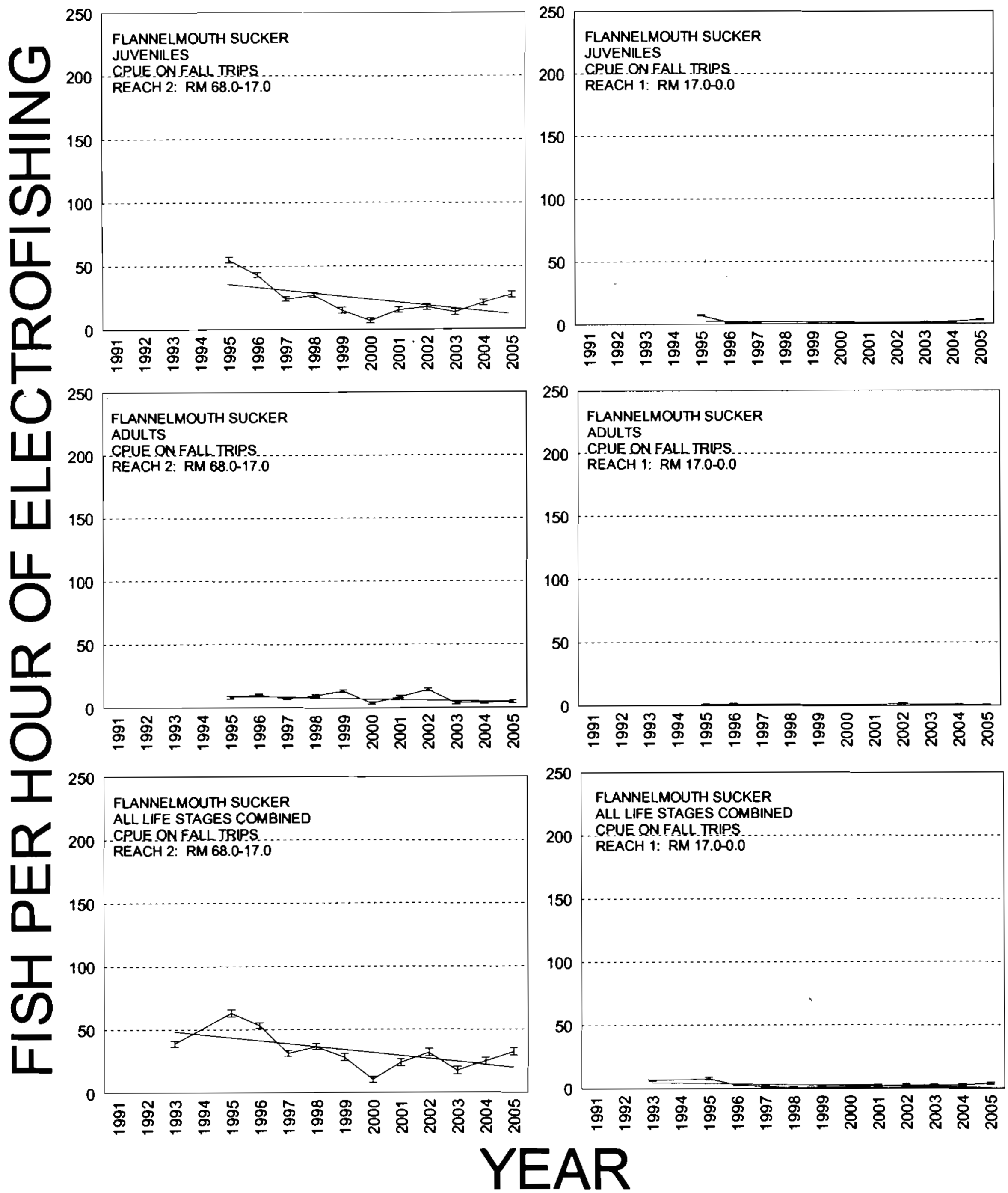

Figure 10. Flannelmouth sucker catch per unit effort (CPUE) in Reach 2 and Reach 1 on fall Adult Monitoring trips for juvenile fish (< 410 mm TL; top), adult fish (≥ 410 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

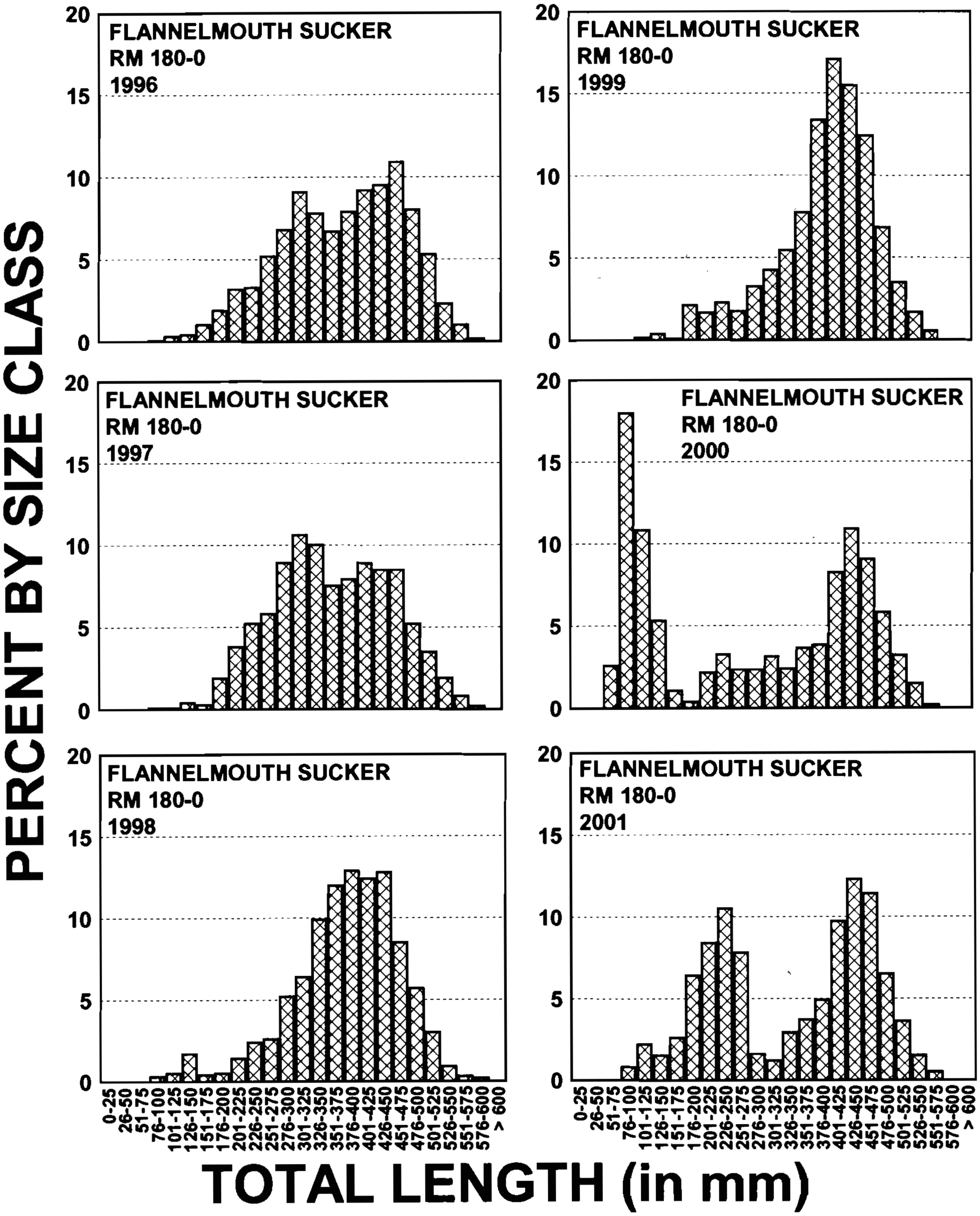

Figure 11. Length-frequency histograms showing the riverwide (RM 180.0-0.0) size-class distribution of flannelmouth sucker on fall Adult Monitoring trips in the San Juan River, 1996-2001.

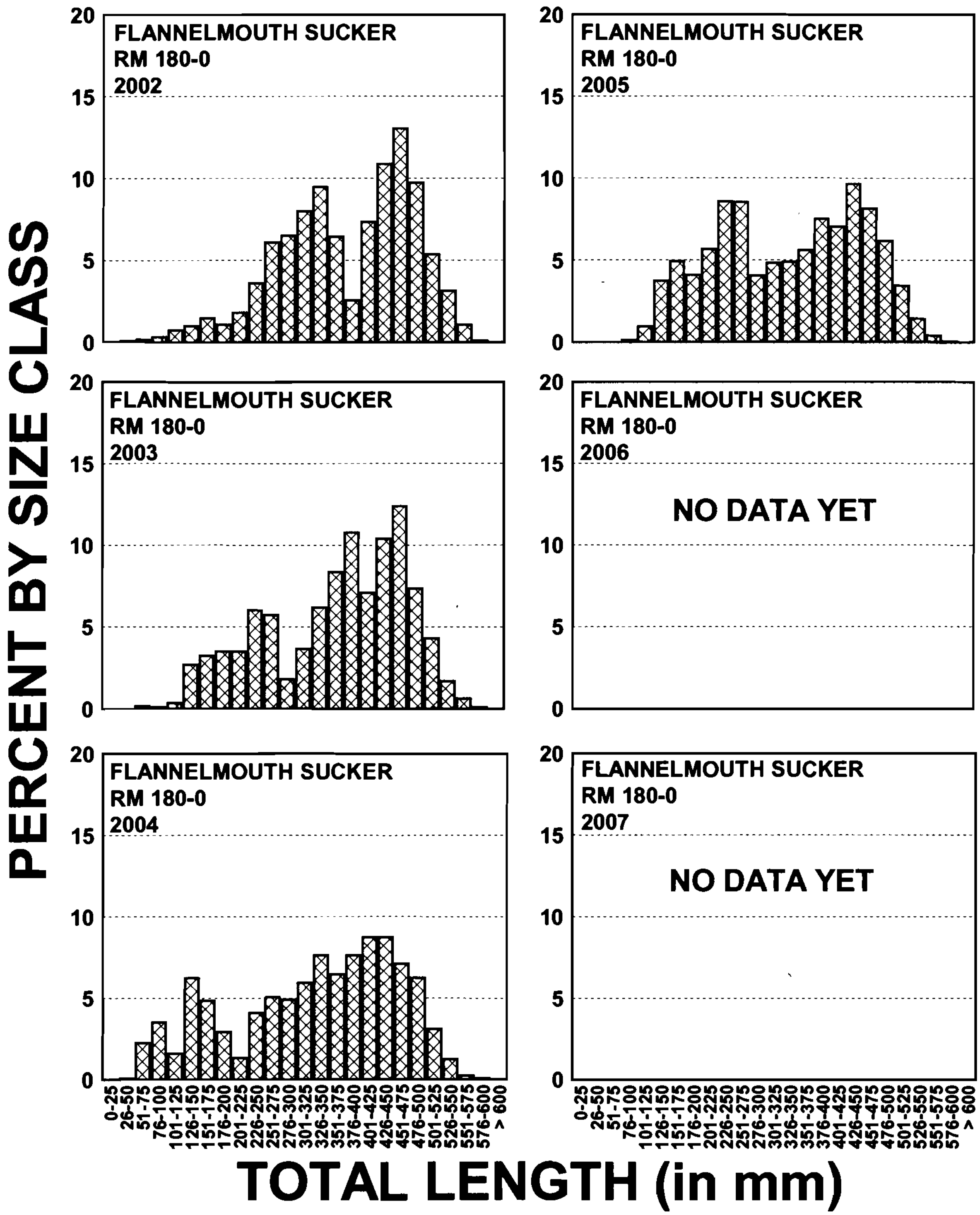

Figure 12. Length-frequency histograms showing the riverwide (RM 180.0-0.0) size-class distribution of flannelmouth sucker on fall Adult Monitoring trips in the San Juan River, 2002-2005.

However, since 1999, there have been three observable pulses of young fish into the San Juan River flannelmouth sucker population (in 2000, 2003, and 2004; Figures 11 and 12).

As was evidenced by the length-frequency histograms, flannelmouth sucker mean TL values riverwide (for all life stages combined) increased markedly between 1997 and 1999 (Figures 11 and 13). Mean TL for flannelmouth sucker then dropped markedly riverwide in 2000 due to the large influx of age-0 juveniles (Figures 11 and 13). The increase in mean TL of flannelmouth sucker riverwide between 2000 and 2002 (Figure 13), tracks right along with the 2000 year-class attaining larger sizes and beginning to recruit (Figures 11-13). Then, between 2002 and 2004, mean TL of flannelmouth sucker riverwide dropped markedly again as new cohorts of young fish entered the population (Figures 11-13). In 2005, mean TL rose again slightly as very few age-0 fish were collected and the young fish collected in previous years grew into larger juveniles (Figure 13).

Biomass

Flannelmouth sucker mean biomass (weight in grams) riverwide tracks almost identically with riverwide mean total length (Figures 13 and 14). In years when influxes of smaller size-class flannelmouth sucker cause a decline in the mean riverwide total length (e.g., in 2000, 2003, and 2004), the mean biomass also declines (Figure 14). However, while mean TL of flannelmouth sucker rose slightly between 2004 and 2005, mean TL stayed essentially identical. While the long-term trend in flannelmouth sucker mean total length over the last nine years shows a noticeable declining trend, the long-term trend in flannelmouth sucker mean biomass is essentially flat over that same time period (Figures 13 and 14).

Total biomass of flannelmouth sucker collected on the fall 2005 Adult Monitoring trip was 32.77 kg per hour of electrofishing (Figure 14). This is an intermediate value, compared to other recent years. Total biomass of flannelmouth sucker collected has normally been in the range of 20.00-40.00 kg per hour of electrofishing on fall Adult Monitoring trips over the last ten years (Figure 14).

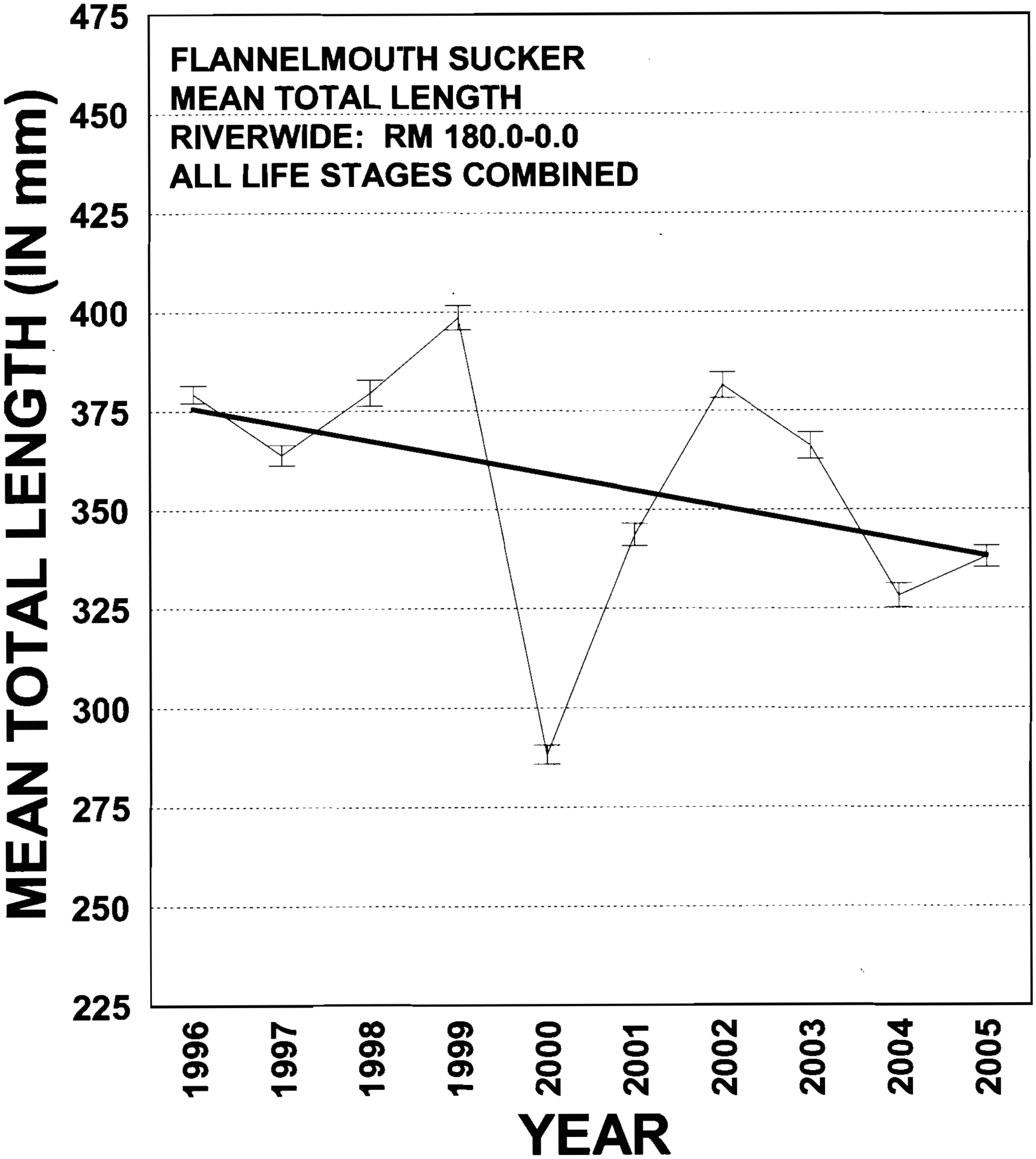

Figure 13. Mean total length (in mm) of flannelmouth sucker riverwide (RM 180.0-0.0) on fall Adult Monitoring trips in the San Juan River. Error bars represent one standard error. The sloping horizontal line represents the long-term trend in mean total length.

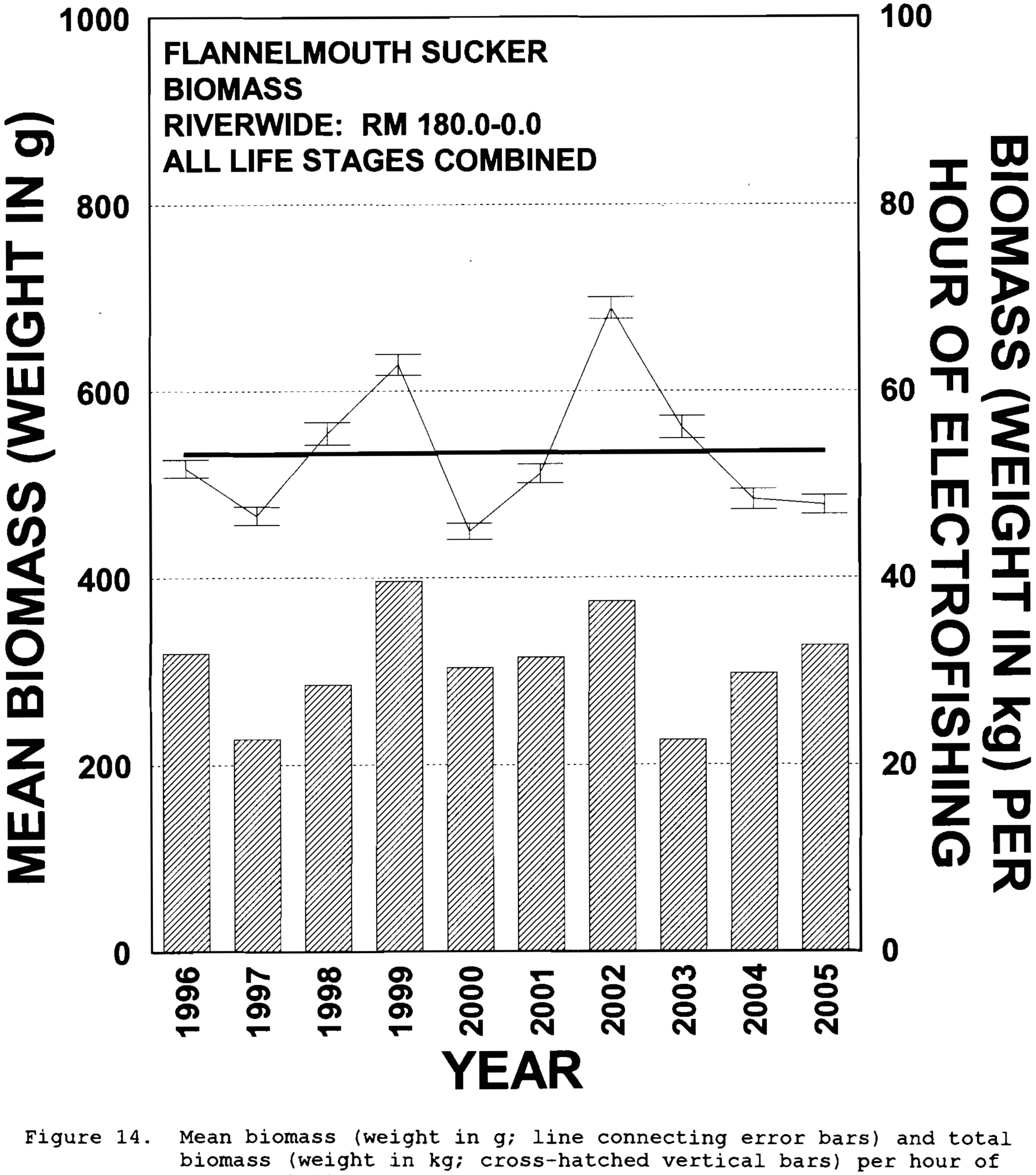

Figure 14. Mean biomass (weight in g; line connecting error bars) and total biomass (weight in kg; cross-hatched vertical bars) per hour of electrofishing of flannelmouth sucker riverwide (RM 180.0-0.0) on fall Adult Monitoring trips in the San Juan River. Error bars represent one standard error. The sloping horizontal line represents the long-term trend in mean biomass.

Bluehead Sucker

Catch Per Unit Effort (CPUE)

Since 1997, bluehead sucker have been among the four most commonly-collected large-bodied fish species during the Adult Monitoring collections (Table 3, Figure 15). In the last four years (2002-2005) bluehead sucker have been the second most commonly-collected fish species overall during fall Adult Monitoring collections (Table 3, Figure 15). Prior to 2002, bluehead sucker never accounted for more than 20% of the total catch on riverwide Adult Monitoring trips over the last ten years (1996-2004; Figure 15). However, they have surpassed this mark (25.3% in 2002, 22.1% in 2003, and 23.2% in 2005) in three of the last four years (Figure 15). Likewise, bluehead sucker have become more widely distributed throughout the San Juan River since 2002 (Figure 15), occurring in > 80% of all electrofishing samples riverwide in each of the last five consecutive years (2001-2005).

Long-term trends in juvenile, adult, and total CPUE values for bluehead sucker riverwide all showed increasing trends between 1996 and 2005 (Figure 16). However, the only statistically significant changes between 1996 and 2005 bluehead sucker riverwide CPUE values occurred among juvenile and total CPUE ($p < 0.000$ in both cases; Figure 16). In 2005, both juvenile and total CPUE for bluehead sucker riverwide were the highest ever observed (24.5 and 35.3 fish/hr of electrofishing, respectively; Figure 16). The increasing long-term trend in juvenile and total CPUE among bluehead sucker that has been observed over the last ten years (1996-2005) is mainly being driven by increasing CPUE trends among juvenile bluehead sucker in Reach 6 (Figures 16-19).

The San Juan River bluehead sucker population, within our study area, is largely centered in Reach 6 (Figure 17-19). In Reach 6, bluehead sucker are very often the most common large-bodied fish species collected. Total CPUE for bluehead sucker in Reach 6 is very unpredictable, demonstrating large up- and downswings between years in both juvenile and adult CPUE. It is very possible that numbers of bluehead sucker in Reach 6 are heavily affected on an annual basis by either immigration of fish from or emigration of fish to upstream river reaches and/or the Animas River. Collections of bluehead sucker are over twice as common (and in many years much higher than that) in Reach 6 as in adjacent Reach 5 downstream and this differential increases versus other river reaches even further downstream (Figures 17-19). Even more so than flannelmouth sucker, bluehead sucker CPUE declines noticeably in each contiguous downstream river reach, with the exception of Reach 2 (Figures 17-19).

In 2005, juvenile CPUE for bluehead sucker increased noticeably in Reaches 6, 5, 4, and 2 (Figures 17-19). Adult bluehead sucker CPUE also increased between 2004 and 2005 in Reaches 5 and 4 (Figures 17 and 18). In Reaches 5, 4, and 2 bluehead sucker total CPUE were at the highest levels ever observed in 2005 (Figures 17-19). In fact, bluehead sucker total CPUE has been increasing in Reach 2 over the last several years and bluehead sucker are now actually more abundant in most years in Reach 2 than they are in adjacent upstream Reach 3 (Figures 18 and 19). No bluehead sucker were collected in Reach 1, adjacent to Lake Powell, in 2005 (Figure 19). Reach 1 has been devoid of bluehead sucker collections in all but two years that Reach 1 has been sampled during Adult Monitoring trips (n = 1 adult fish and 1 juvenile fish collected in Reach 1 in 2003; n = 2 juvenile fish collected in Reach 1 in 2004).

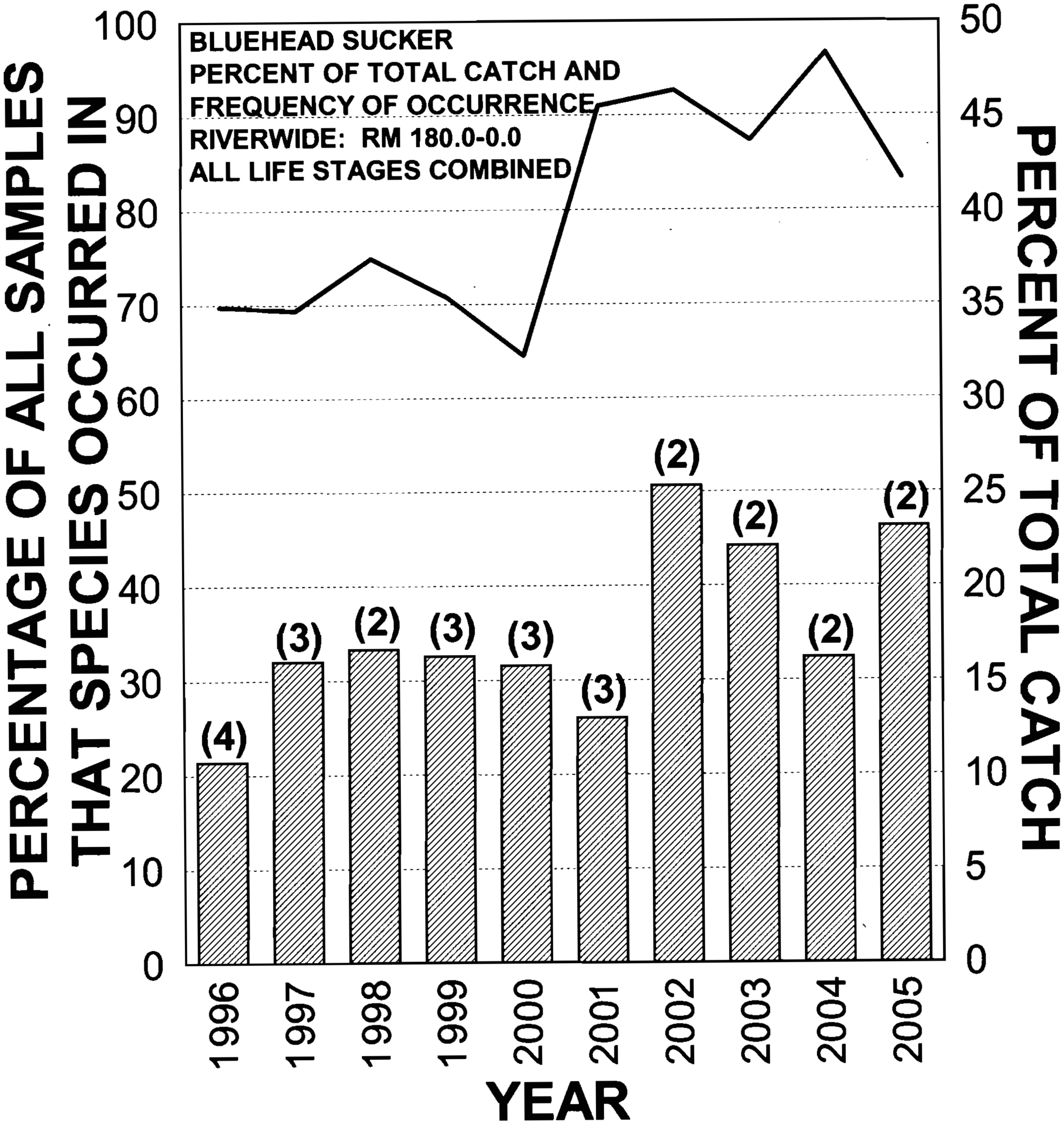

Figure 15. A summary of bluehead sucker relative abundance in riverwide Adult Monitoring collections, 1996-2005. The solid black line represents the percentage of all electrofishing samples on a given Adult Monitoring trip in which this species occurred (i.e., frequency of occurrence). The shaded bars represent the percent of the total catch that this species composed in a given year. The parenthetic numbers indicate the numeric rank for this species in a given year relative to all other fish species collected.

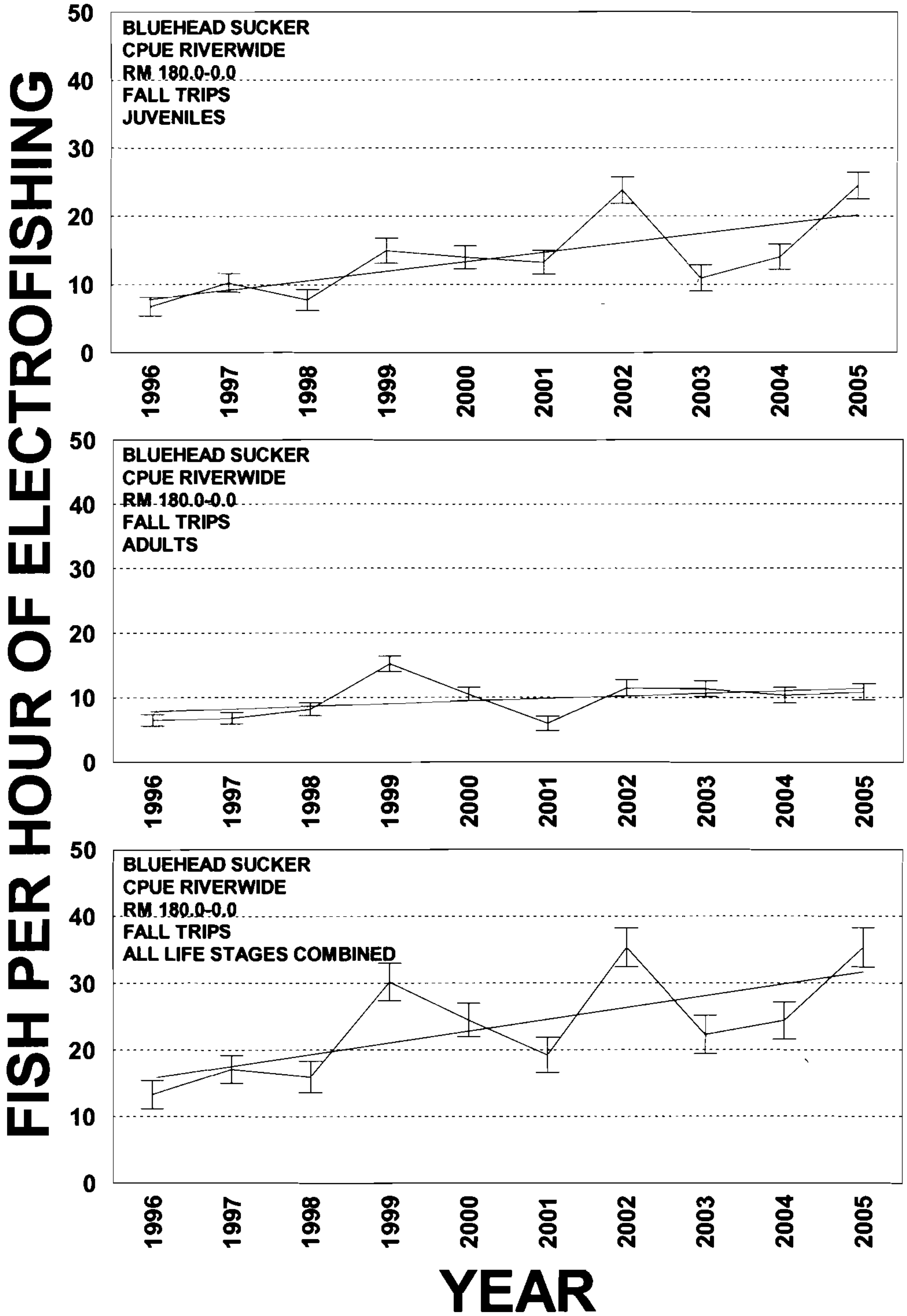

Figure 16. Bluehead sucker catch per unit effort (CPUE) riverwide (RM 180.0-0.0) on fall Adult Monitoring trips, for juvenile fish (< 300 mm TL; top), adult fish (≥ 300 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

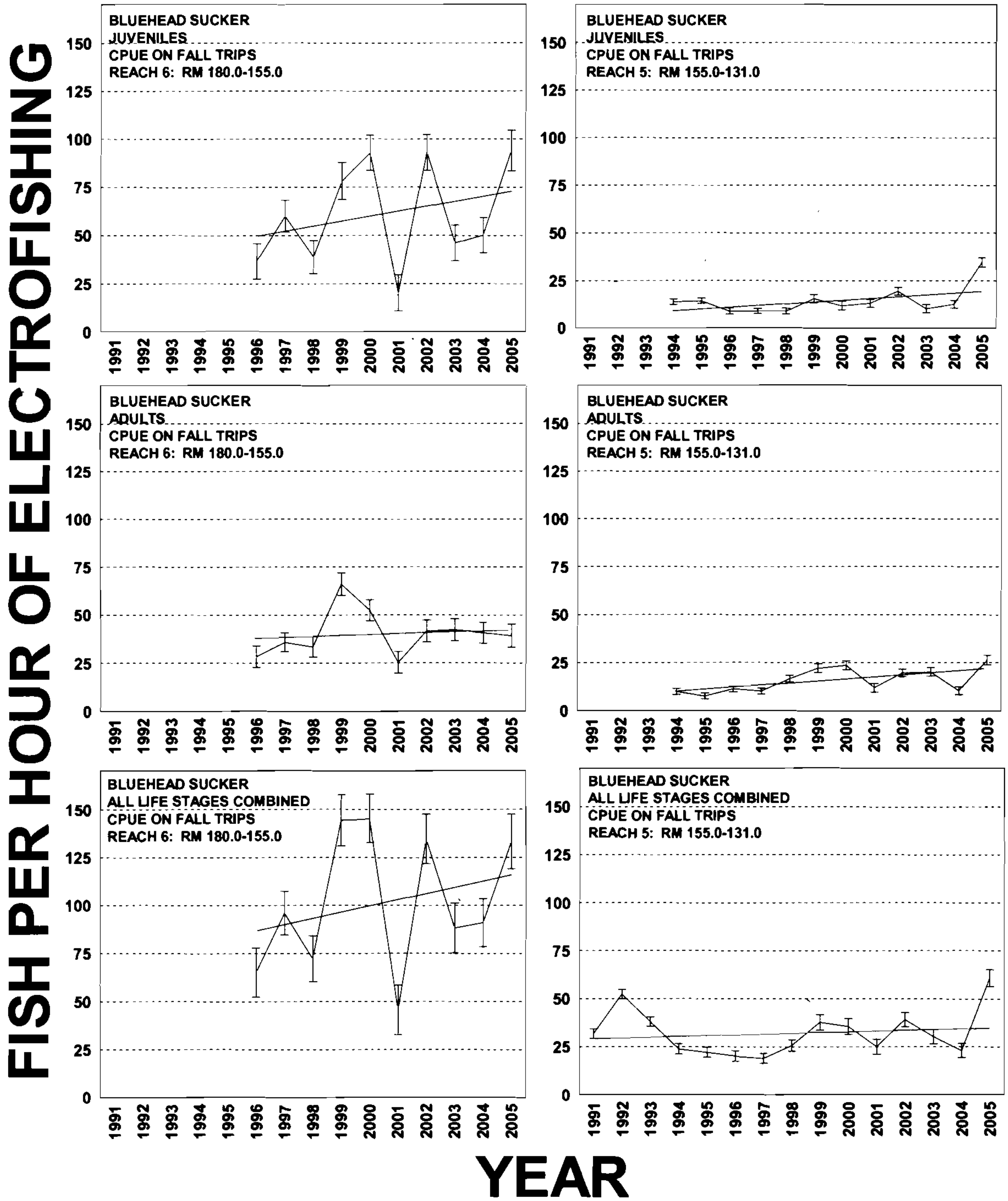

Figure 17. Bluehead sucker catch per unit effort (CPUE) in Reach 6 and Reach 5 on fall Adult Monitoring trips for juvenile fish (< 300 mm TL; top), adult fish (≥ 300 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

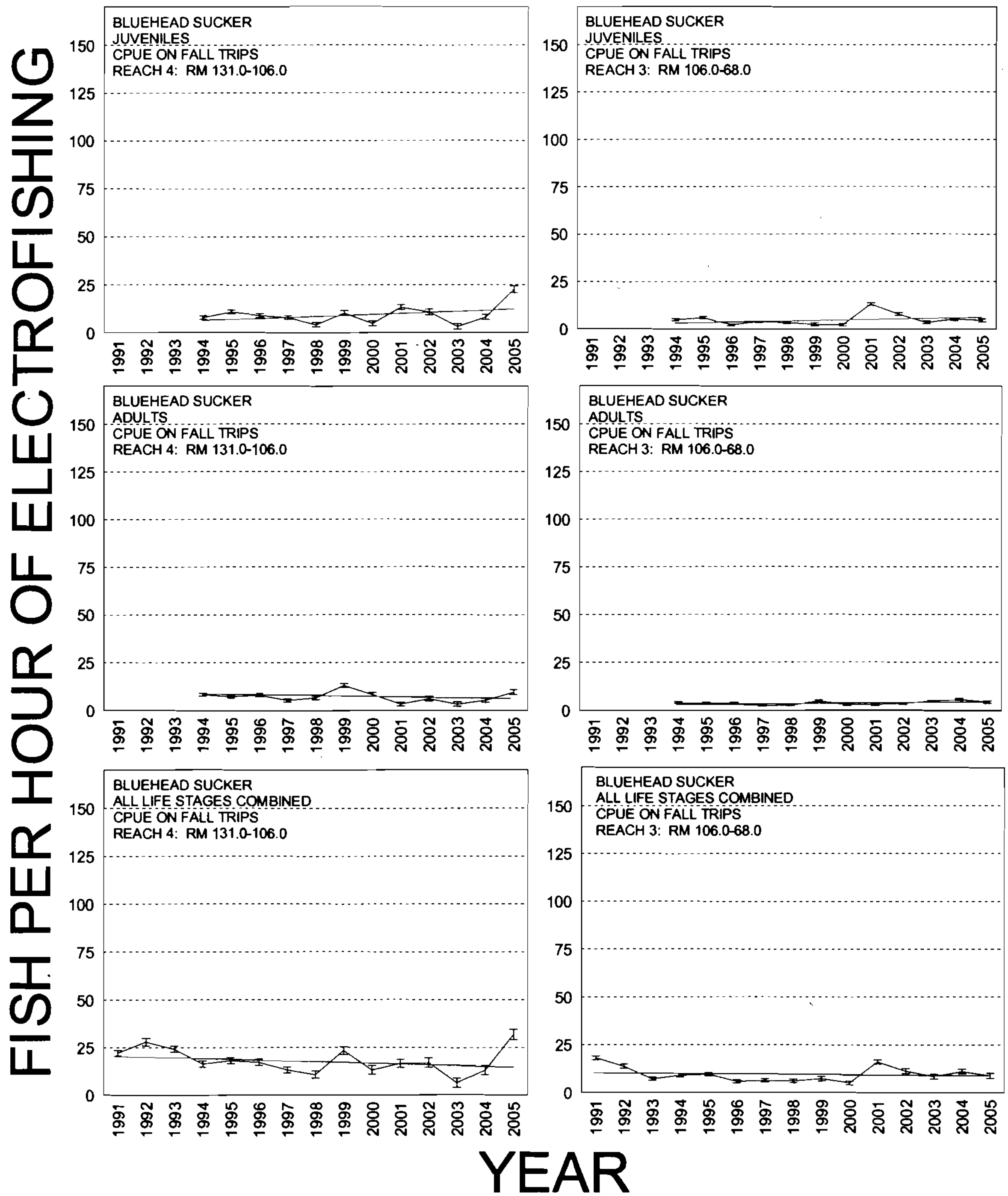

Figure 18. Bluehead sucker catch per unit effort (CPUE) in Reach 4 and Reach 3 on fall Adult Monitoring trips for juvenile fish (< 300 mm TL; top), adult fish (≥ 300 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

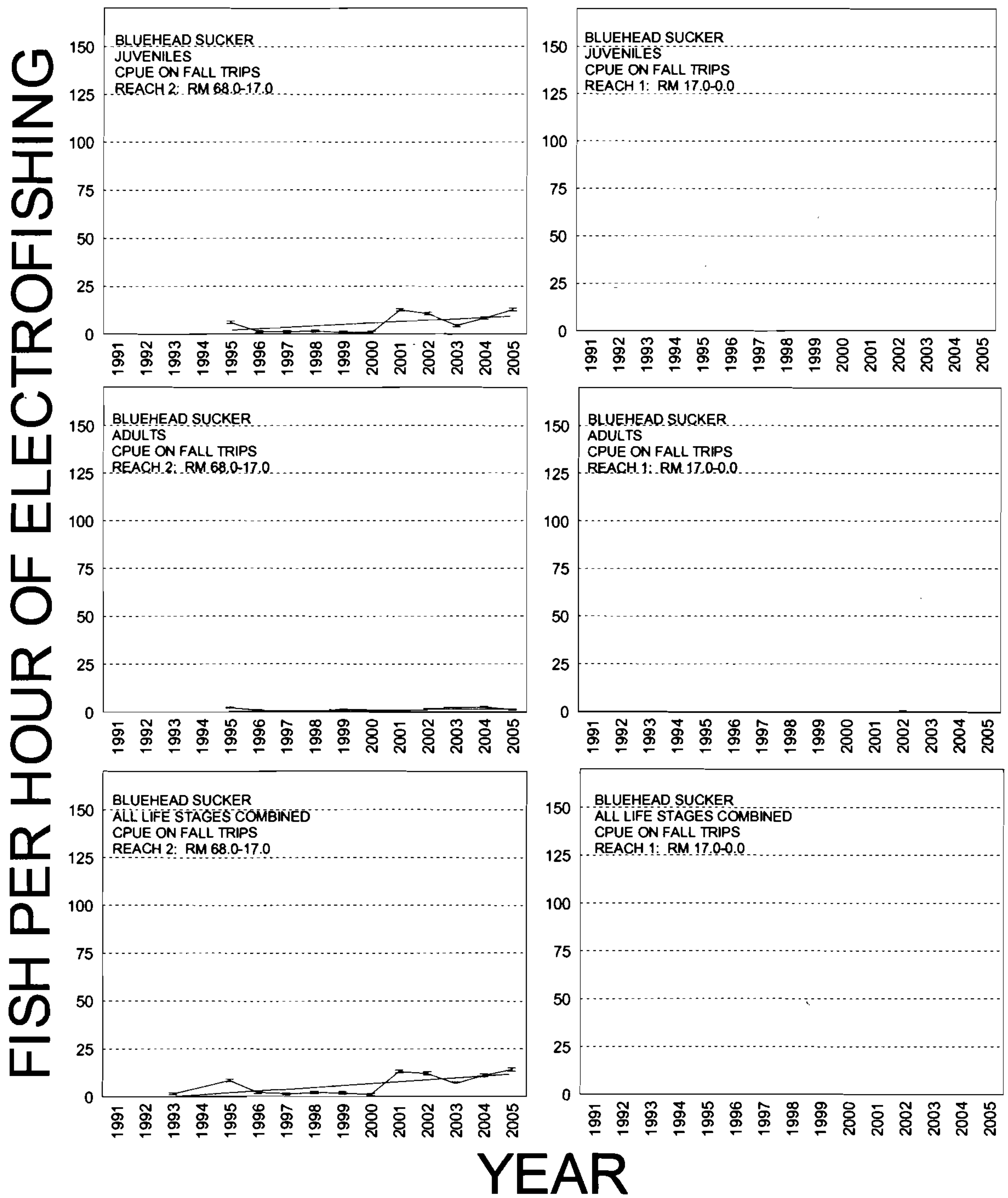

Figure 19. Bluehead sucker catch per unit effort (CPUE) in Reach 2 and Reach 1 on fall Adult Monitoring trips for juvenile fish (< 300 mm TL; top), adult fish (≥ 300 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

Length Frequency And Mean Total Length

The 2005 riverwide length-frequency histogram for bluehead sucker was dominated by a large cohort of age-1 (2004 year-class) fish, centered around 126-150 mm TL (Figure 21). This is the second largest group of age-1 fish that has been observed (the 2000 year-class fish observed during the 2001 Adult Monitoring trip being the largest) since riverwide Adult Monitoring trips began in 1996 (Figures 20 and 21). Length-frequency histograms show that over the last six years, there have been regular influxes of young fish into the San Juan River bluehead sucker population. These influxes occurred in 2000, 2002 (as evidenced by the age-1 fish collected in 2003), 2003 and 2004 (Figures 20 and 21). It also appears as if there were smaller cohorts of young fish spawned in 1996 and 1997 (based on the smaller size-class fish evident in the 1997 length-frequency histogram (Figure 20).

With the large influxes of young fish, bluehead sucker mean TL values (for all life stages combined) dropped markedly riverwide between 1999 and 2000 and again between 2000 and 2001 (Figure 22). Riverwide, bluehead sucker mean TL values in 2001 were lower than in any of the five preceding or following years (i.e., 1996-2000 and 2002-2004; Figure 22). Then, as young fish from the 2000 cohort grew larger and became large sub-adults in 2002, the riverwide mean TL value increased (Figure 22). In 2003, the riverwide mean TL for bluehead sucker dropped again. This is due to the influx of age-1 (2002 year-class) fish that were observed as age-1 fish in the 2003 length-frequency histogram (Figures 21). Likewise, in 2004, bluehead sucker mean TL values dropped again (Figure 22) as two more year-classes (the 2003 and 2004 year-classes) of young bluehead sucker were observed in the 2004 length-frequency histogram (Figure 21). Then in 2005, bluehead sucker mean TL dropped to the lowest value ever observed, as the large number of age-1 (2004 year-class) fish were picked up during the fall Adult Monitoring trip.

The long-term trend in bluehead sucker mean TL riverwide shows a marked drop in mean TL over the last ten years. Bluehead sucker mean TL in 2005 was significantly lower than eight of the nine previous years (2001 being the single exception; Figure 22).

Biomass

Yearly increases and decreases in bluehead sucker mean biomass (weight in grams) riverwide tended to closely mirror those in bluehead sucker mean TL riverwide (Figures 22 and 23). Despite these yearly fluctuations in bluehead sucker mean biomass, the overall long-term trend for mean biomass riverwide was essentially flat between 1996 and 2004 (Ryden 2005a). Then in 2005 bluehead sucker mean biomass dropped to the lowest value ever observed. The mean biomass for bluehead sucker in 2005 (193.5 g) was significantly lower than all nine previous years values (Figure 23).

Despite the significant decline in bluehead sucker mean biomass riverwide, bluehead sucker total biomass (weight in kg) per hour of electrofishing was 6.63 kg/hr in 2005. This was the fourth highest observed value over the last ten years (Figure 23).

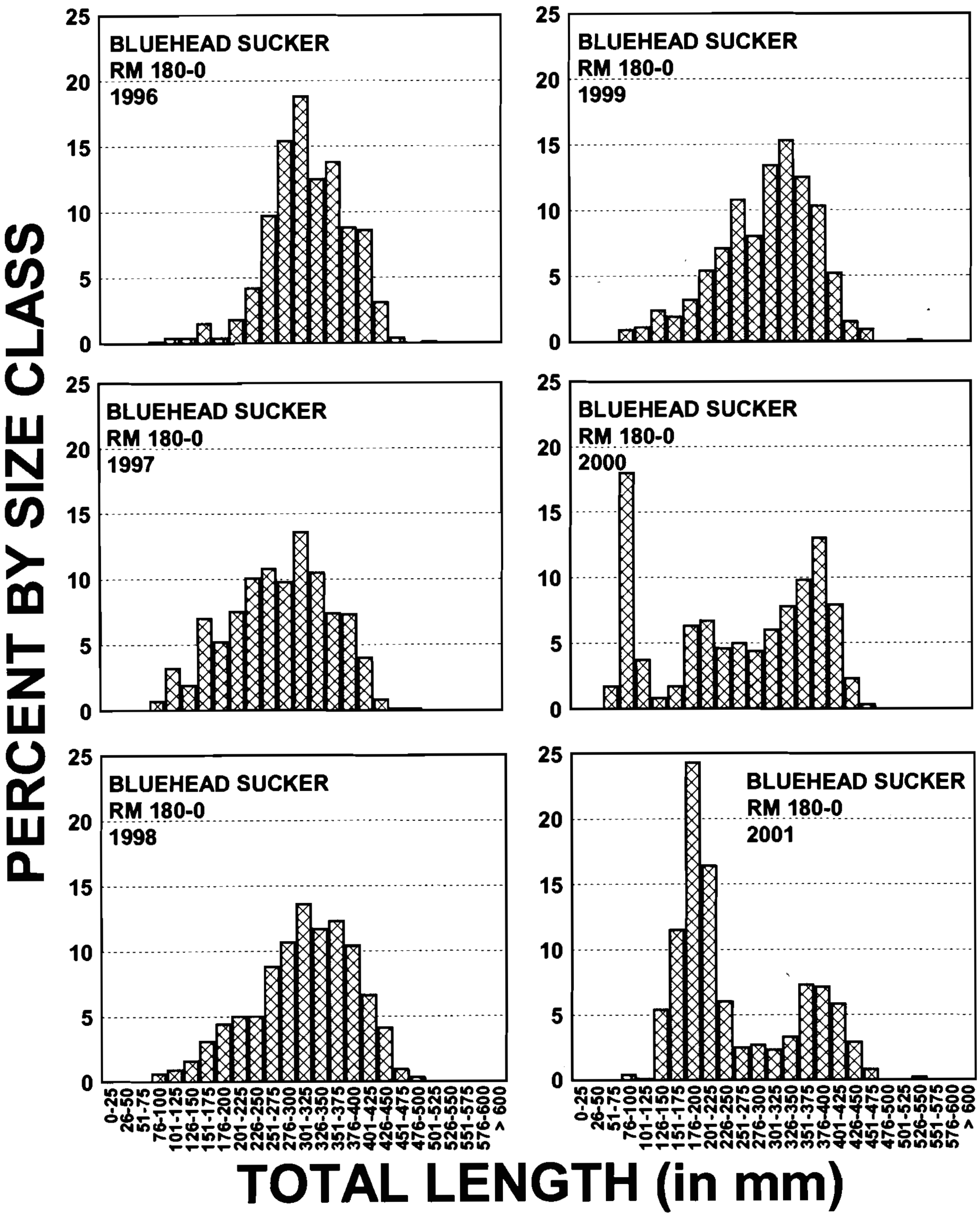

Figure 20. Length-frequency histograms showing the riverwide (RM 180.0-0.0) size-class distribution of bluehead sucker on fall Adult Monitoring trips in the San Juan River, 1996-2001.

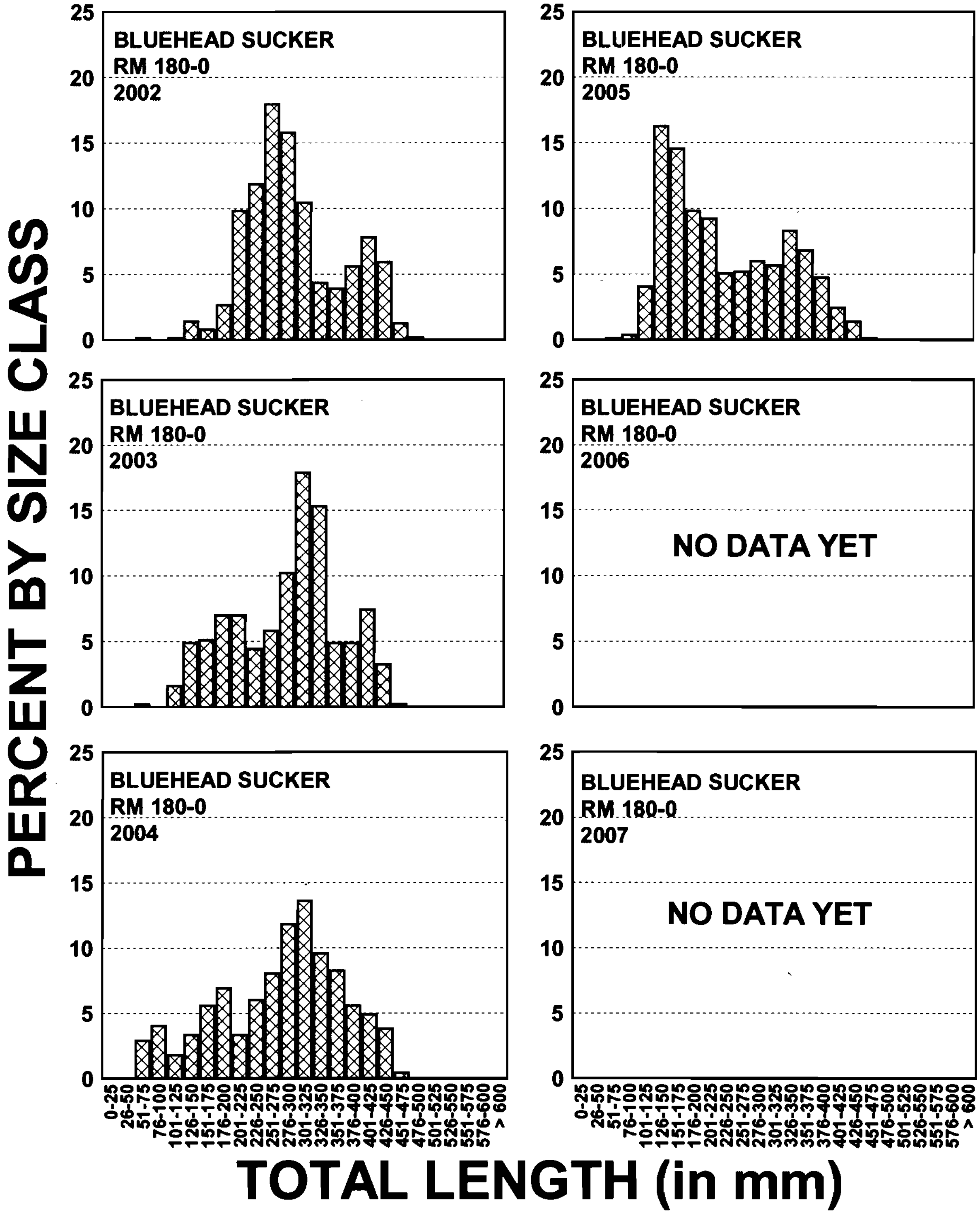

Figure 21. Length-frequency histograms showing the riverwide (RM 180.0-0.0) size-class distribution of bluehead sucker on fall Adult Monitoring trips in the San Juan River, 2002-2005.

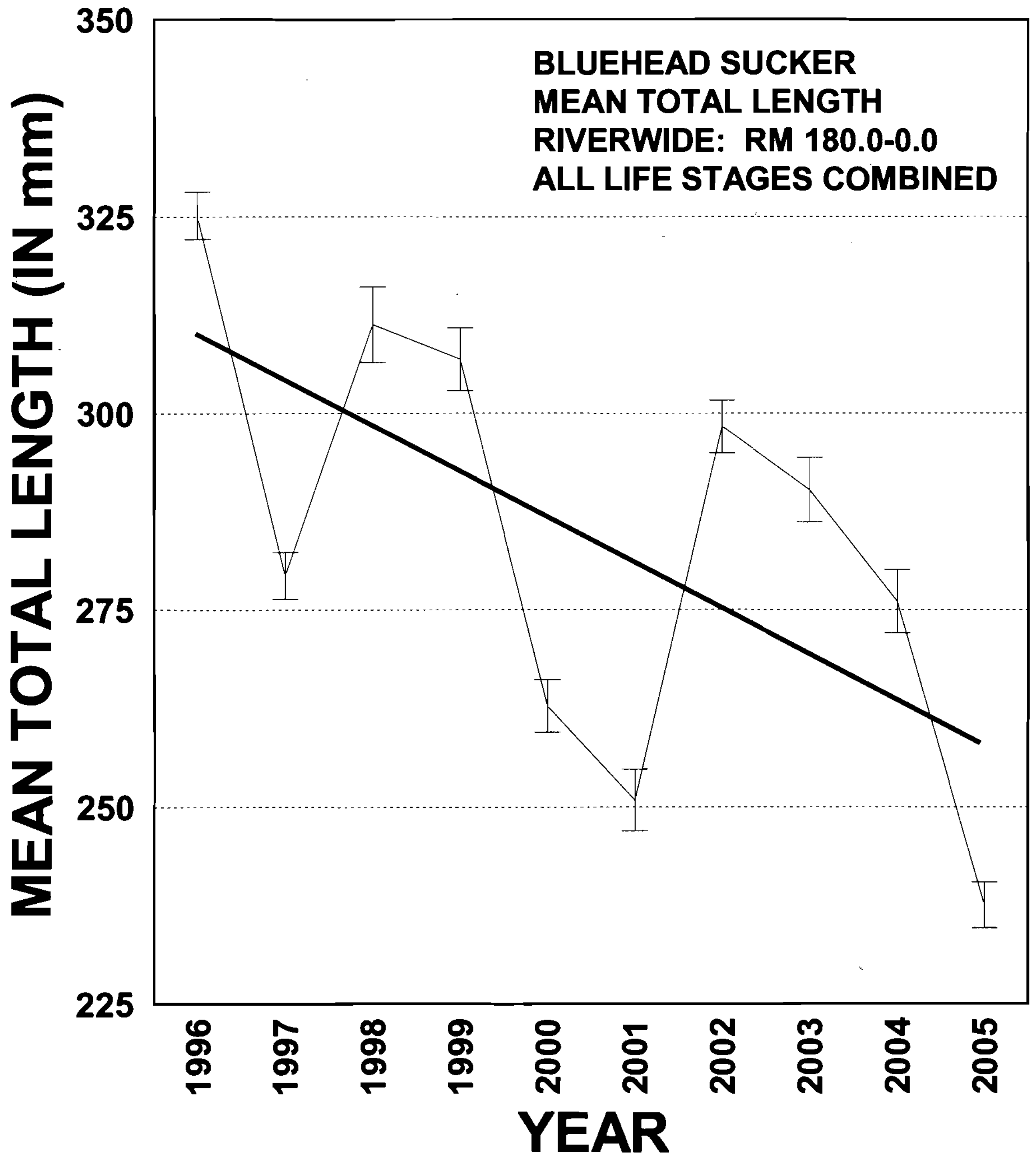

Figure 22. Mean total length (in mm) of bluehead sucker riverwide (RM 180.0-0.0) on fall Adult Monitoring trips in the San Juan River. Error bars represent one standard error. The sloping horizontal line represents the long-term trend in mean total length.

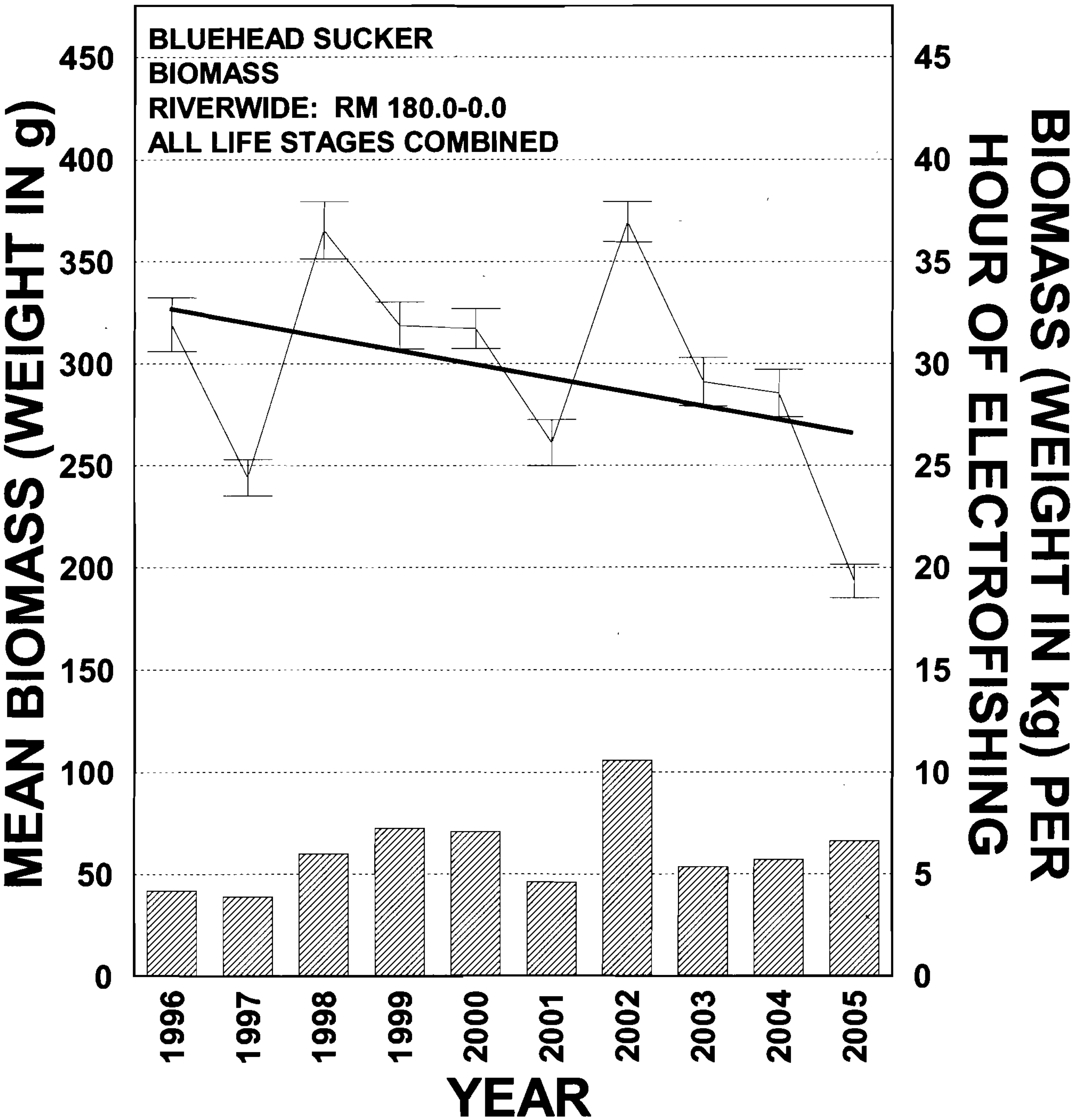

Figure 23. Mean biomass (weight in g; line connecting error bars) and total biomass (weight in kg; cross-hatched vertical bars) per hour of electrofishing of bluehead sucker riverwide (RM 180.0-0.0) on fall Adult Monitoring trips in the San Juan River. Error bars represent one standard error. The sloping horizontal line represents the long-term trend in mean biomass.

Common Nonnative Fishes

Channel Catfish

Catch Per Unit Effort (CPUE)

Channel catfish are the most common nonnative fish collected on Adult Monitoring trips (Table 3) and have remained among the top three most commonly-collected fish species on fall Adult Monitoring trips in each of the last ten years (Figure 24). Channel catfish are ubiquitous, being collected in a myriad of habitat types (pers. obs.) and occasionally (as was the case in 2000) being collected in more individual electrofishing samples than even flannelmouth sucker (Figures 6 and 24; Ryden 2003b). However, over the last four years (2002-2005) the percent of the total catch composed by channel catfish has remained between 14% and 18%, down from the highs (> 22% of the total catch) observed from 1999-2001 (Figure 24). In 2001, channel catfish were collected in 94.38% of all electrofishing samples riverwide, the highest observed value in the last ten years (Figure 24). However, from 2002-2004, the frequency of occurrence of channel catfish in Adult Monitoring collections steadily declined, until in 2004, channel catfish were only collected in 75.42% of electrofishing collections riverwide (Figure 24). In 2005, channel catfish were collected in 81% of all electrofishing samples, an increase over 2004 (Figure 24), but despite this increase in relative abundance, this species still remained less abundant than both common native suckers (Table 3, Figures 6, 15, and 24). The increase in channel catfish total CPUE from 2004-2005 was based almost entirely on juvenile fish and small adult fish just beginning to recruit into the adult population (Figure 25).

Riverwide, juvenile and total CPUE for channel catfish rose markedly between 1998 and 2001 and stayed relatively high for the next two years (2000-2001; Figure 25). That increase was predominantly caused by an increase in juvenile fish riverwide, although adult channel catfish CPUE riverwide also increased slightly every year between 1997 and 2001 (Figure 25). It was assumed that this was a compensatory reproductive effort related to the removal of larger adult channel catfish ($\geq$ 450 mm TL) during nonnative fish removal efforts that occurred between 1996 and 2001. These early nonnative fish removal efforts were relatively effective at removing the larger size-classes of channel catfish from the river, but less effective at targeting and removing the smaller size-classes of channel catfish.

In 2001, intensive, multiple-pass nonnative fish removal trips were begun in the San Juan River from RM 166.6-158.6 (e.g., Davis 2005). These efforts were later expanded to include RM's 158.6-147.9. Likewise, similar efforts were begun in the lower San Juan River in 2002 from RM 52.9-2.9 (e.g., Jackson 2005). Between 2001 and 2004, channel catfish total CPUE dropped markedly during fall Adult Monitoring trips(Figure 25). This was caused by a large decline in numbers of juvenile channel catfish between 2001 and 2003 as well a steady decline in numbers of adult fish between 2001 and 2004 (Figure 25). This decrease in channel catfish adult CPUE riverwide between 2001 and 2004 almost certainly decreased the reproductive potential of the San Juan River channel catfish population. In 2005, there was an increase in both juvenile and adult CPUE riverwide (Figure 25). This may be the beginning of another compensatory reproductive effort occurring within the San Juan River's channel catfish population.

Since 1991, trends in channel catfish CPUE over time among individual river reaches have been, at best, hard to discern. This is due to very pronounced fluctuations in both juvenile and adult channel catfish CPUE,

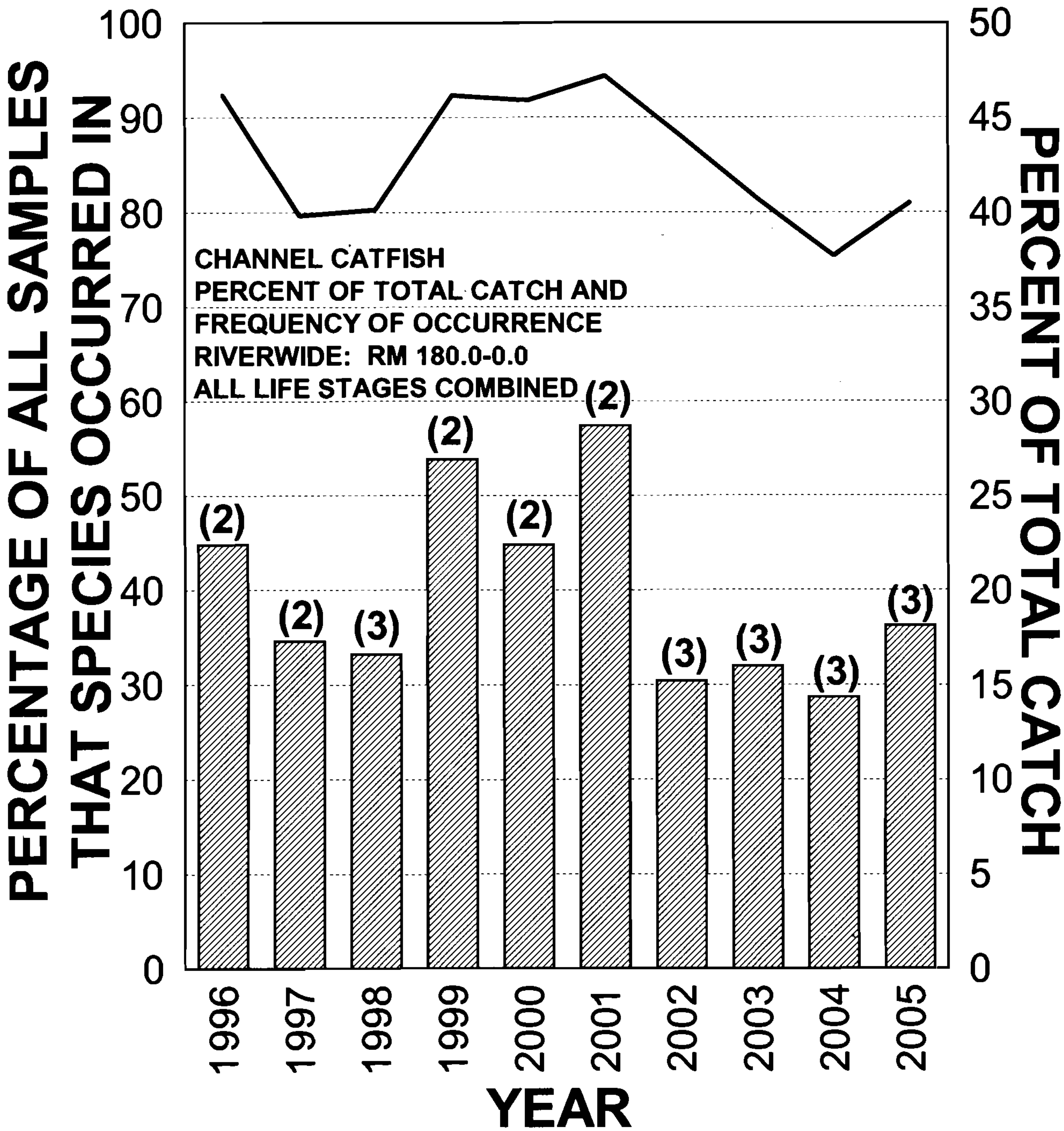

Figure 24. A summary of channel catfish relative abundance in riverwide Adult Monitoring collections, 1996-2005. The solid black line represents the percentage of all electrofishing samples on a given Adult Monitoring trip in which this species occurred (i.e., frequency of occurrence). The shaded bars represent the percent of the total catch that this species composed in a given year. The parenthetic numbers indicate the numeric rank for this species in a given year relative to all other fish species collected.

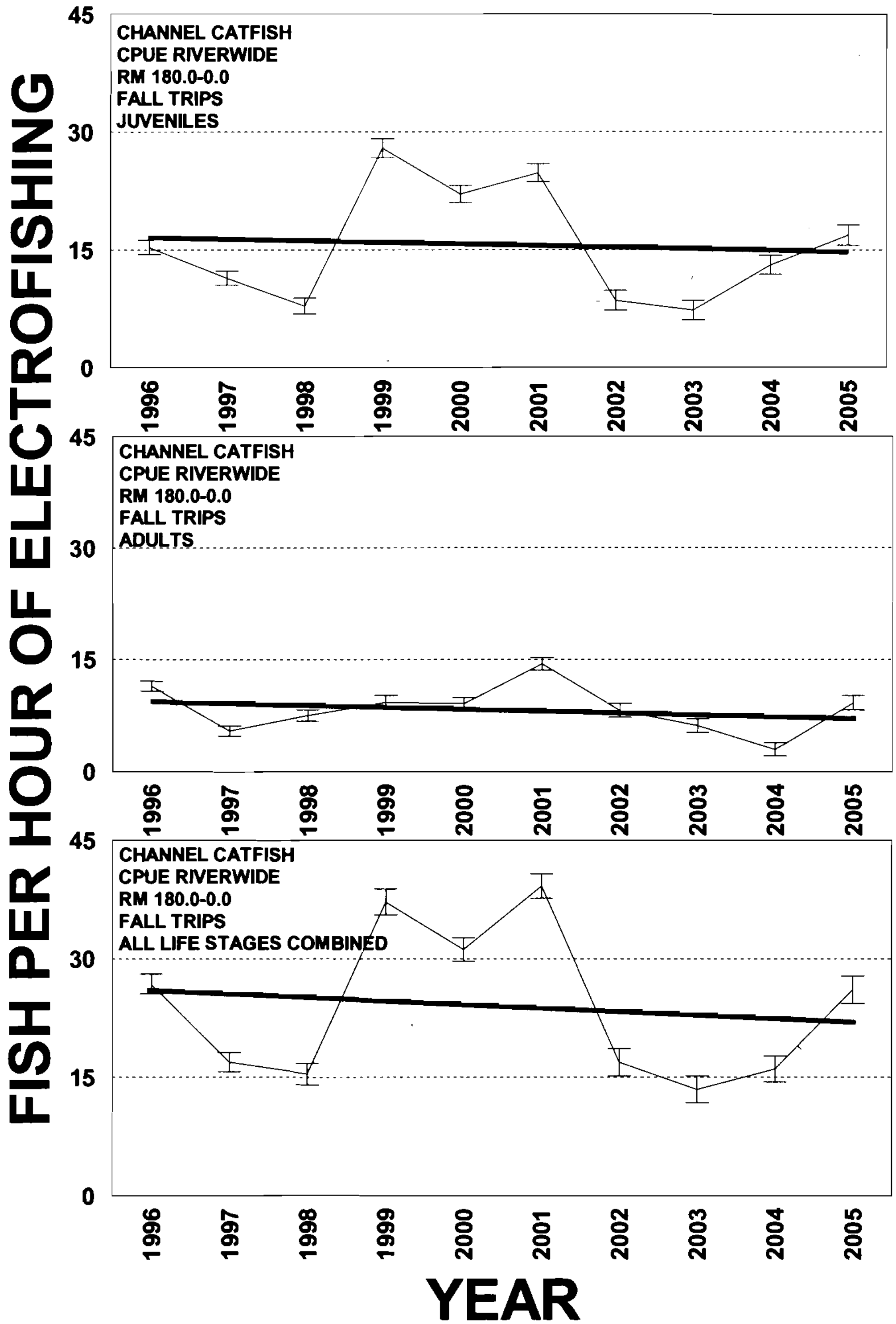

Figure 25. Channel catfish catch per unit effort (CPUE) riverwide (RM 180.0-0.0) on fall Adult Monitoring trips, for juvenile fish (< 300 mm TL; top), adult fish (≥ 300 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

However, some clear trends can be determined. First, in Reach 6 the channel catfish population is dominated by adult fish, whereas in Reaches 5-2, juvenile channel catfish become increasingly numerically dominant in each contiguous downstream river reach (Figures 26-28). The overall effect of this is that from a riverwide perspective, juvenile channel catfish outnumber adult channel catfish about two to one (Figure 25). Second, the riverwide increase in channel catfish numbers observed between 2003 and 2005 (Figure 25) is reflective of increasing numbers of juvenile and very young adult (i.e., fish that are just beginning to recruit into the adult population) fish in Reaches 5 and 4. Third, Reaches 5-2 harbor the large majority of the San Juan River's channel catfish population (Figures 26-28). More specifically, the river sections in between the upstream (RM 166.6-147.9) and downstream (RM 52.9-2.9) intensive nonnative fish removal sections harbor the large majority of the San Juan River's channel catfish population. This includes 95.0 contiguous RM's (52.6% of the entire river from the Animas River confluence to Lake Powell (RM 180.6-0.0), including the lower 70.8% of Reach 5 and the upper 29.4% of Reach 2. Fourth, in Reach 6 (channel catfish only occur in the lower 45.3% of Reach 6 from RM 166.6-155.0) and in Reach 1 where intensive nonnative fish removal efforts have been ongoing since 2001 and 2002 respectively, both juvenile and adult channel catfish CPUE have shown long-term declining trends. Lastly, since opportunistic removal of nonnative fishes began in 1996, channel catfish adult CPUE has shown a long-term decreasing trend in four of the six river reaches (Reach 6 and Reaches 3-1; Figures 26-28).

It appears as though intensive nonnative fish removal efforts are effective in the limited river sections (a total of 68.7 RM's = 38.0% of the entire river from the Animas River confluence to Lake Powell) where they have been implemented. However, there is a large reservoir of channel catfish in the middle sections (RM 147.9-52.9) of the San Juan River between these two intensive removal sections that act to keep the San Juan River channel catfish population robust and abundant. These fish also apparently reinvade at least the upper intensive removal section an annual basis (J. Davis, pers. comm.). Despite the current limited range of intensive nonnative fish removal efforts and the large amount of channel catfish that populate the middle sections of the San Juan River, the riverwide channel catfish CPUE values show a long-term decreasing trend (Figure 25). It is my belief that if intensive, multiple-pass nonnative fish removal efforts could be expanded into the middle sections of the San Juan River and effectively crop off the large numbers of adult fish in Reaches 5 and 4 (Figures 26 and 27) and the even larger numbers of juvenile fish in Reaches 5-2 (Figures 26-28) that numbers of channel catfish riverwide would show a marked downward decline within just a few years.

<u>Length Frequency And Mean Total Length</u>

During fall 2005 Adult Monitoring, numerous juvenile channel catfish ranging from age-0 fish (51-75 mm TL) all the way up to large sub-adults (276-300 mm TL) were collected (Figure 30). In addition, a relatively large group of young adult fish, just recruiting into the adult population (centered around 301-325 mm TL) were collected. The young adult channel catfish in this one size-class grouping alone accounted for almost 10% of all channel collected in 2005 (Figure 30). No other adult size-class grouping accounted for more than 6% of the total channel catfish catch in 2005.

Over the last ten years (i.e., since removal of nonnative fishes began in 1996), there has been a general trend towards the San Juan River channel catfish population becoming increasingly dominated by smaller size-class fish, as larger, older fish are mechanically removed (Figures 29-31). The large influxes of juvenile fish observed from 1999-2001 (Figure 25) were likely the

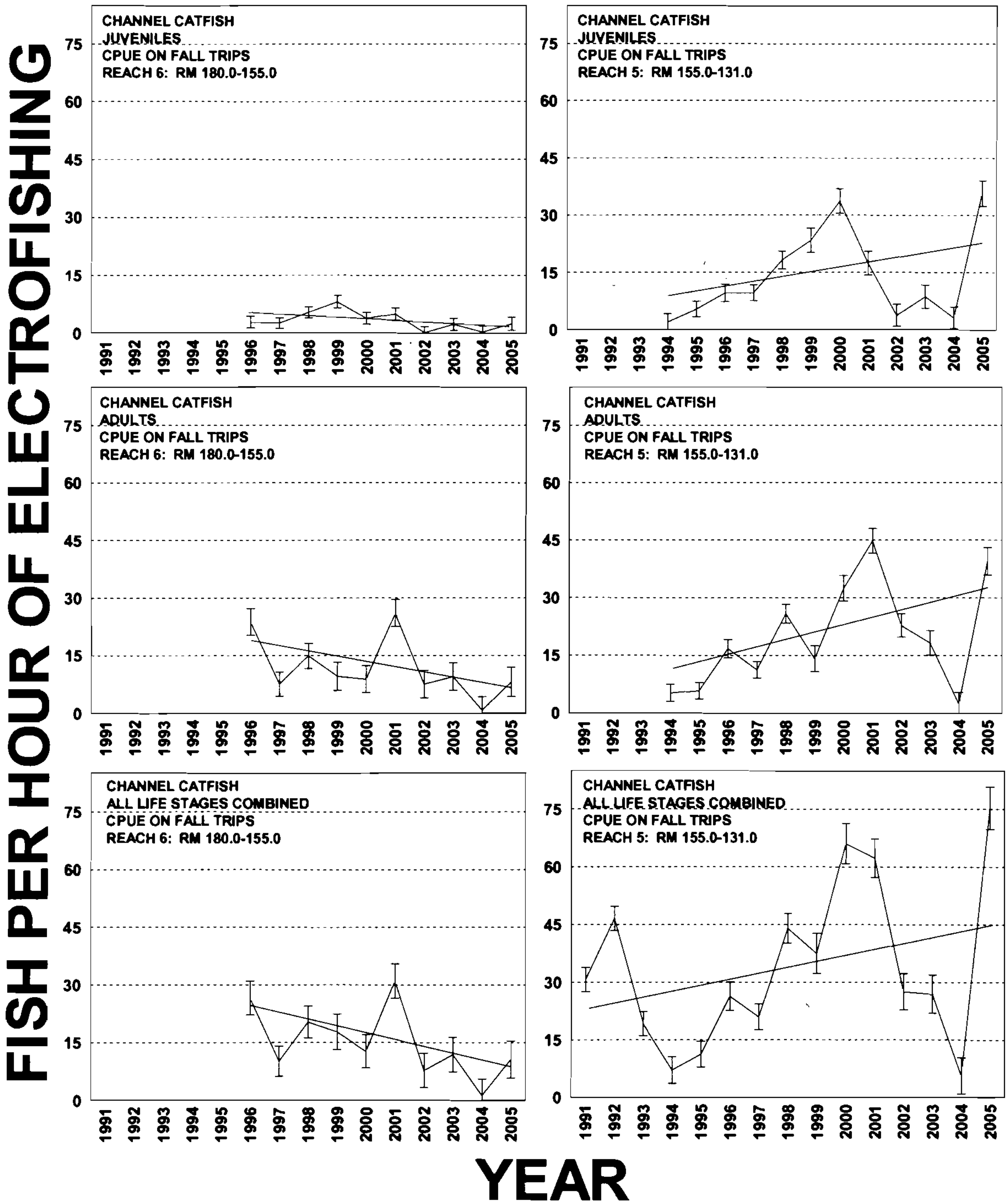

Figure 26. Channel catfish catch per unit effort (CPUE) in Reach 6 and Reach 5 on fall Adult Monitoring trips for juvenile fish (< 300 mm TL; top), adult fish (≥ 300 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

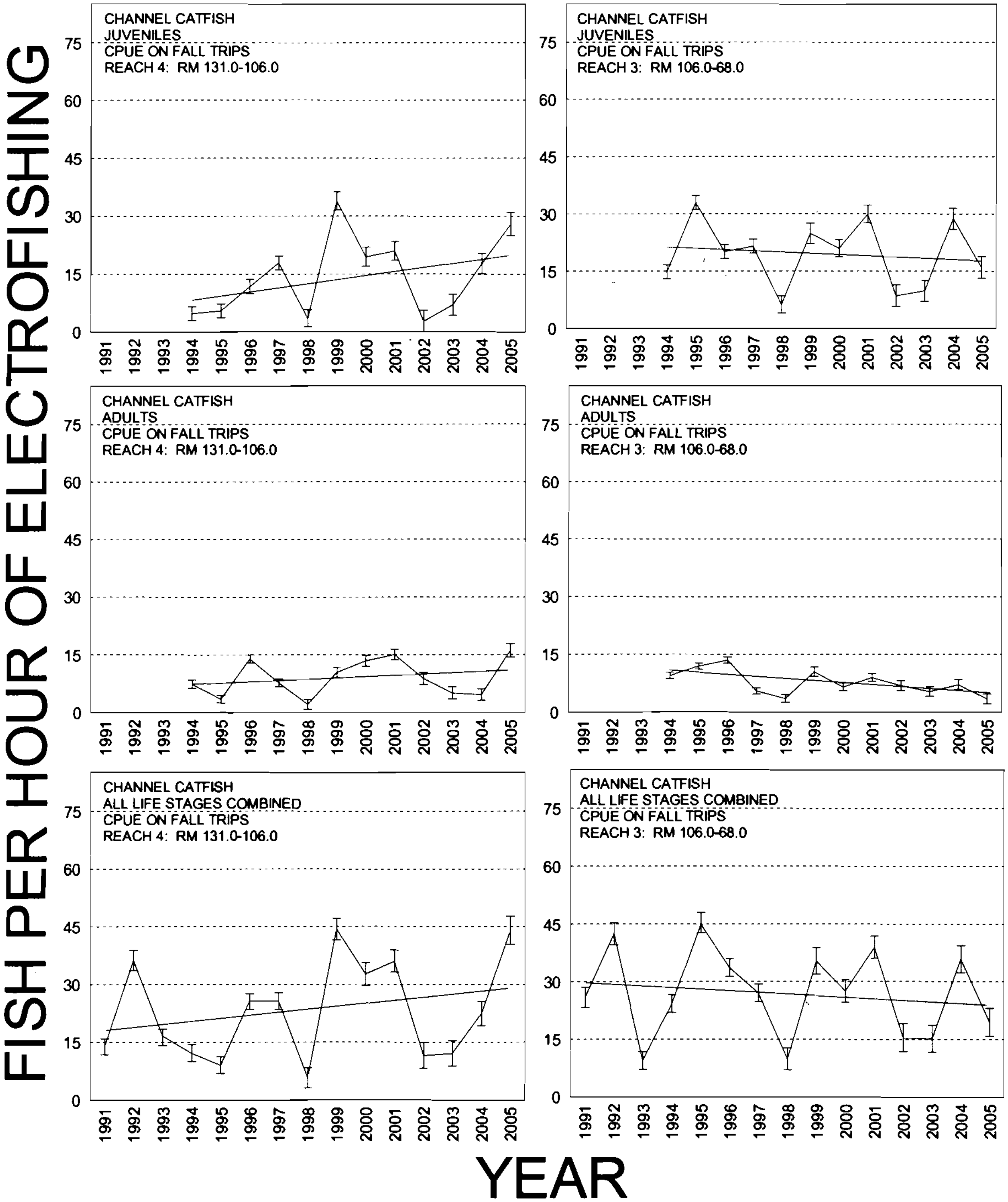

Figure 27. Channel catfish catch per unit effort (CPUE) in Reach 4 and Reach 3 on fall Adult Monitoring trips for juvenile fish (< 300 mm TL; top), adult fish (≥ 300 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

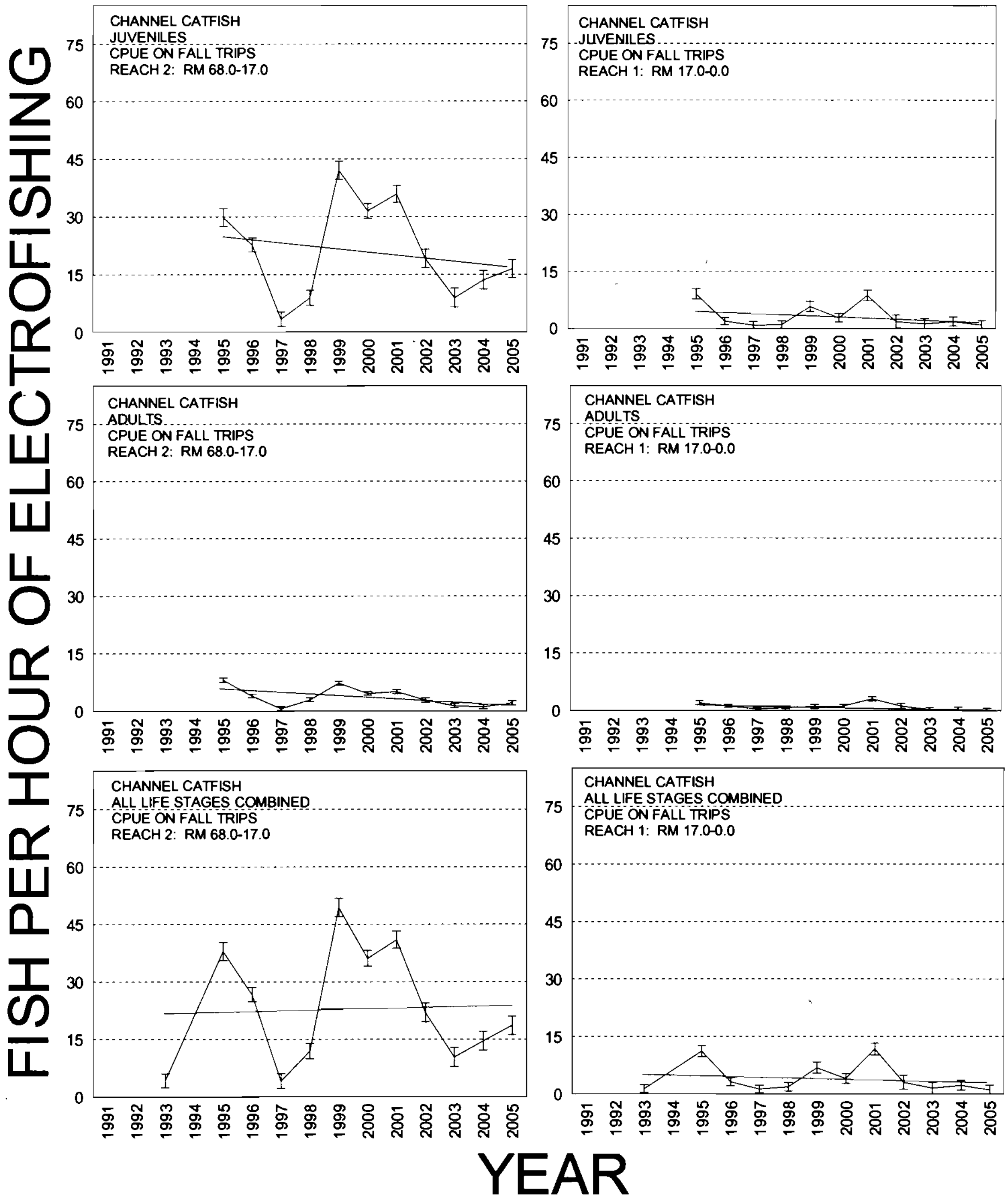

Figure 28. Channel catfish catch per unit effort (CPUE) in Reach 2 and Reach 1 on fall Adult Monitoring trips for juvenile fish (< 300 mm TL; top), adult fish (≥ 300 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

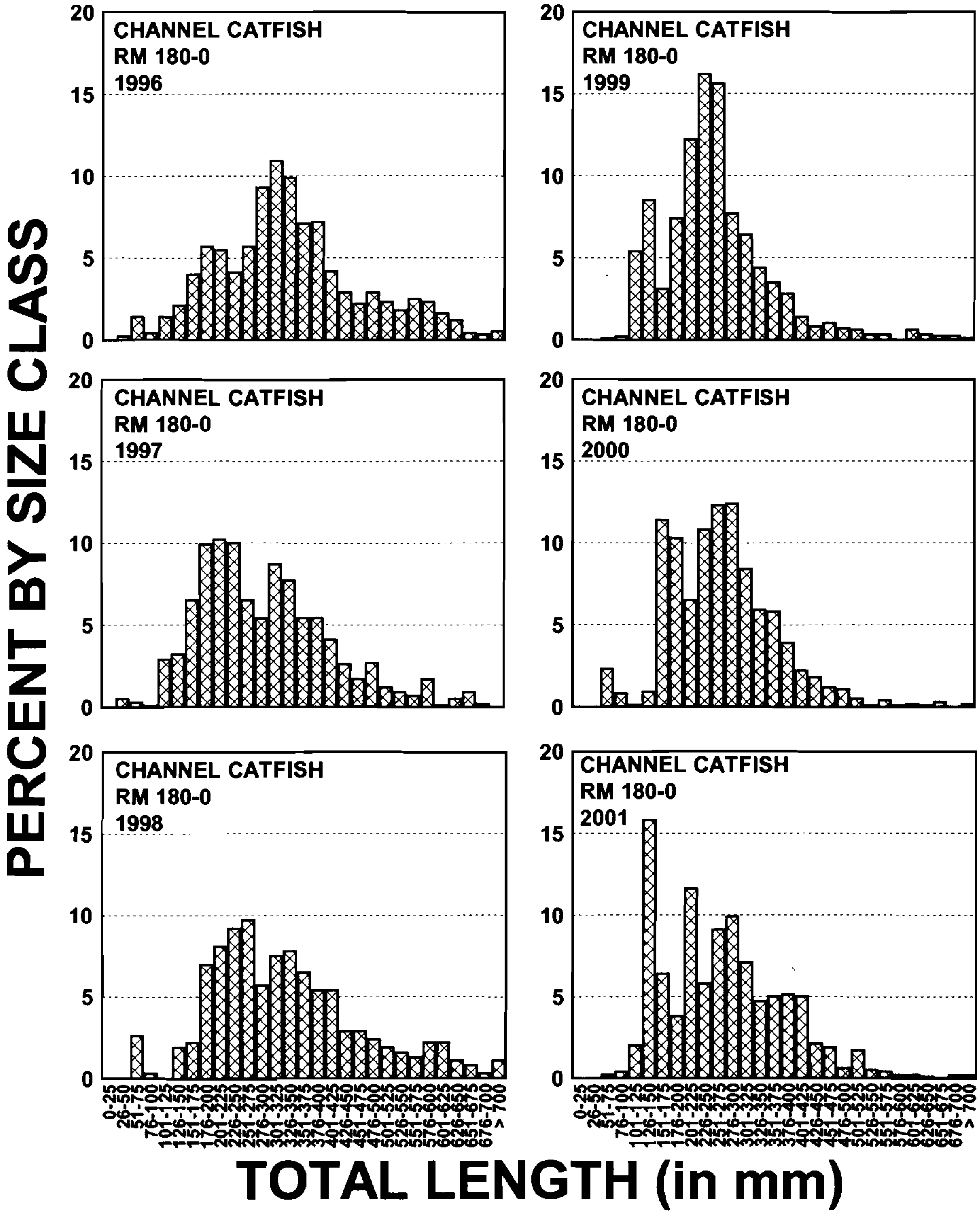

Figure 29. Length-frequency histograms showing the riverwide (RM 180.0-0.0) size-class distribution of channel catfish on fall Adult Monitoring trips in the San Juan River, 1996-2001.

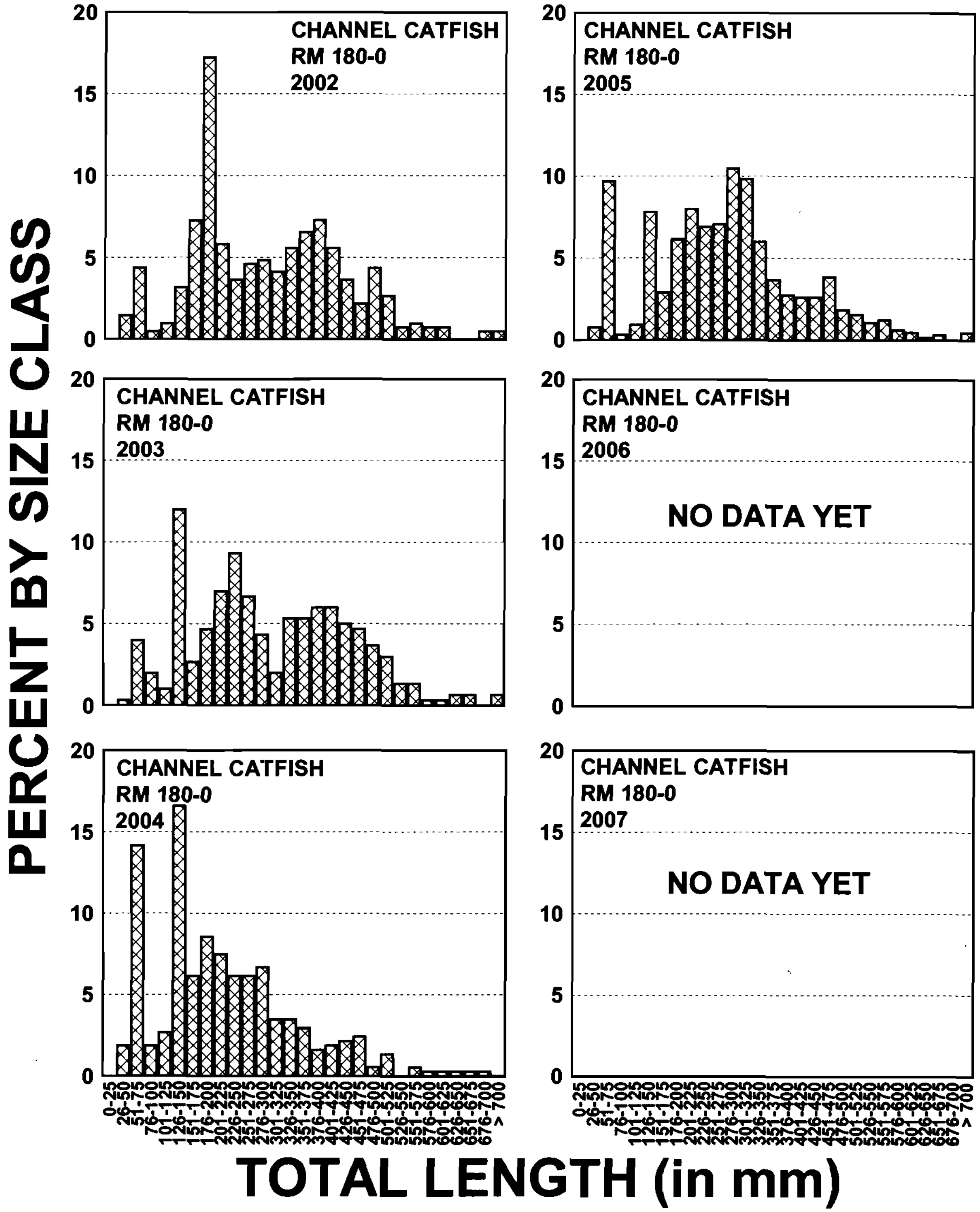

Figure 30. Length-frequency histograms showing the riverwide (RM 180.0-0.0) size-class distribution of channel catfish on fall Adult Monitoring trips in the San Juan River, 2002-2005.

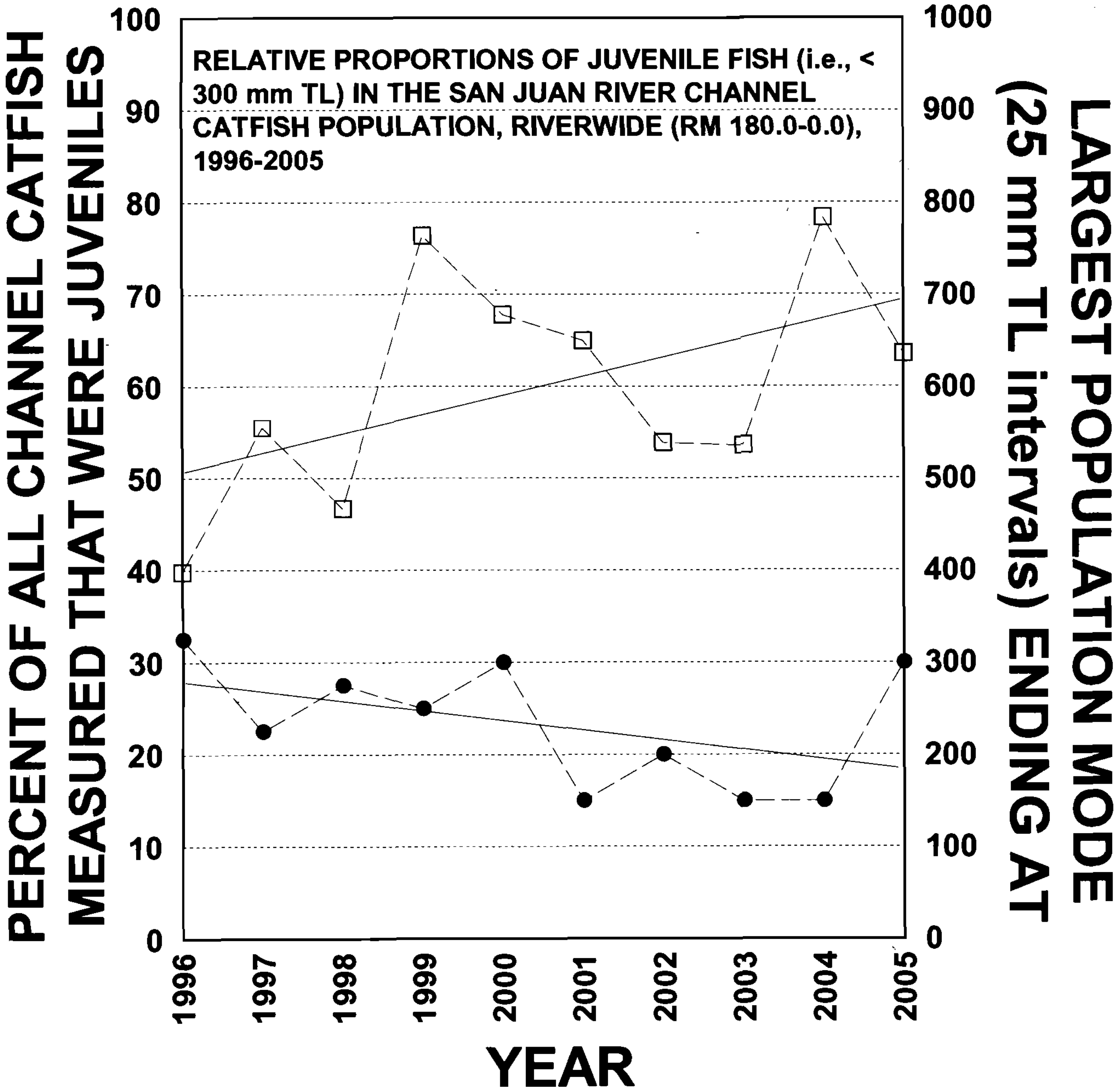

Figure 31. The relative proportion of juvenile fish (< 300 mm TL) observed among channel catfish collected and measured from the San Juan River, 1996-2005. The top dashed line (with open squares) represents the percent of all measured channel catfish in a given year's samples that were juveniles. The bottom dashed line (with solid circles) represents the TL at which the largest population mode (from Figures 29 and 30), ended at. Therefore, the 2005 value represents 276-300 mm TL, the 2002 value represents 176-200 mm TL, and so on. The solid sloping lines (top and bottom) represent the long-term trends for these two metrics.

result of compensatory reproductive efforts, associated with a drop in numbers of larger adult channel catfish riverwide, caused by mechanical removal efforts. The upward trend in juvenile and young adult channel catfish in 2004 and 2005 may be the result of compensatory reproductive effort similar to that observed from 1999-2001. The relative percentage of juvenile fish in the San Juan River channel catfish population, has shown a marked increasing trend over the last ten years (1996-2005; Figure 31). Over that same ten-year period, the relative size-class of the largest mode observed in channel catfish length-frequency histograms (Figures 29 and 30) has shown a marked decreasing trend (Figure 31).

As might be expected, with the increasing dominance of juvenile channel catfish in collections over the last nine years, channel catfish mean TL riverwide has shown a long-term declining trend (Figure 32). This particular metric did increase steadily for four straight years, between 1999 and 2003, as fish spawned in the mid- to late 1990's (e.g., 1996-1998) began recruiting into the adult size-classes (i.e., > 400 mm TL; Figures 29 and 30). It also increased again between 2004 and 2005 as the relatively large group of young adult channel catfish (301-325 mm TL) appeared in fall 2005 Adult Monitoring collections (Figures 26-28, Figures 30-32). However, between 1996 and 2005 channel catfish mean TL declined significantly ($P < 0.000$; Figure 32).

Biomass

As was seen with mean TL riverwide among channel catfish (Figure 32), mean biomass (weight in g) riverwide increased steadily between 1999 and 2003 (Figure 33), as fish spawned in the mid- to late 1990's (e.g., 1996-1998) began recruiting into the adult size-classes (i.e., > 400 mm TL; Figures 29 and 30). Mean biomass riverwide then decreased markedly between 2003 and 2004 as nonnative fish removal effectively cropped this incoming group of young adult fish (Figure 33). Then, between 2004 and 2005, riverwide channel catfish mean biomass increased again slightly as another group of young adult channel catfish recruited in the adult population (Figures 30 and 33). The long-term trend in riverwide channel catfish mean biomass has been downward over the last ten years. This decline was statistically significant between 1996 and 2004 ($p < 0.000$), but not significant between 1996 and 2005.

Like total CPUE, mean TL and mean biomass, channel catfish total biomass (weight in kg) per hour of electrofishing rose again between 2004 and 2005, reflecting the capture of large numbers of large sub-adult and young adult channel catfish on the fall 2005 Adult Monitoring trip (Figure 33).

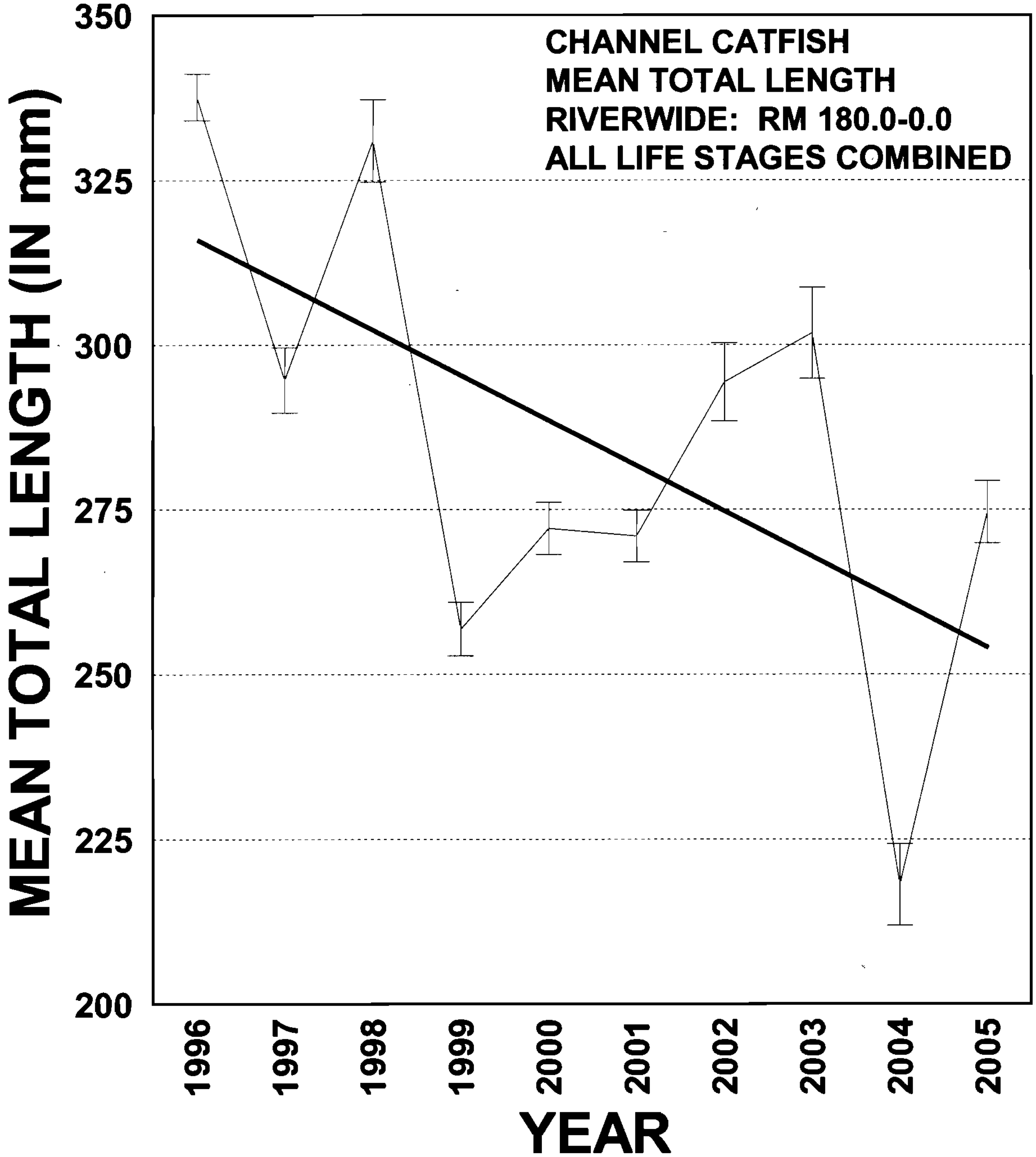

Figure 32. Mean total length (in mm) of channel catfish riverwide (RM 180.0-0.0) on fall Adult Monitoring trips in the San Juan River. Error bars represent one standard error. The sloping horizontal line represents the long-term trend in mean total length.

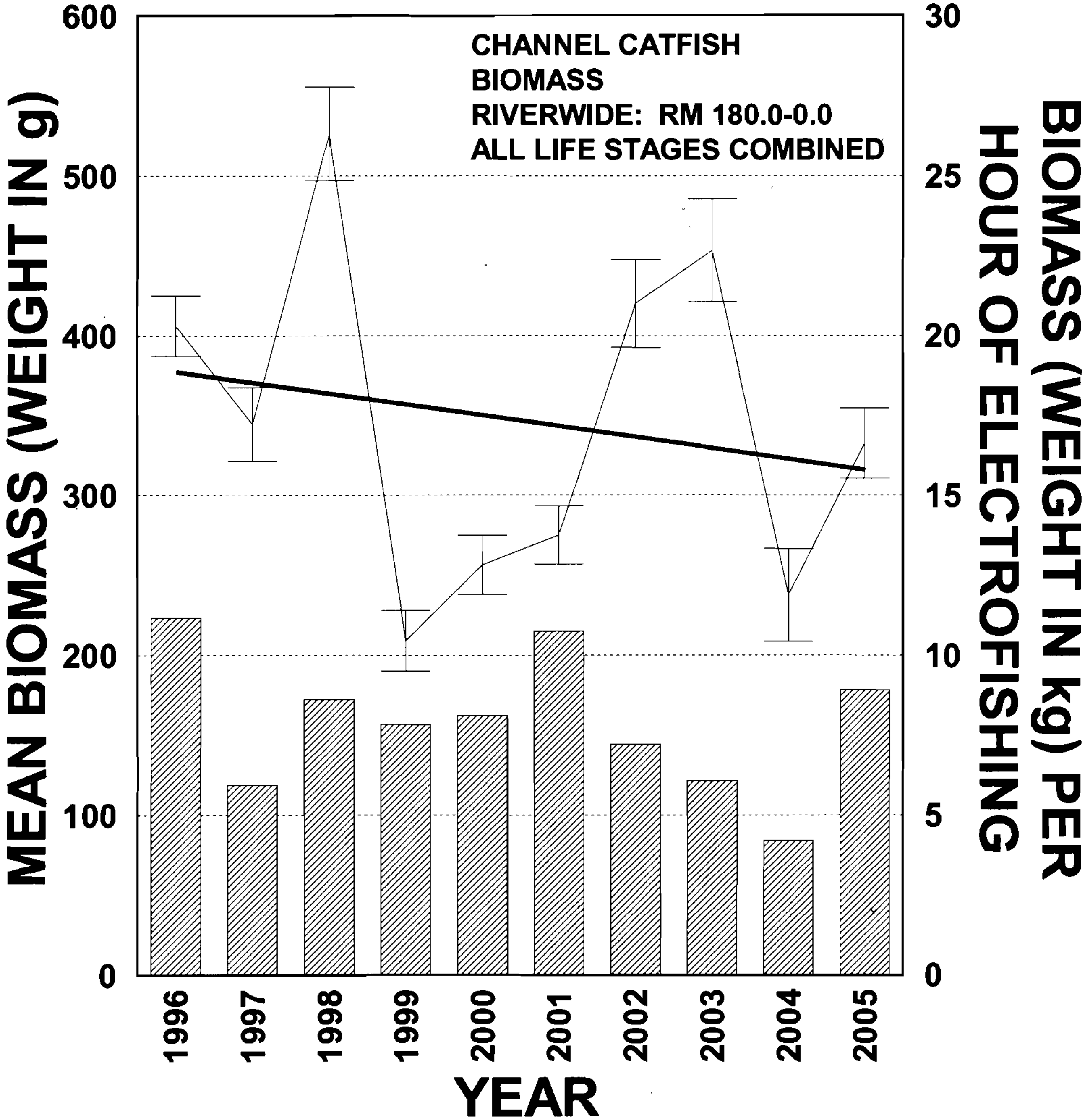

Figure 33. Mean biomass (weight in g; line connecting error bars) and total biomass (weight in kg; cross-hatched vertical bars) per hour of electrofishing of channel catfish riverwide (RM 180.0-0.0) on fall Adult Monitoring trips in the San Juan River. Error bars represent one standard error. The sloping horizontal line represents the long-term trend in mean biomass.

Common Carp

Catch Per Unit Effort (CPUE)

Common carp dropped to being the sixth most commonly-collected fish (behind flannelmouth sucker, bluehead sucker, channel catfish, speckled dace and red shiner) on the fall 2005 Adult Monitoring trip (Table 3, Figure 34). This marks only the second time (in 2004 and 2005) since Adult Monitoring studies began in 1991, that common carp have not been among the four most commonly-collected fish on a fall Adult Monitoring trip (Figure 34; Ryden 2000). A total of only 297 common carp were collected riverwide during the fall 2005 Adult Monitoring trip (Table 3). As a point of comparison, on an Adult Monitoring trip in 1998, 77 individual common carp were collected in a single electrofishing sample (from RM 163-162 = 1.0 total RM's of electrofishing; D. Ryden unpublished data). On the fall 2005 Adult Monitoring trip, less than four times that number were collected in 210 electrofishing samples (210.4 total RM's of electrofishing).

Common carp have composed less of the total catch in each consecutive year since 1997, dropping to a low of 2.33% of the total catch in 2005 (Figure 34). Common carp were collected in only 54.76% of all electrofishing collections in 2005, compared to being collected in 82.99%-89.14% of all electrofishing collections riverwide between 1996 and 2002 (Figure 34).

The decline in common carp abundance riverwide was reflected in a significant ($p < 0.000$) drop in CPUE among adult common carp between 1996 and 2005 (from 14.67 fish/hr to 2.95 fish/hr; Figure 35). During this same period, CPUE among juvenile common carp riverwide significantly increased in 2000, 2002, and 2004 (Figure 35). However, these pulses of juvenile fish did not seem to last more than one year and have not led to a comeback in numbers of adult fish, leading me to believe that most of the juvenile common carp seen in these large pulses are not recruiting into adulthood. Juvenile common carp CPUE riverwide in 2005 was low (0.52 fish/hr of electrofishing) and not significantly different than it was in 1996 (Figure 35).

The declining trend in adult common carp CPUE over the last ten years has been the most pronounced in Reach 6 (Figure 36). However, the long-term trend in CPUE among adult common carp has declined in all six river reaches over the last ten years (Figures 36-38). The recent spikes in CPUE among juvenile common carp occurred mostly in upstream river reaches (i.e., Reaches 6-4; Figures 36-38). Even with the declines in numbers of adult common carp riverwide, the remaining common carp population is still dominated by adult fish in all river reaches (Figures 36-38). As stated before the semi-regular spikes in juvenile common carp CPUE do not seem to endure over several consecutive years in any given river reach, nor do these young fish appear to be bolstering the adult population in any specific river reach. It would appear that nonnative fish removal efforts have had a profound and measurable impact on the San Juan River's common carp population.

Length Frequency And Mean Total Length

From 1996-1999, riverwide length-frequency histograms of common carp showed a population whose main channel component was based almost completely around large, adult fish (> 375 mm TL; Figure 39). However, in four of the last six years (i.e., in 2000, 2002, 2004, and 2005) there have been relatively large (but short-lived) influxes of juvenile fish into the San Juan River common carp population (Figures 39 and 40). These relatively large

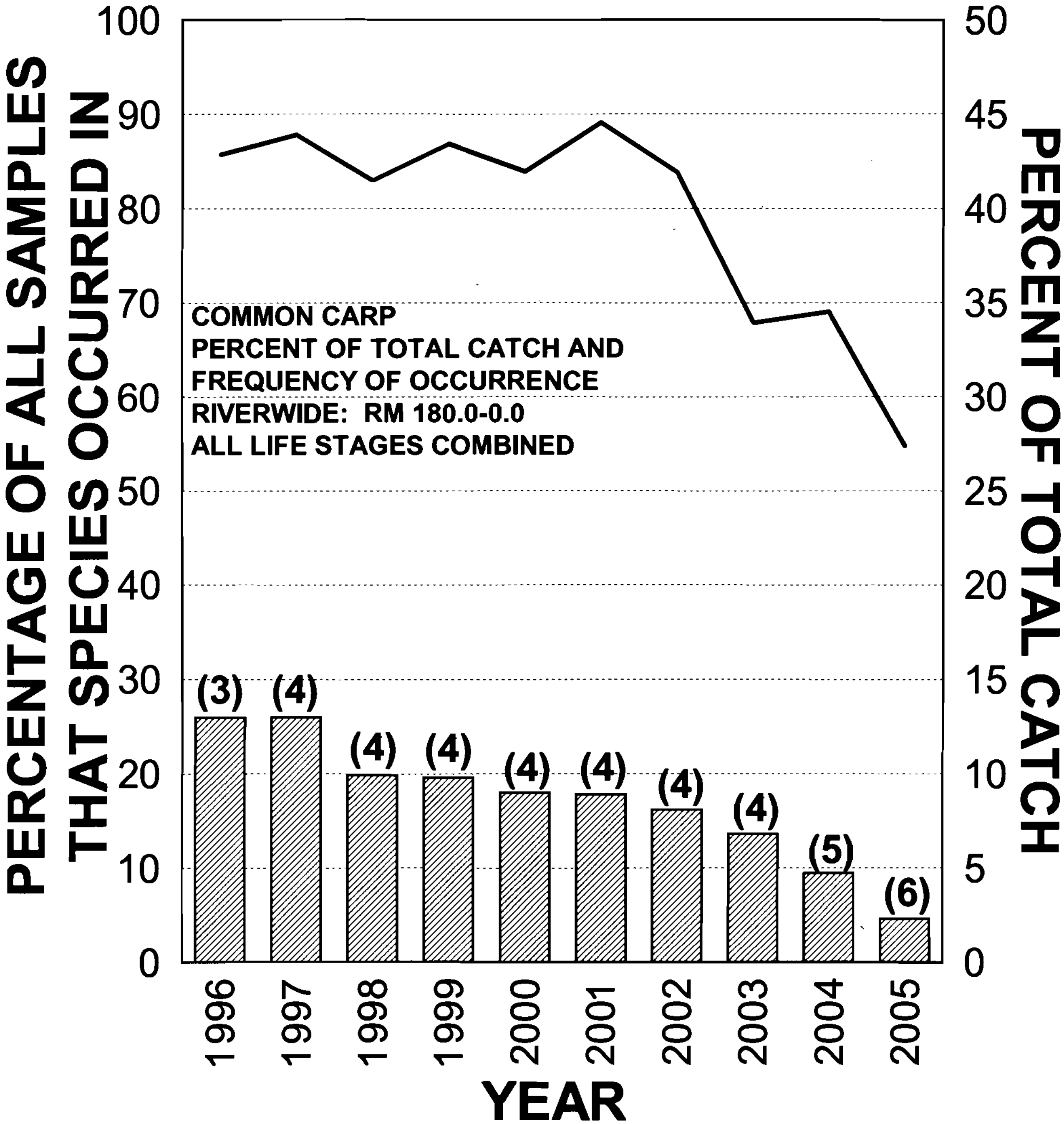

Figure 34. A summary of common carp relative abundance in riverwide Adult Monitoring collections, 1996-2005. The solid black line represents the percentage of all electrofishing samples on a given Adult Monitoring trip in which this species occurred (i.e., frequency of occurrence). The shaded bars represent the percent of the total catch that this species composed in a given year. The parenthetic numbers indicate the numeric rank for this species in a given year relative to all other fish species collected.

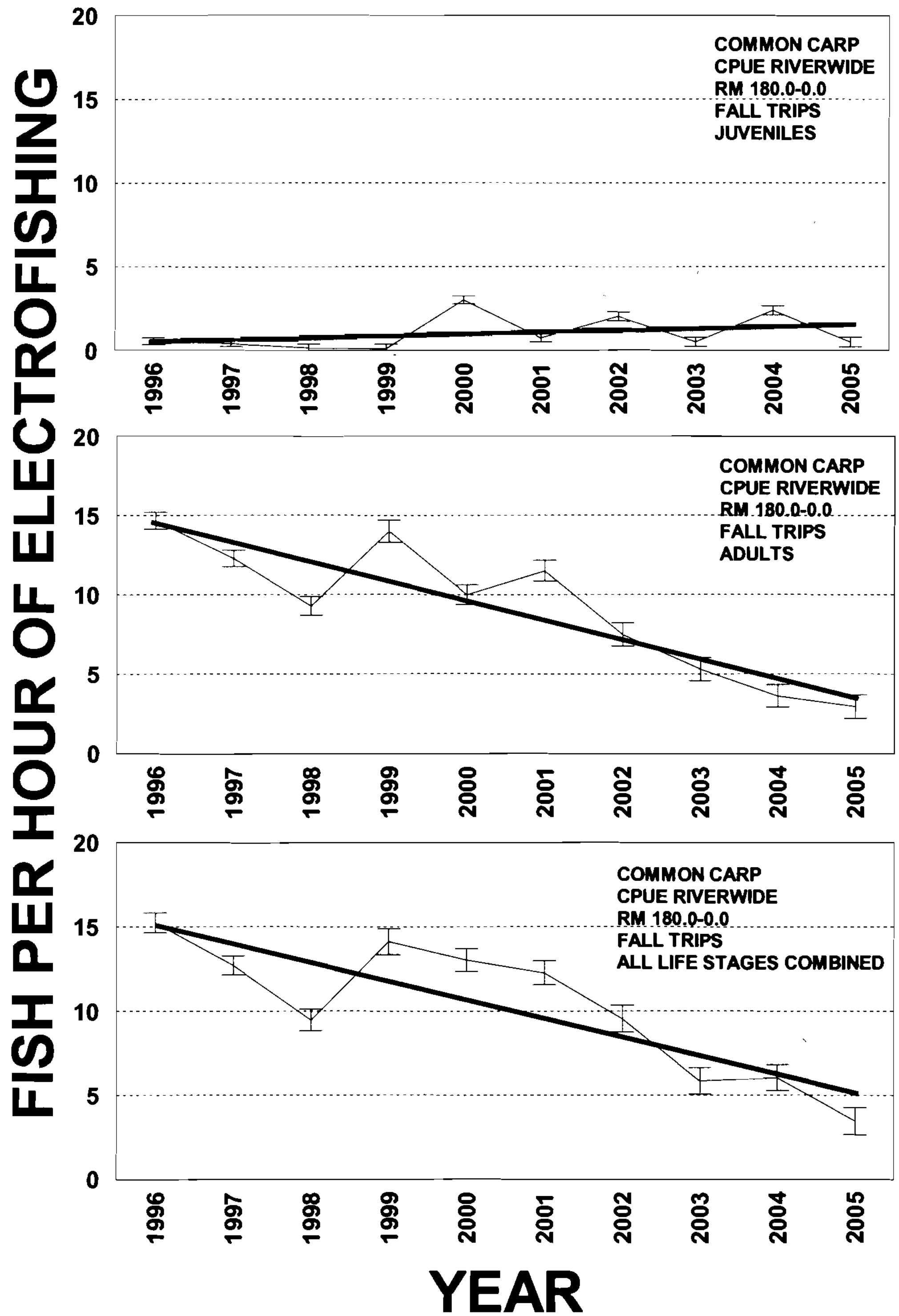

Figure 35. Common carp catch per unit effort (CPUE) riverwide (RM 180.0-0.0) on fall Adult Monitoring trips, for juvenile fish (< 250 mm TL; top), adult fish ($\geq$ 250 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

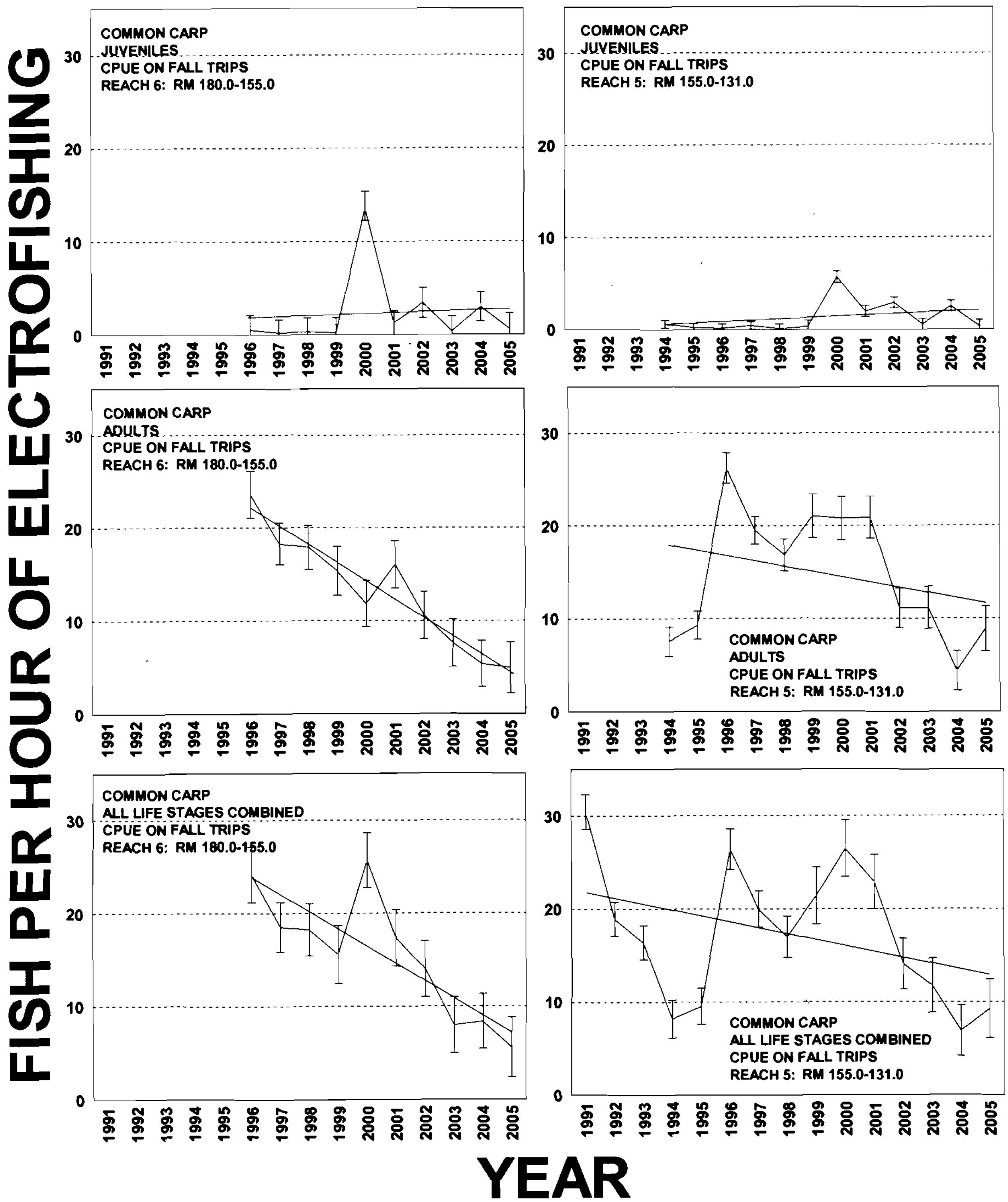

Figure 36. Common carp catch per unit effort (CPUE) in Reach 6 and Reach 5 on fall Adult Monitoring trips for juvenile fish (< 250 mm TL; top), adult fish ($\geq$ 250 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

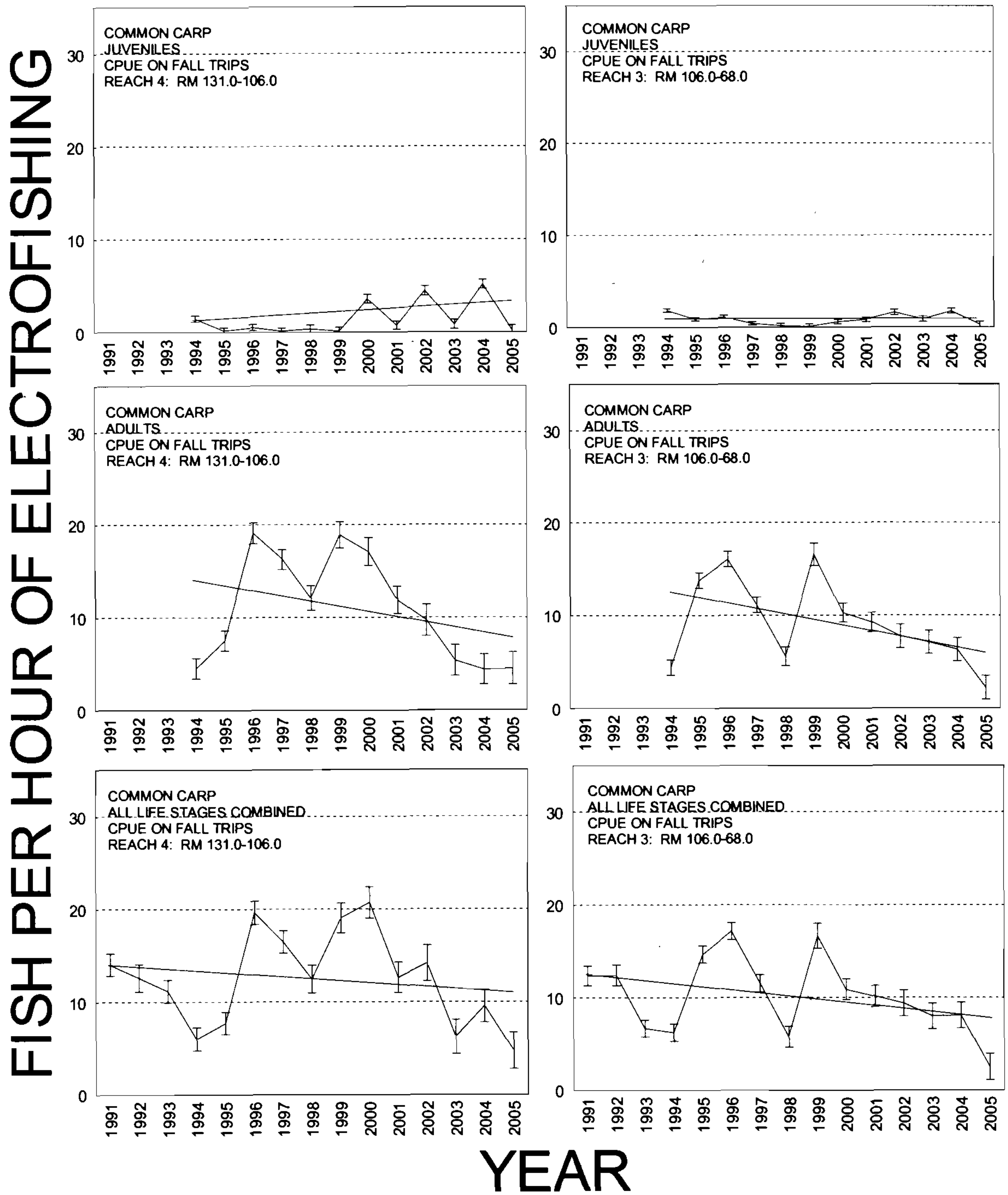

Figure 37. Common carp catch per unit effort (CPUE) in Reach 4 and Reach 3 on fall Adult Monitoring trips for juvenile fish (< 250 mm TL; top), adult fish (≥ 250 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

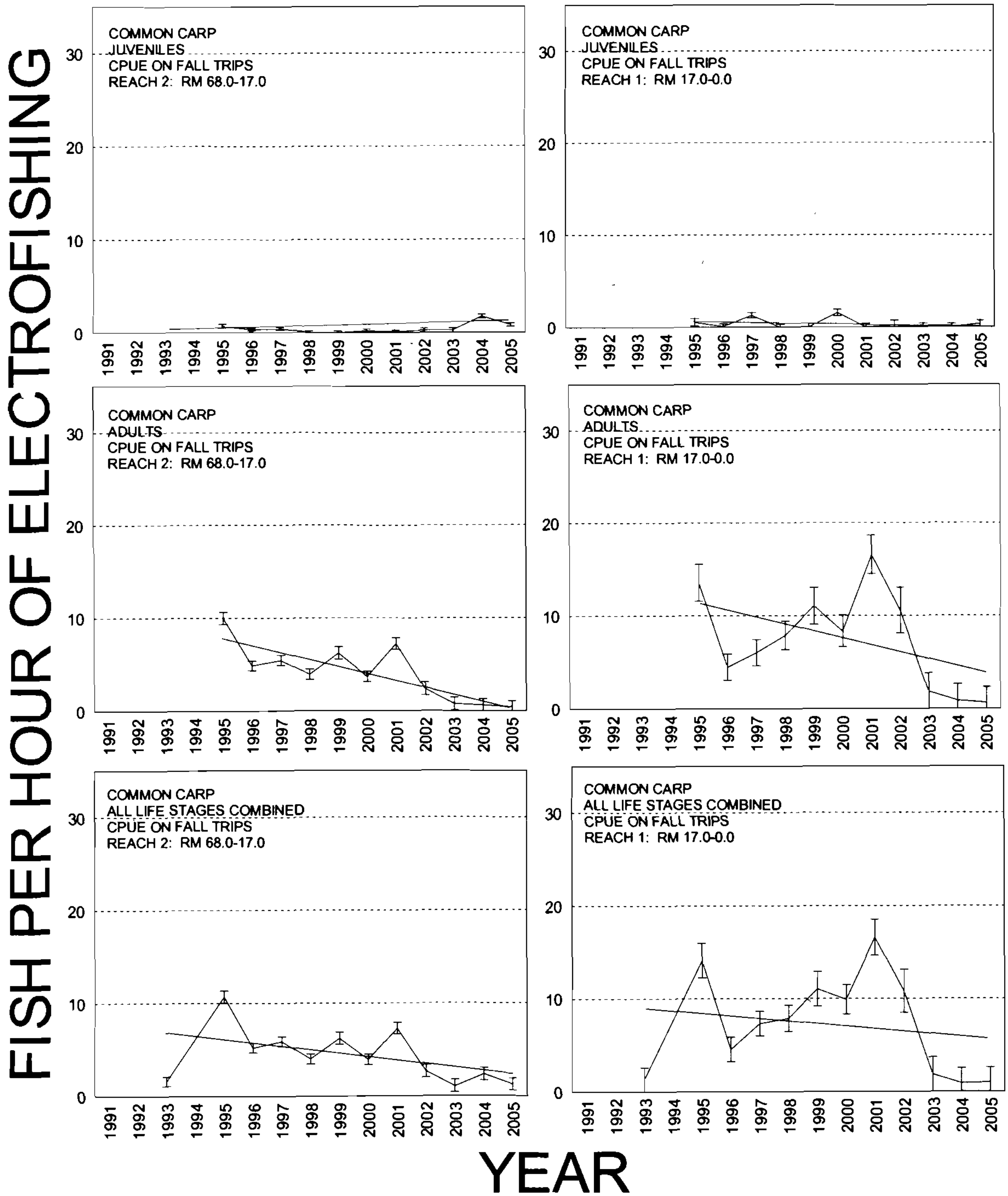

Figure 38. Common carp catch per unit effort (CPUE) in Reach 2 and Reach 1 on fall Adult Monitoring trips for juvenile fish (< 250 mm TL; top), adult fish (≥ 250 mm TL; middle), and for all life stages combined (juveniles + adults; bottom). Error bars represent one standard error. Sloping horizontal lines represent the long-term trend in CPUE.

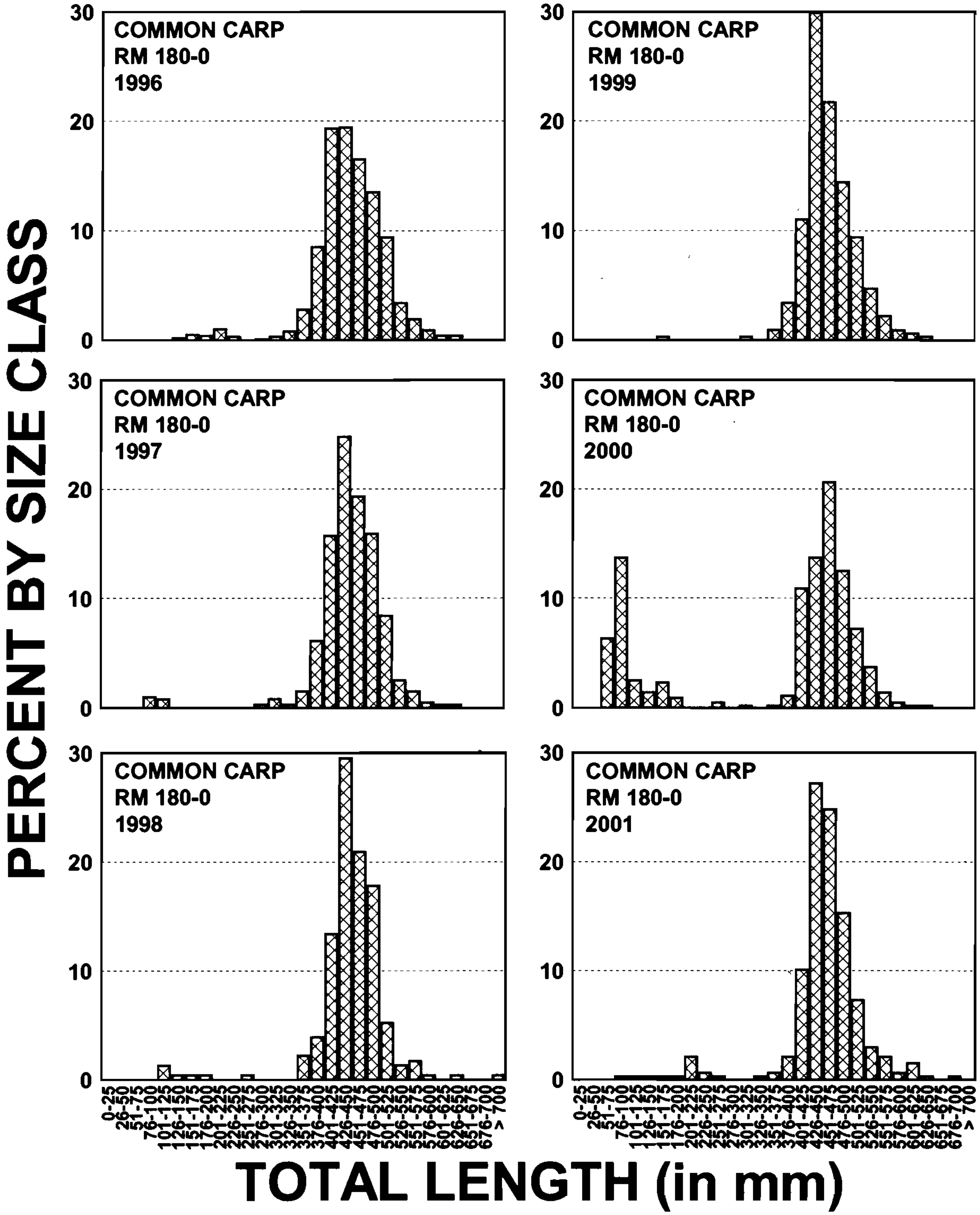

Figure 39. Length-frequency histograms showing the riverwide (RM 180.0-0.0) size-class distribution of common carp on fall Adult Monitoring trips in the San Juan River, 1996-2001.

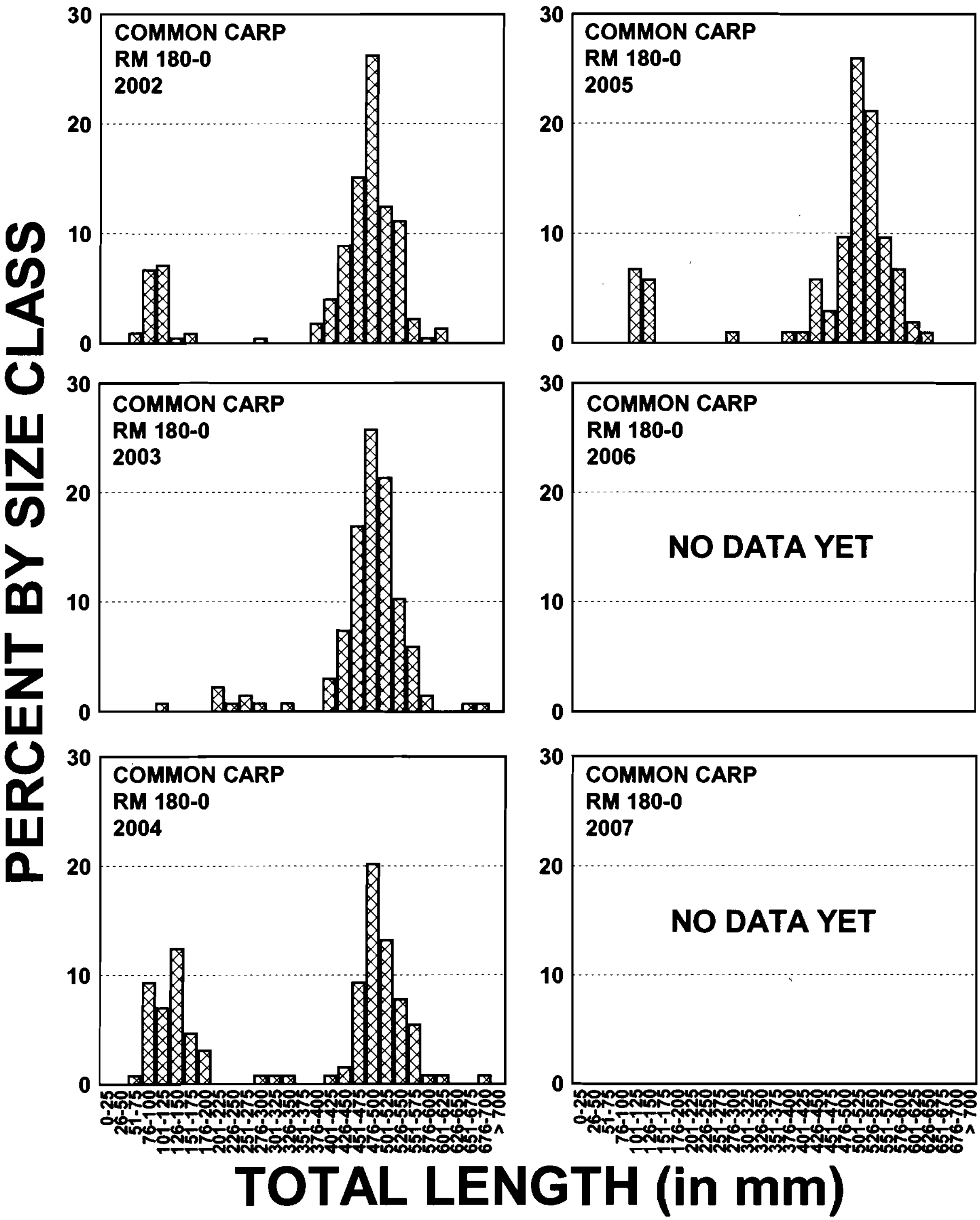

Figure 40. Length-frequency histograms showing the riverwide (RM 180.0-0.0) size-class distribution of common carp on fall Adult Monitoring trips in the San Juan River, 2002-2005.

influxes of juvenile fish may be the result of compensatory reproductive efforts, associated with a drop in numbers of adult fish riverwide, caused by mechanical removal efforts. However, unlike in the channel catfish population (where this same type of phenomenon seems to have occurred from 1999-2001 and may be occurring again in 2004 and 2005), where juvenile fish now compose fully 63.4% of the population riverwide and accounted for 16.89 fish/hr of electrofishing in 2005 (Figure 25), juvenile common carp are still considerably more rare, composing only 14.5% of the population and accounting for only 0.52 fish/hr of electrofishing in 2005 (Figure 35). The reason that the periodic influxes of juvenile common carp have been so noticeable in the riverwide length-frequency histograms (Figures 39 and 40) since 2000 is due to the steadily decreasing numbers of adult fish over the last several years (Figure 35-38).

Despite the relative increasing percentage of juvenile fish within the San Juan River common carp population over the last ten years, large, adult common carp (> 425 mm TL) still continue to be the most commonly-collected size-class (Figures 39, 40, and 41). In fact, as the relative numbers of adult fish decline, the adult fish that are remaining in the river are apparently becoming larger (Figures 41 and 42). The most frequently-collected size-class of common carp in 2005 was fish from 500-525 mm TL (Figure 41). This was up from 2002-2004, when the most frequently-collected size-class of common carp were fish that were 476-500 mm TL (Figure 41). And those three years were an increase over the period 1996-2001, when the most commonly-collected size-class (with the exception of 2000) were fish that were 426-450 mm TL (Figure 41).

The relatively large influxes of juvenile fish in 2000, 2002, 2004, and to a lesser extent in 2005 are clearly associated with declines in common carp mean TL riverwide in those same years (Figure 42). If these years are excised from the riverwide mean TL graphic, it can be clearly seen that the average size of common carp riverwide (which was based almost completely on adult fish in the remaining six years) has shown a marked increasing trend over the last ten years (Figure 42).

<u>Biomass</u>

Like mean TL, common carp mean biomass (weight in g) riverwide saw drops in 2000 and 2004, associated with the influxes of juvenile fish (Figure 43). With the exception of those two years, there has been a generally increasing trend in common carp mean TL riverwide between 1996 and 2003 (Figure 43). This is because adult common carp are so much larger and heavier than their juvenile counterparts that even in years when there are relatively large numbers of juvenile fish present (i.e., 2000, 2002, 2004, 2005) the mean biomass of these larger adult fish masks the smaller fish and tends to drive the trends seen in the mean biomass profile riverwide. The increasing trend in mean biomass riverwide (Figure 43) over the last ten years also attests to the fact that the adult common carp that remain in the San Juan River are not only getting larger, but heavier as well. This rise in mean biomass of common carp riverwide was statistically significant between 1996 and 2005 ($p < 0.000$).

Unlike mean biomass, total biomass (weight in kg) per hour of electrofishing riverwide has been steadily declining over the last four years and reached an all-time observed low in 2005 of 6.05 kg/hr of electrofishing; Figure 43). This is directly associated with the overall decline in adult common carp CPUE riverwide (Figure 35).

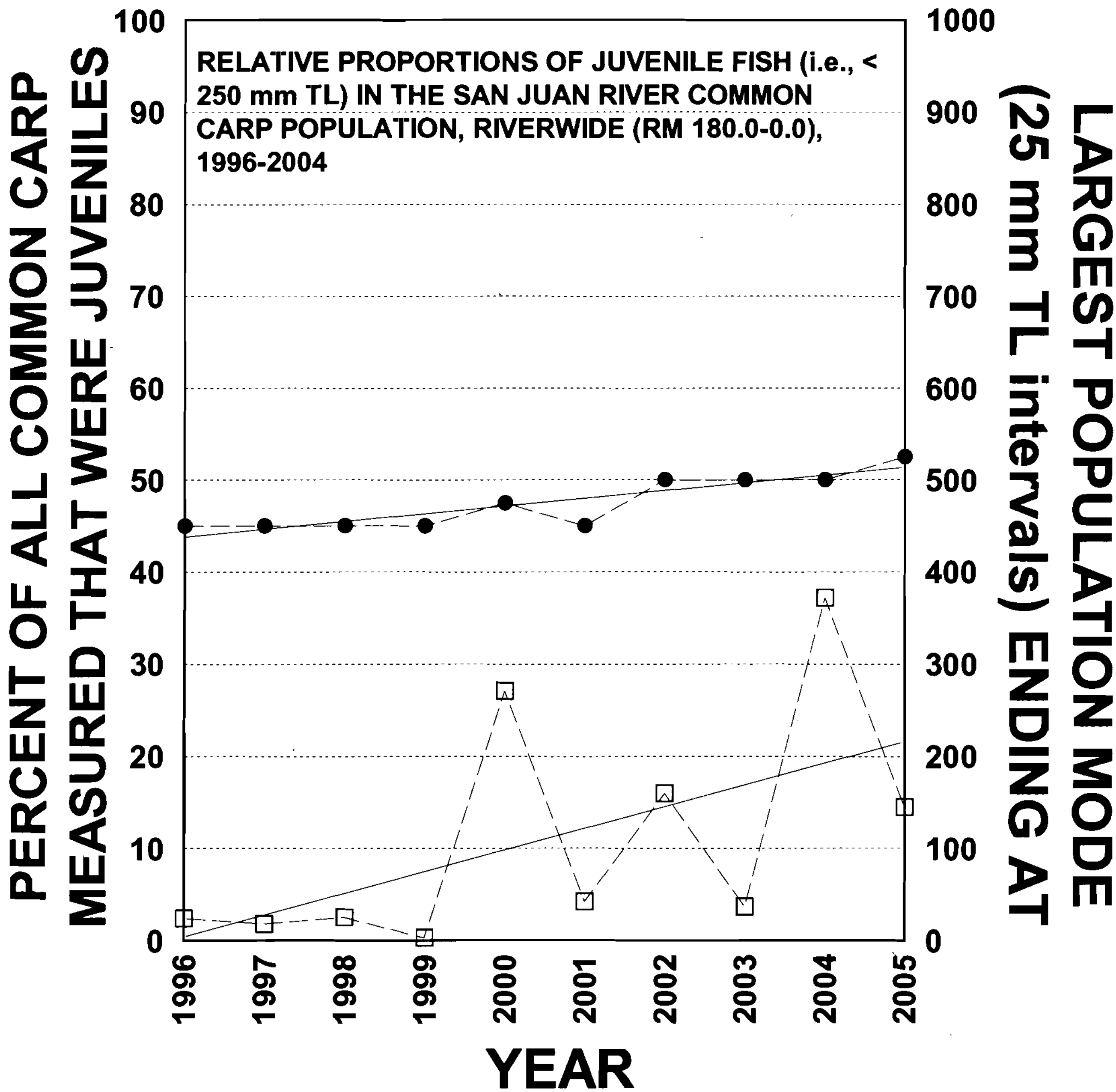

Figure 41. The relative proportion of juvenile fish (< 250 mm TL) observed among common carp collected and measured from the San Juan River, 1996-2005. The bottom dashed line (with open squares) represents the percent of all measured common carp in a given year's samples that were juveniles. The top dashed line (with solid circles) represents the TL at which the largest population mode (from Figures 39 and 40), ended at. Therefore, the 2002-2004 values represent 476-500 mm TL, the 1996-1999 values represent 426-450 mm TL, and so on. The solid sloping lines (top and bottom) represent the long-term trends for these two metrics.

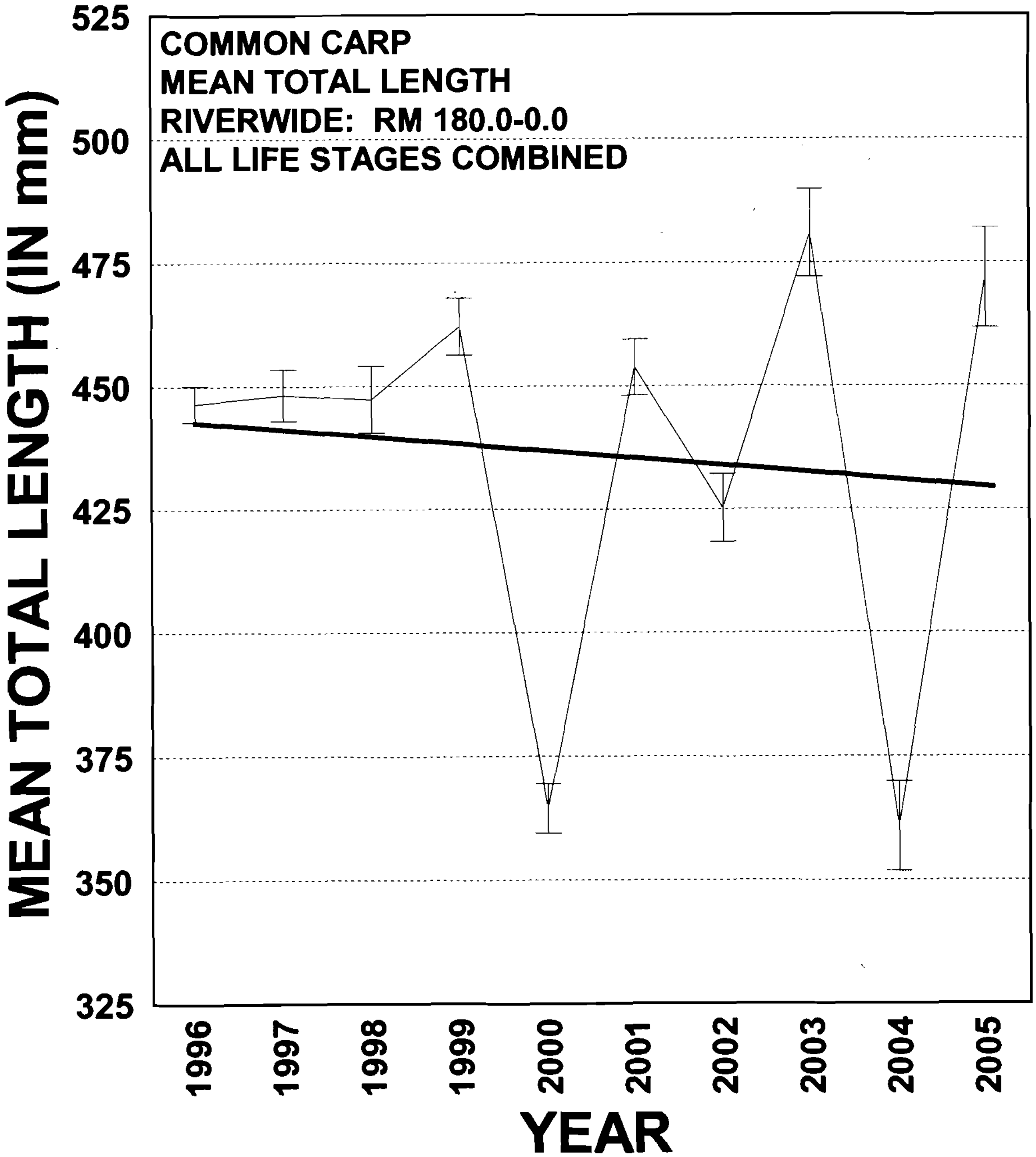

Figure 42. Mean total length (in mm) of common carp riverwide (RM 180.0-0.0) on fall Adult Monitoring trips in the San Juan River. Error bars represent one standard error. The sloping horizontal line represents the long-term trend in mean total length.

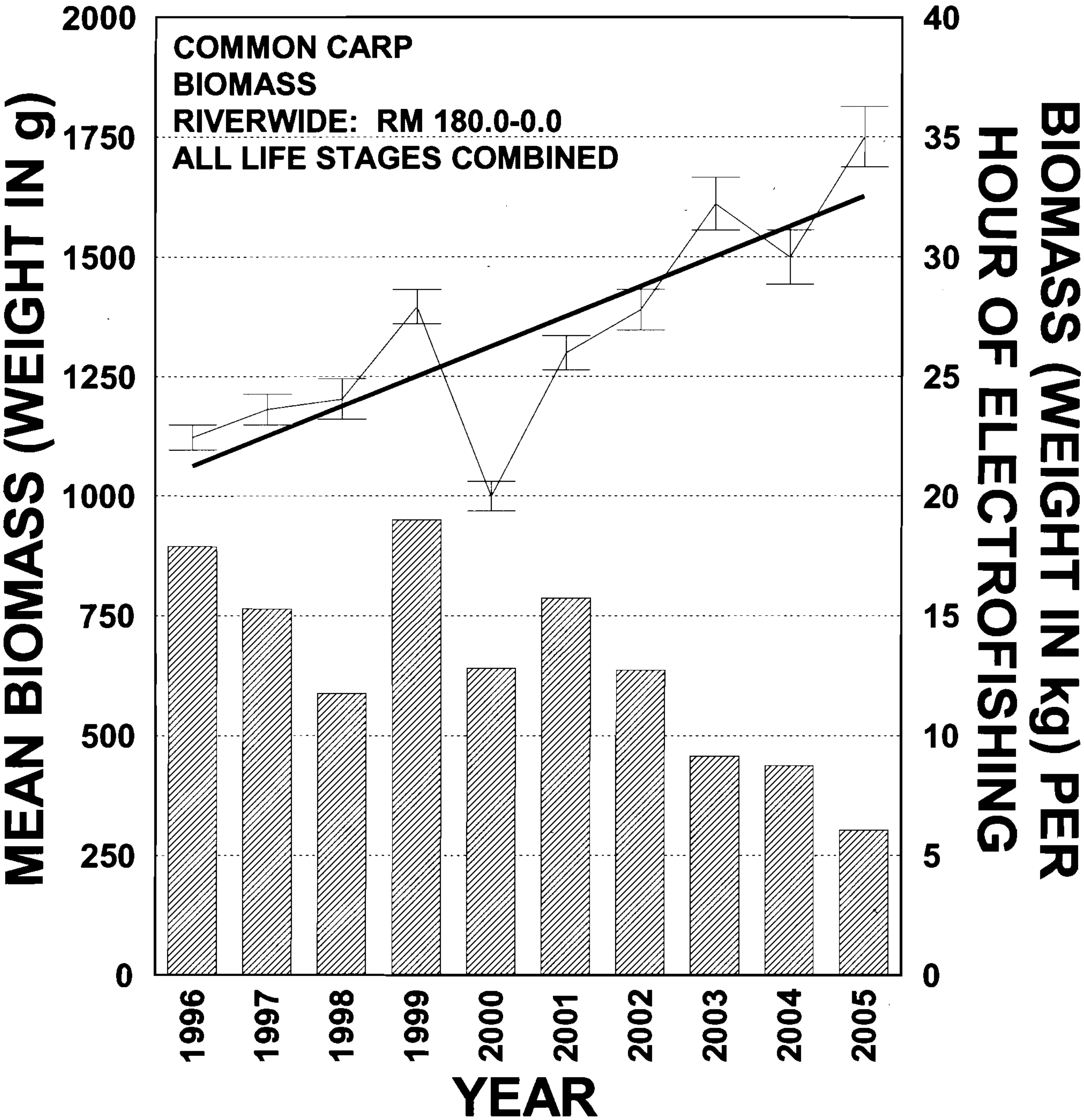

Figure 43. Mean biomass (weight in g; line connecting error bars) and total biomass (weight in kg; cross-hatched vertical bars) per hour of electrofishing of common carp riverwide (RM 180.0-0.0) on fall Adult Monitoring trips in the San Juan River. Error bars represent one standard error. The sloping horizontal line represents the long-term trend in mean biomass.

Other Nonnative Fishes

Largemouth Bass, Striped Bass, and Walleye

A total of nine largemouth bass (all juveniles) were collected during the fall 2005 Adult Monitoring trip (Tables 3 and 8). Collections of largemouth bass ranged from RM 175.0—80.0 and fish ranged in size from 76-207 mm TL. Of the nine juvenile largemouth bass collected, seven were collected in Reach 6, one was collected in Reach 5, and one was collected in Reach 3. Eight (76.3%) of the nine were collected upstream of RM 154.0.

As in years past, it would seem that the point of origin of these fish is upstream of Shiprock, NM. The complete lack of adult largemouth bass in electrofishing collections would seem to suggest that these fish are coming from an off-channel source, and not being spawned in the river itself. The lack of appreciable numbers of largemouth bass from year to year (Table 8) and the apparent lack of recruitment would also seem to indicate that these fish are not surviving for long periods of time in the mainstem San Juan River (i.e., they are transient members of the mainstem river's fish community).

Once again, no striped bass or walleye were collected during Adult Monitoring collections in 2005 (Table 8). The formation of three separate waterfalls (J. Jackson, pers. comm.) downstream of Clay Hills boat landing (Clay Hills = RM 2.9) since 2003 seems to have effectively isolated the lower San Juan River from Lake Powell, thereby preventing predatory fish from Lake Powell from invading the San Juan River.

White Sucker and White Sucker Hybrids

As in past years, white sucker and hybrids between white sucker and native suckers (either flannelmouth sucker or bluehead sucker) were rare in fall 2005 Adult Monitoring collections. A total of two white sucker, two white sucker X bluehead sucker hybrids, and one white sucker X flannelmouth sucker hybrid were collected in 2005 (Table 3). Both white sucker were juvenile fish (TL = 227 mm, collected at RM 161.0-160.0; TL = 188 mm, collected at RM 57.0-56.0). The two white sucker X bluehead sucker hybrids were both juvenile fish as well (TL = 129 mm and 139 mm, both collected at RM 173.0-172.0). The white sucker X flannelmouth sucker hybrid was also a juvenile fish (TL = 277 mm, collected at RM 180.0-179.0).

As in past years, most of the white sucker or white sucker hybrids collected in 2005 were collected in Reach 6 upstream of Shiprock, near Farmington, NM. As with largemouth bass, the lack of appreciable numbers of white sucker and their hybrids from year to year and the dearth of adult fish seem to indicate that these fish are not surviving for long periods of time in the mainstem San Juan River (i.e., they are transient members of the mainstem river's fish community). These fish are likely entering the San Juan from tributaries higher in the system (e.g., the Animas River) that have population of white sucker already established in them.

Table 8. A comparison of numbers of fish collected and riverwide catch per unit effort (CPUE), for largemouth bass, striped bass, and walleye collected during Adult Monitoring trips in the San Juan River, 1996-2005.

Year	Number Of Hours Of Electrofishing	Total Numbers Collected, Life Stages[a], And (CPUE) By Species		
		Largemouth Bass	Striped Bass	Walleye
1996	165.41	Total = 16 J=16 (0.10/hr)	Total = 14 A=14 (0.08/hr)	Total = 21 A=21 (0.13/hr)
1997	166.01	Total = 2 A=2 (0.01/hr)	Total = 0 (0.00/hr)	Total = 9 J=5/A=4 (0.05/hr)
1998	137.15	Total = 5 J=5 (0.04/hr)	Total = 17 J=6/A=11 (0.12/hr)	Total = 6 J=1/A=5 (0.04/hr)
1999	88.36	Total = 0 (0.00/hr)	Total = 0 (0.00/hr)	Total = 9 A=9 (0/10/hr)
2000	116.89	Total = 111 J=109/A=2 (0.95/hr)	Total = 109 J=1/A=108 (0.93/hr)	Total = 7 A=7 (0.06/hr)
2001	109.61	Total = 2 J=2 (0.02/hr)	Total = 2 A=2 (0.02/hr)	Total = 1 A=1 (0.01/hr)
2002	92.17	Total = 7 Y=1/J=2/A=4 (0.08/hr)	Total = 0 (0.00/hr)	Total = 0 (0.00/hr)
2003	94.42	Total = 2 J=2 (0.02/hr)	Total = 0 (0.00/hr)	Total = 0 (0.00/hr)
2004	93.75	Total = 59 J=59 (0.63/hr)	Total = 0 (0.00/hr)	Total = 0 (0.00/hr)
2005	85.95	Total = 9 J=9 (0.10/hr)	Total = 0 (0.00/hr)	Total = 0 (0.00/hr)

a Y= Young-Of-The-Year; J= Juvenile; A= Adult

DISCUSSION

Rare Native Fishes

Colorado Pikeminnow

No wild adult Colorado pikeminnow were collected during any 2005 sampling trip or study. Additionally, no wild-produced larval Colorado pikeminnow were collected in 2005.

A total of 127 individual juvenile Colorado pikeminnow were recaptured during the fall 2005 Adult Monitoring trip. This marks only the third time that > 100 Colorado pikeminnow were collected on an Adult Monitoring trip (n = 104 in 1998 and n = 159 in 2004). Three different year-classes of Colorado pikeminnow were collected on the fall 2005 Adult Monitoring trip. The large majority of recaptured fish (n = 75) were age-1 fish. Sixty-four of these age-1 fish had been stocked as age-0 fish in the fall of 2004, while another 11 had been stocked as age-1 fish on 7 July 2005. The second largest group of recaptured fish in 2005 (n = 50) were age-2 fish. Thirty-nine of these age-2 fish had been stocked as age-0 fish in the fall of 2003, while another 11 had been stocked as age-2 fish on 7 July 2005. The smallest group were age-3 fish (n = 2). One of the age-3 recaptures had been stocked as age-0 fish in the fall of 2002, while the other had been stocked as an age-2 fish on 9 June 2004.

Based on the total numbers of Colorado pikeminnow stocked since the fall of 2002 and potentially available for recapture, the age-1 fish stocked as age-0 fish in the fall of 2004 made up 41.8% of all fish available to be recaptured, but accounted for 50.4% of the total catch in 2005. The age-1 fish stocked as age-1 fish on 7 July 2005 made up just 0.07% of all fish available to be recaptured, but accounted for 8.7% of the total catch in 2005. However, this should be tempered by the fact that these fish had only been in the river between 74 and 93 days when they were sampled on the fall 2005 Adult Monitoring trip and hadn't had to undergo the rigors that the other groups of available Colorado pikeminnow had already experienced and survived. The age-2 fish stocked as age-0 fish in the fall of 2003 made up 26.2% of all fish available to be recaptured, but accounted for 30.7% of the total catch in 2005. The age-2 fish stocked as age-2 fish on 7 July 2005 made up just 0.2% of all fish available to be recaptured, but made up 8.7% of the total catch in 2005. Again, this should be tempered by the fact that these fish had only been in the river between 74 and 93 days when they were sampled on the fall 2005 Adult Monitoring trip and hadn't had to undergo the rigors that the other groups of available Colorado pikeminnow had already experienced and survived. The age-3 fish stocked as age-0 fish in the fall of 2002 made up 31.4% of all fish available to be recaptured, but accounted for only 0.7% of the total catch in 2005. The age-3 fish stocked as age-2 fish on 9 June 2004 made up just 0.2% of all fish available to be recaptured, but accounted 0.7% of the total catch in 2005. So, fish from five of the six different stockings collected on the fall 2005 Adult Monitoring trip were collected in higher proportions than might be anticipated, based strictly on the number of fish originally stocked. The only group that seemed to be proportionally under-represented were the fish stocked as age-0 fish in the fall of 2002. Evidence from another study would also seem to indicate that survival/retention among that particular group of Colorado pikeminnow was poor when compared to other stockings (Golden and Holden 2005, M. Golden in prep.).

Total CPUE for Colorado pikeminnow declined slightly (but not significantly) between the fall 2004 and fall 2005 Adult Monitoring trips. This observed decline from 2004 to 2005 is likely related to the comparatively high spring discharge that occurred in 2005 (peaked at 13,200 CFS on 25 May 2005 at Shiprock USGS gage 09368000), an event that has not been duplicated or matched in the last several years. Despite this decline, total CPUE for Colorado pikeminnow riverwide was the second highest value ever observed. In addition, collections of Colorado pikeminnow continued to be widespread on the fall 2005 Adult Monitoring trip (i.e., from RM 178.0-5.0).

In addition to the Colorado pikeminnow collected on the fall 2005 Adult Monitoring trip, several hundred collections of stocked juvenile Colorado pikeminnow occurred on sampling trips for other studies throughout 2005.

Several potential sources of loss of stocked Colorado pikeminnow were identified in 2005. These include: 1) the collection of recently-stocked juvenile Colorado in the Hogback and Fruitland canals (L. Renfro pers. comm.); 2) the collection of a juvenile Colorado pikeminnow (296 mm TL) on 21 September between RM 125.0 and 124.0 that had a channel catfish bite mark completely encircling its dorsal fin (this fish had been in the river only 76 days at the time of its recapture; D. Ryden unpublished data); and 3) on 15 May 2005, two stocked juvenile Colorado pikeminnow (200 and 250 mm TL) were collected below the most upstream waterfall that now separates the lower San Juan River from Lake Powell (J. Jackson, pers. comm.).

In July of 2004, five stocked juvenile Colorado pikeminnow were collected in the lower Animas River (Zimmerman 2005). Despite sampling in the lower Animas River again in 2005, crews from the Southern Ute Indian Tribe and Bureau of Reclamation did not collect any Colorado pikeminnow in the lower Animas River (K. Lashmett, pers. comm.).

Recaptures of Colorado pikeminnow (1991 year-class) that were stocked as adults on 11 April 2001 continue, although the numbers of contacts with these fish continues to dwindle. None of these fish were collected during the fall 2005 Adult Monitoring trip. However, two individuals were recaptured during other studies in 2005. One (538 mm TL) was collected during nonnative fish removal efforts for the tenth time since it was stocked (J. Davis, pers. comm.). The other (650 mm TL) was recaptured in the PNM Fish Ladder (A. Lapahie, pers. comm.). This was the fifth recapture of this fish since it was stocked and its third time through the fish ladder.

Another adult Colorado pikeminnow was collected in 2005 (J. Davis, pers. comm.) by nonnative fish removal crews, but it is not known whether this was a stocked fish or a wild fish. Its size (603 mm TL) at the time of recapture (28 July 2005) would seem to indicate that this fish was likely between 9-11 years old (8-16 years old at the outside; M. Trammel, pers. comm.). This would mean that it likely was spawned between 1994 and 1996 (1989-1997 at the outside; M. Trammel, pers. comm.) and was very probably a long-term survivor of either the 1996 or 1997 experimental stockings of age-0 Colorado pikeminnow by UDWR (Table 4). However, this could have also been a wild-produced fish.

So, at present, there are Colorado pikeminnow from several different year-classes and stockings residing in the San Juan River. In addition, the distribution of these fish is widespread (i.e., from just below the Animas River confluence downstream to Lake Powell). However, even though CPUE of Colorado pikeminnow during the fall 2005 Adult Monitoring trip was the second highest value ever observed and numerous different year-classes of fish (including a few adults) were present in the river in 2005, there is still a need for caution when interpreting these results.

First, very few adult fish are being collected annually. Likewise collections of wild-produced larvae remain low or absent in most years. In addition, survival/retention between various groups of stocked fish seems to highly variable. Survival into the first year or two post-stocking seems to be relatively good among a few groups of recently stocked fish, but whether or not these fish will continue to survive and recruit remains to be seen.

Several sources of post-stocking loss among stocked Colorado pikeminnow have been identified over the last several years. These include: 1) entrainment of recently-stocked fish into canals (Archer et al. 2000, L. Renfro pers. comm.); 2) the loss of large numbers of stocked fish within the first 36-72 hours post-stocking due to either stocking stress or differences in water quality between the hatchery and the river appears to have been an issue in the fall of 2003 (Golden and Holden 2005); 3) adverse interactions between stocked Colorado pikeminnow and nonnative ictalurids, including predation (Jackson 2005), aggression (documented herein), or choking (e.g, Ryden and Smith 2002, Lapahie 2003); and 4) the movement of stocked fish downstream and into Lake Powell (J. Jackson, pers. comm.).

It appears as if the San Juan River's wild Colorado pikeminnow population is now essentially gone. At best, a few older, adult fish may remain. Therefore, the artificial augmentation of this population using hatchery-produced fish (following Ryden 2003a) has become critically necessary. The documented losses of stocked fish, to various sources, within the first couple of years post-stocking is likely not anything unusual. Even among healthy populations of wild fish, very high mortality rates between spawning and recruitment into adulthood are the norm. Therefore, when employing hatchery-reared fish (which have even higher mortality rates than wild-produced fish) to augment the San Juan River Colorado pikeminnow population, it becomes very much a numbers game. Hopefully, if we stock Colorado pikeminnow in large enough numbers for enough consecutive years (while still working to remove impediments to their survival and long-term retention), the few survivors from several different years-classes, along with their wild-produced offspring, will combine to form a healthy, multi-year-class population.

Razorback Sucker

Stocked razorback sucker continue to persist throughout the San Juan River. Unfortunately, due to difficulties in obtaining and rearing razorback sucker for stocking, many fewer razorback sucker have been stocked to date than were originally planned (e.g., Ryden 2005b). This was the case again in 2005, when only 1,996 razorback sucker were stocked into the San Juan River (Ryden 2005b). However, despite falling well short of the annual stocking goal of 11,400 razorback sucker ≥ 300 mm TL (as specified in Ryden 2003c), 2005 represented the third largest group (numerically) of razorback sucker ever stocked into the San Juan River. Additionally, it was the second largest group of large (≥ 300 mm TL) razorback sucker ever stocked into the San Juan River.

Despite the comparative paucity of razorback sucker that have been stocked into the San Juan River, these fish continue to persist and grow. These fish have successfully spawned for eight consecutive years. Larval razorback sucker were collected in every year from 1998-2005 (e.g., Brandenburg et al. 2005; H. Brandenburg, pers. comm.). Unfortunately, no spawning aggregations of adult razorback sucker were identified in the San Juan River in 2005.

Despite the relatively small numbers of fish that have been stocked since 1994, trends in CPUE among stocked razorback sucker have been encouraging. CPUE among razorback sucker on the fall 2005 Adult Monitoring trip was the second highest ever recorded for an Adult Monitoring trip (at 0.62 fish/hr of electrofishing) and was significantly higher than seven of the previous nine years. Although razorback sucker total CPUE declined between the fall 2004 and fall 2005 Adult Monitoring trips, the 2005 total CPUE value was still twice as high as every other previous year, except 2004. As was the case with Colorado pikeminnow, the observed decline in razorback sucker total CPUE between 2004 and 2005 is likely related to the comparatively high spring discharge that occurred in 2005 (peaked at 13,200 CFS on 25 May 2005 at Shiprock USGS gage 09368000), an event that has not been duplicated or matched in the last several years. 2005 was the second consecutive year during which > 50 (n = 52) individual razorback sucker were collected on a fall Adult Monitoring trip.

Numerous stocked razorback sucker also continue to be collected throughout the San Juan River during sampling trips for other studies (J. Davis, pers. comm.; M. Golden, pers. comm.; J. Jackson, pers. comm., Y. Paroz, pers. comm.). In addition, there is evidence that razorback sucker spawned in the wild are beginning to recruit, albeit in small numbers. Three juvenile razorback sucker (174, 180, and 221 mm TL), suspected to be wild-spawned progeny of stocked razorback sucker, were collected in 2005 (J. Jackson pers. comm.). All three of these suspected wild juveniles were collected during nonnative fish removal efforts being performed by UDWR in the lower San Juan River (J. Jackson, pers. comm.). This is the third year during which wild-produced, post-larval razorback sucker were collected in the San Juan River. Stocked razorback sucker and their offspring continue to be found, longitudinally, throughout the San Juan River, as well as in the San Juan River arm of Lake Powell (Ryden 2005a; J. Jackson, pers. comm.). Razorback sucker now inhabit the San Juan River from the PNM Weir (Lapahie 2004; A. Lapahie, pers. comm.) to Lake Powell.

Some stocked razorback sucker are still being collected in the San Juan River up to nine years post-stocking. However, of 167 razorback recapture events examined from 2005, the large majority (n = 65; 98.8%) had been in the river less than five years. Further, 79.6% (n = 133) of these 167 recapture events occurred with fish that had been in the river less than two years (i.e., ≤ 600 days). Only two fish (1.2%) out of the 167 recapture events examined had been in the river longer than five years. This trend among recaptured razorback sucker can be at least partially explained by the fact that over the last two years (2004-2005) 4,984 razorback sucker have been stocked -- 38.8% of all fish stocked since 1994. Likewise, over the last five years (2001-2005) 6,699 razorback sucker have been stocked – 52.2% of all fish stocked since 1994. In this light, the fact that some razorback sucker are still being collected in the river as long as nine years post-stocking is encouraging. However, it does not change the fact that the increases in razorback sucker total CPUE observed in 2004 and 2005 are composed mostly of recently-stocked fish.

As was the case with hatchery-reared Colorado pikeminnow, pond-reared razorback sucker (≥ 300 mm TL) are likely survive in lesser numbers post-stocking than would wild fish of the same age- and size-classes. Since it appears that numbers of razorback sucker in the San Juan River are still relatively low and since survival and/or retention among stocked razorback sucker may drop off markedly at about four to five years post-stocking, then the continued annual stocking of large numbers of razorback sucker (up to 11,400 annually; Ryden 2003c) becomes critically important to the future health of this fish population in the San Juan River.

Roundtail Chub

Roundtail chub collections continue to be very rare during Adult Monitoring collections in the San Juan River. No roundtail chub were collected in the San Juan River during 2005 Adult Monitoring collections.

Common Native Fishes

Flannelmouth Sucker

Flannelmouth sucker are still the most abundantly-collected large-bodied fish species in the San Juan River. This species is consistently collected in > 90% of all electrofishing riverwide each year. Flannelmouth sucker are found throughout all six river reaches in the Adult Monitoring study area and are ubiquitous, occupying a multitude of habitat types. In addition, flannelmouth sucker of all life stages continue to be collected with regularity, showing that reproduction and recruitment are still occurring. Long-term trend lines show that despite year-to-year fluctuations observed in riverwide CPUE, the flannelmouth sucker population has remained relatively stable over the last ten years. However, CPUE data from Reaches 5-3 collected from 1991-1995 seem to indicate that while the San Juan River flannelmouth sucker population appears to be relatively stable over the last nine years (1996-2004), its overall abundance is less than what it likely was, riverwide, in the early 1990's.

Noticeable influxes of age-0 and age-1 fish were apparent in flannelmouth sucker length-frequency histograms over the last several years. This indicates that sizeable cohorts of flannelmouth sucker are in the process of recruiting into the adult population.

Bluehead Sucker

Since the early 1990's, bluehead sucker in the San Juan River have been heavily concentrated in upstream reaches of the river, specifically in Reach 6 of the Adult Monitoring study area. In most years, bluehead sucker total CPUE in Reach 6 is twice as high (sometimes as much as three times as high as in adjacent Reach 5, where they are next most abundant. In reaches downstream of Reach 5, bluehead sucker CPUE drops off very rapidly, with bluehead sucker usually becoming completely absent from Adult Monitoring collections by Reach 1. Therefore, "riverwide" trends in bluehead sucker CPUE are really driven by what occurs in Reach 6 and to a lesser extent in Reach 5. Given their heavy concentration in the most upstream reach of our study area, it seems likely that the dramatic fluctuations in bluehead sucker CPUE observed in Reach 6 over the last ten years are, at least in part, an artifact of the population in this reach being heavily influenced (e.g., via immigration and emigration) by bluehead sucker from adjacent upstream river sections (i.e., the Animas River and/or Reach 7).

Over the last five years, bluehead sucker have become more widely distributed, longitudinally, throughout the San Juan River. This species was the second most commonly-collected fish species during fall Adult Monitoring collections in each of the last four years. In 2005, bluehead sucker occurred in 83.3% of all electrofishing collections riverwide. In both 2003 and 2004, a small number of bluehead sucker were collected in Reach 1, adjacent to Lake

Powell. However, no bluehead sucker were collected from Reach 1 in 2005. This returns to the trend observed between 1993 and 2003, when no bluehead sucker were ever collected from Reach 1 during Adult Monitoring studies. Unlike the other three common large-bodied fish species, the long-term trend line for total CPUE riverwide for bluehead sucker has shown a noticeable (and statistically significant) increase over the last ten-year period.

The reason for the increased distribution of bluehead sucker in the San Juan River over the last ten years is unknown. The last four years corresponds nicely to the time when intensive nonnative fish removal efforts really began in earnest in both the upper (RM 166.6-147.9) and lower (RM 52.9-2.9) San Juan River, in 2001 and 2002 respectively. Nonnative fish removal efforts actually began in 1996, but between 1996 and 1999, they were fairly limited both in numbers of sampling trips and in the amount of river being repeatedly sampled. In 2001, nonnative fish removal efforts began intensively (ten trips per year with three passes per trip) in the upper portion of the San Juan River between PNM Weir and Buck Wheeler's property (RM 166.6-159.4), just upstream of the Hogback Diversion. Later, these efforts were expanded to include the section of river from Hogback Diversion downstream to Shiprock, NM (RM 158.6-147.9). In 2002, a similar intensive nonnative fish removal effort (ten trips per year with one pass per trip) began in the lower river downstream of Mexican Hat, UT (RM 52.9-2.9). However, whether the increased distribution and number of bluehead sucker riverwide is actually tied to nonnative fish removal efforts, or whether these two things are purely coincidental is unknown.

As was the case with flannelmouth sucker, bluehead sucker length-frequency histograms have shown noticeable cohorts of both age-0 and age-1 fish over the last several years. This indicates that there are healthy and abundant year-classes of young fish currently recruiting in the San Juan River bluehead sucker population.

Common Nonnative Fishes

Channel Catfish

For the fourth consecutive year, channel catfish were the third most commonly-collected species during fall Adult Monitoring collections. It appears as if the San Juan River channel catfish population is beginning to be noticeably impacted by nonnative fish removal efforts, at least in those sections of the river where these intensive efforts are ongoing. Channel catfish were only collected in 81.0% of all electrofishing collections riverwide in 2005, down from highs (occurring in 91.8%-94.4% of all electrofishing collections) observed between 1999 and 2001. In Reaches 6 and 1 (i.e., reaches completely encompassed by nonnative fish removal efforts), channel catfish total CPUE has either visibly declined or remained suppressed over the last ten years. With the removal of large numbers of adult channel catfish ($\geq$ 450 mm TL) over the last ten years, juvenile channel catfish have become increasingly numerically dominant in riverwide collections, accounting for 63.4% of all channel catfish collected in 2005. This is reflected in the significant drop in channel catfish mean TL riverwide between 1996 and 2005 (from 337.6 mm TL to 274.6 mm TL). The decline in adult CPUE riverwide, combined with a reduction in distribution and mean TL has almost certainly adversely affected the reproductive potential of this species riverwide.

Unfortunately, channel catfish are still widespread and abundant in the middle sections of the San Juan River (RM 147.9-52.9) between the two intensive nonnative fish removal sections. This large reservoir of fish allows the channel catfish population to remain both numerous and robust. This large reservoir of fish has also allowed channel catfish to seasonally reinvade at least the upper nonnative fish removal section (RM 166.6-147.9). The assumed compensatory reproductive influxes of juvenile fish observed from 1999-2001 (and possibly being observed again in 2004 and 2005) were centered in these middle sections of the San Juan River. The observed increase in channel catfish total CPUE between 2004 and 2005 is composed of both smaller juvenile as well as young adult channel catfish (i.e., those fish just beginning to recruit into the adult population).

Channel catfish have been documented to have adverse effects on the San Juan River's native fish community. They are documented predators of flannelmouth sucker, bluehead sucker, speckled dace, Colorado pikeminnow (Jackson 2005), and razorback sucker (Jackson 2005). They present a choking hazard when ingested by Colorado pikeminnow (Ryden and Smith 2002). They have also been implicated in attacking adult native suckers and Colorado pikeminnow. Circular or crescent-shaped "bite marks" found on all three native sucker species as well as on a juvenile Colorado pikeminnow (detailed in this report) are thought to be from channel catfish (Appendix A).

If the SJRIP is truly serious about nonnative fish removal, multi-pass removal efforts appear to be the way to go. On the fall 2004 Adult Monitoring trip, a total of 1,662 channel catfish were removed in a single pass from RM 180.0-2.9. Comparatively, USFWS-NMFRO nonnative fish removal crews removed 6,925 channel catfish from RM 166.6-147.9 in ten trips (three passes per trip) and UDWR-Moab nonnative fish removal crews removed 7,781 channel catfish from RM 52.9-2.9 in ten trips (one pass per trip) in much shorter river sections in 2004 (Ryden 2005a). The number of nonnative fish removed by supporting studies like Adult Monitoring or razorback sucker monitoring, while not inconsequential, is much lower than the numbers of fish that can be removed on multiple trips that specifically target nonnative fish species. If multi-pass nonnative fish removal efforts were initiated riverwide, then it would likely be possible to keep the large number of juvenile channel catfish (specifically those in Reaches 5-2) cropped back, so they do not become reproductively-active adults, while at the same time further reducing the number of mature adult fish that are currently remaining in the river. Even if nonnative fish removal efforts are not expanded, it is my recommendation that they not be terminated or scaled back. It is also my recommendation that opportunistic removal of all nonnative fishes encountered continues on all SJRIP studies.

Common Carp

In 2005, common carp fell to being the just the sixth most commonly-collected species on the fall Adult Monitoring trip. They were less abundant in 2005 Adult Monitoring collections than were either speckled dace or red shiner, two small-bodied fish species that can't really be well-sampled via raft-borne electrofishing. Common carp accounted for only 2.33% of the total catch in 2005 and were collected in barely half (54.8%) of all electrofishing samples riverwide. A total of only 297 common carp were collected during the fall 2005 adult Monitoring trip. As a point of comparison, on an Adult Monitoring trip in 1998, 77 individual common carp were collected in a single electrofishing sample (from RM 163-162 = 1.0 total RM's of electrofishing). On the fall 2005 Adult Monitoring trip, less than four times that number were collected in 210 electrofishing samples (210.4 total RM's of electrofishing).

The San Juan River common carp population (at least the portion we collect on fall Adult Monitoring trips) has always been dominated by large adult fish. However, numbers of adult common carp have been declining in almost every river reach for at least three to four years and longer than that in Reach 6. The result is that the riverwide CPUE for adult common was at the lowest value ever observed in 2005. Between 1999 and 2005, juvenile common carp CPUE riverwide have had several marked spikes in CPUE. However, these spikes in juvenile common carp CPUE do not seem to be sustained from year to year and they do not seem to have led to a comeback in numbers of adult common carp.

One interesting characteristic among the remaining common carp in the San Juan River is that as they become less abundant, the adults that remain in the river are becoming both larger (a longer mean TL) and heavier (a higher mean weight). It would not seem as if common carp were food-limited (i.e., stunted) when they were more abundant, yet is does seem somewhat suspicious that as they have declined significantly in numbers, the remaining adult fish are becoming significantly larger. This is usually a sign that some limiting factor has been removed from the population.

The exact causes of the large-scale decline in adult common carp CPUE riverwide through 2005 are unknown. However, some speculation on the life history of this species may lend some clues. As adults, common carp tend to be long-lived and almost invulnerable to predation by other fishes common in the San Juan River. However, as adults, common carp need access to shallow, warm, flooded areas with vegetation in order to successfully reproduce (e.g., areas such as flooded vegetation, backwaters, oxbows, etc.). These shallow out-of-channel habitats are rare in the San Juan River even during high flow years, but with the dearth of out-of-bank flows over the last five plus years, common carp reproductive efforts have almost certainly not been as successful as they might have been under other flow regimes. Combine these poor reproductive conditions with an ever-increasing number of adult fish being removed riverwide and a lack of new common carp invading the river from Lake Powell (due to the presence of three distinct waterfalls that have formed since the summer of 2003) and we see an isolated population with little to no recruitment being successfully cropped back by intensive, repetitive mechanical removal efforts.

While nonnative fish removal efforts may not be the single driving factor in the decline in common carp CPUE's observed through 2005, they are almost certainly a heavily contributing factor. These nonnative fish removal efforts are the only control method that can actually be controlled by the SJRIP and it is my recommendation that they continue unabated for the foreseeable future or possibly even expanded (see the Channel Catfish Discussion section above).

Other Nonnative Fishes

No striped bass or walleye were collected during 2005 Adult Monitoring collections. Upstream access into the lower San Juan River for these two species has been blocked by the very low water levels in Lake Powell and the formation of three distinct new waterfalls that have formed since the summer of 2003 just downstream of Clay Hills boat landing (Clay Hills = RM 2.9).

A total of nine juvenile largemouth bass were collected during the fall 2005 adult Monitoring trip. However, no adult largemouth bass were collected on that trip. The collection locations and sizes of these nine fish seemed to indicate that they were originating from an upstream source (likely off-channel ponds), possibly near Farmington, NM. The lack of adult largemouth bass collections, combined with very few largemouth bass collections of any life stage in most years seems to indicate that the largemouth bass that are being collected are transient members of the San Juan River fish community. There does not appear to be a healthy, reproductively-active largemouth bass population in the mainstem San Juan River.

As was the case with largemouth bass, white sucker and their hybrids with native suckers remain relatively rare in Adult Monitoring collections. The collections of both white sucker and their hybrid forms have historically been centered upstream near Farmington, NM. The locations of these collections, the lack of large adult fish, and the generally low numbers of fish collected annually would seem to argue that the white sucker (and their hybrid forms) that are collected in the San Juan River are likely originating from upstream tributaries (such as the Animas River) that have established populations of white sucker in them already.

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APPENDIX A

Photographs of native fishes collected during the fall 2005 Adult Monitoring trip that had channel catfish "bite marks" on them.

A 296 mm TL Colorado pikeminnow. Collected between RM 125 and 124 on 21 September 2005.

A 380 mm TL razorback sucker. Collected between RM 123 and 122 on 21 September 2005.

A 412 mm TL flannelmouth sucker. Collected between RM 125 and 124 on 21 September 2005.