E N T R I X

FINAL PROGRESS REPORT 7
KERN RIVER NO. 1 HYDROELECTRIC PROJECT
SMALLMOUTH BASS STUDY

Prepared for:

SOUTHERN CALIFORNIA EDISON COMPANY
San Dimas, California

Prepared by:

ENTRIX, INC.
Walnut Creek, CA

Project No. 3006663

May 2007

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Prepared for:

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1.0 INTRODUCTION

Southern California Edison Company (SCE) operates the Kern River No. 1 Hydroelectric Project (KR1), FERC No. 1930 on the lower Kern River. The Project is located downstream of Lake Isabella, 17 miles northeast of Bakersfield and 16 miles southwest of Bodfish, California (Figure 1-1).

SCE was issued a new license for the Project by the Federal Energy Regulatory Commission (FERC) on June 16, 1998. Article 403 of the new license states:

> *Within 6 months from the date of issuance of this license, the licensee shall file for Commission approval a plan to study the adequacy of the minimum flows, required by Forest Service Condition No. 4 for protecting and enhancing the smallmouth bass fishery in the project bypassed reach.*
>
> *The plan shall include a schedule for: implementation of the study plan; consultation with the appropriate federal and state agencies; and filing the results, agency comments, and licensee's response to agency comments with the Commission.*
>
> *The licensee shall prepare the plan after consultation with the California Department of Fish and Game and the Forest Service. The licensee shall include with the plan documentation of consultation, copies of comments, and recommendations on the completed study plan after it has been prepared and provided to the agencies and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.*
>
> *The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.*
>
> *Authority is reserved to the Commission to modify the minimum flows required by article 404 if the study results show that flow modifications are warranted.*

An appropriate study plan (ENTRIX 1999) was filed with FERC in May 1999, and FERC's order approving the plan was issued on June 21, 1999. The first year of monitoring was implemented in early October 1999; sampling for the second year of monitoring was delayed until January 2001, due to high flows and high turbidity resulting in unsafe and unworkable conditions (ENTRIX 2001). The third and fourth monitoring

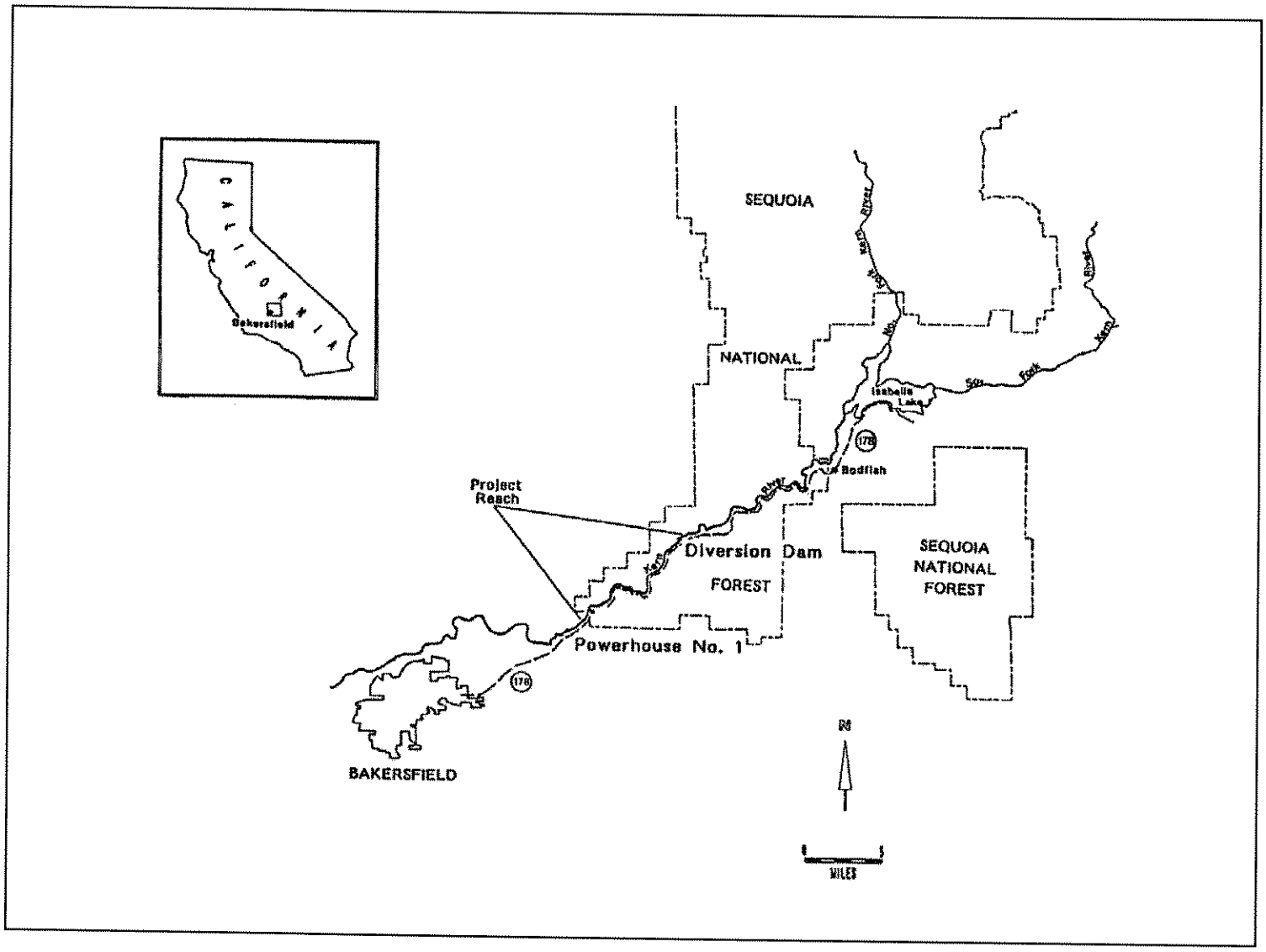


Figure 1-1. Map of the Kern River in the Vicinity of the Kern River No. 1 Hydroelectric Project. Non-Internet Public.

trips were conducted during October 2001, and October 2002, respectively (ENTRIX 2002 and ENTRIX 2003). The fifth monitoring trip was organized for October 2003, although due to high flows, the trip was postponed until November 2003 (ENTRIX 2004). The sixth monitoring trip was conducted during October 2004. In 2005 flows were too high to allow for any field work, so the seventh monitoring trip was conducted during October of the following year (2006). During 2006, scour deepened the most downstream sampling site, which in combination with higher than normal flows resulted in making that site too deep for safe electrofishing. In addition, turbidity was too high to adequately perform snorkeling at all of the sites. The lower sites were checked in December 2006 and January 2007 to determine whether snorkel sampling could be completed. After the January check, it was decided that conditions were unsuitable for snorkeling and the 2006 sampling was considered complete without data collected at the Site E.

During a meeting with the lower Kern River stakeholders on May 9, 2003, which included California Department of Fish and Game (CDFG), US Forest Service Sequoia National Forest (USFS), and the State Water Board, SCE was requested to continue the current monitoring program for an additional two years. In response to SCE's request for an additional two years of monitoring and postponement of the final report until the end of the study, the Commission issued a June 8, 2004 Order, which extends the final report due date to May 15, 2006. Based on the effect of sediment on stream habitats and fish, SCE recognized that both temperature monitoring and fish populations in the KR1 bypass reach may still be affected by the presence of large volumes of sediment that entered the reach in fall 2000. After consultation with the agencies, SCE agreed to extend the monitoring program for a total of four years rather than the two originally planned and filed this time extension request with the Commission. The Commission granted the time extension under license articles 403 (Smallmouth Bass) and 404 (Temperature) by order dated May 9, 2006, establishing new final report deadlines of June 1, 2008 and May 15, 2008, respectively. Based on the discussion that took place during the Kern River Group meetings, the resource agencies desire to include monitoring of the hardhead population in this reach.

This progress report represents the results of the seventh year of monitoring. The study plan (ENTRIX 1999) is appended to this progress report.

1.1 AGENCY CONSULTATION

CDFG, USFS, and State Water Board were contacted regarding comments on the Draft Progress Report 7 Kern River No. 1 Hydroelectric Project Smallmouth Bass Study (Draft Report). Comments were received from USFS and CDFG; these are provided in Appendix B of this report.

The USFS provided several comments. The first two comments and the fourth comment addressed specific edits and observations. These have been addressed in this report. The third comment observed that conditions that prevented sampling at Site E may have resulted in an overall lower estimation of smallmouth bass in the reach during 2006. This

may be the case, or high flows may have been responsible for washout of young of the year or reduced recruitment.

The USFS indicated that it is encouraged that hardhead minnow were sampled within the bypass reach. The USFS observed that the high flows may have transported young-of-year hardhead and Sacramento pikeminnow into the project bypass reach. The USFS stated that it remains interested in the continued monitoring of fish populations and water temperature associated with the license conditions of Kern River No. 1.

CDFG's comment was in respect to SCE's intent to emphasize hardhead in its analysis of the data collected during this study. The question was "Would you please clarify what this special emphasis involves, or if any additional studies are intended to evaluate hardhead populations in the project-affected reach of the Kern River?"

With respect to hardhead in the project-affected reach of the Kern River, SCE's analysis has added tracking of the abundance and age-structure of hardhead in the project-affected reach. In addition, it is the intent of the cumulative analysis to evaluate (to the extent sufficient data are collected) factors affecting hardhead in this reach, such as high flows, low flows, water temperatures, sediment, and other physical factors. The emphasis on studying hardhead was added to the original objective of studying the adequacy of minimum flows on smallmouth bass. Additional years of monitoring were added to the original study to allow collection of additional data to study smallmouth bass and hardhead following the deposition of sediment in the reach during 2000, data collection will be completed with the 2007 sampling effort.

2.1 STUDY SITES

As identified in the Study Plan (see Appendix A), five monitoring sites are included in this program. All sites were selected during the first monitoring survey in 1999 and are located downstream of Democrat Dam. Each monitoring station consists of one snorkeling and one electrofishing station. As will be described below, river conditions in the KR1 reach were not amenable to direct observation (snorkel) surveys in 2001, 2002, 2003, 2004 and 2006. Conditions in 2005 were unsuitable for both snorkel and electrofishing methods at all sites due to high flows and turbidity. The monitoring stations could not be sampled in that year.

The sites are dispersed throughout the Project Area and are chosen based on the presence of representative habitats, proximity to other appropriate sites, and accessibility. Sites were given a letter designation of A through E from upstream to downstream within the study area. Electrofishing monitoring stations, as initially selected, consisted mostly of runs with a few deeper pool areas. Electrofishing and snorkeling monitoring stations measure approximately 46 m (150 ft) in length. The physical habitat characteristics of the electrofishing stations are summarized in Table 2-1.

2.1.1 SITE DESCRIPTIONS

As described in the second progress report, during the January 2001 field trip, we found that substantial amounts of sand and fine sediment had been deposited in approximately 4.8 km (3.0 miles) of the upper portion of the KR1 reach. Fine sediments in lesser amounts were observed further downstream. During October 2001, the deposited sand and fine sediments were observed as far downstream as Site D (9.0 km). The sediment filled areas such as the deep pool habitats (i.e., snorkel stations) in Sites A through D. Site E stream channel characteristics were unaltered, except for the high turbidity in the water; visibility was very limited and inadequate for direct observation estimates of fish abundance. During October 2002, some of the deposited sand and fine sediment had shifted further downstream, but the deep pool habitats in Sites A through D still contained significant amounts of sediment. Site E stream channel characteristics appeared to have experienced only minor change through October 2002, but turbidity remained high. By November of 2003, the deposited sand and fine sediment had shifted further downstream. In October of 2004, the deposited sand had continued to shift downstream with diminished amounts of sand and fine sediment in the upper sites and increased sand and fine sediment in the lower sites. Turbidity remained high in 2003 and 2004, although it appeared that the source of much, if not all of the turbidity originated upstream of the KR1 Project. In October of 2006, reductions in deposits of sand and fine

Table 2-1. Physical Characteristics of Electrofishing Stations, October 2006, October 2004, November 2003, October 2002, October 2001, January 2001 and October 1999.

Site	A							B						C						
Distance Downstream of Democrat Dam (km)	4.3							5.1						6.6						
Road Marker (mi)	23							22.4						21.5						
Site Information																				
Date Sampled	10/25/06	10/23/04	11/21/03	10/30/02	10/24/01[1]	1/20/01	10/11/99	10/25/06	10/23/04	11/22/03	10/30/02	10/26/01	1/21/01	10/10/99	10/26/06	10/23/04	11/22/03	10/31/02	10/27/01	1/22/01	10/15/99
Flow at Democrat Dam m^3(cfs)[2,4,5]	1.33(47.0)	0.74(26.1)	0.74(26.1)	0.54(19.1)	0.51(18.0)	0.93(32.8)	0.57(20.1)	1.33(47.0)	0.74(26.1)	0.74(26.1)	0.54(19.1)	~0.47[3](16.6)	0.93(32.8)	0.57(20.1)	1.25(44.1)	0.74(26.1)	0.74(26.1)	0.54(19.1)	0.44(15.5)	0.93(32.8)	1.42(50.1)
Reach Length (m)	45.7	50.5	50.5	61.9	45.7	45.7	45.7	45.7	47.9	47.9	49.5	45.7	45.7	45.7	45.7	45.7	40.2	45.7	45.7	45.7	45.7
Average Width (m)	19.5	16.2	16.2	11.4	14.2	19.5	17.6	15.5	14.4	14.4	14.0	13.3	14.5	14.3	13.5	15.1	15.1	15.2	14.5	15.6	14.5
Average Depth (m)	0.9	0.6	0.6	0.4	0.2	0.2	0.6	0.8	0.6	0.6	0.5	0.4	0.6	0.5	0.9	1.0	1.0	0.9	0.6	0.9	0.7
Maximum Depth (m)	1.7	1.1	1.0	0.9	0.5	0.4	1.0	1.7	1.0	1.0	0.9	0.8	0.9	0.9	1.8	1.7	1.6	1.8	1.8	1.7	1.4
Water Temp (°C)	15.0	14.2	11.2	13.0	14.0	7.0	19.0	13.0	13.6	8.0	15.0	14.0	5.0	17.0	14.0	13.8	8.5	14.0	17.0	7.0	17.0
Air Temp (°C)	21.0	16.6	8.2	24.0	19.0	13.0	22.0	22.0	16.1	9.0	22.0	23.0	12.0	23.0	20.0	16.2	9.4	24.0	22.0	12.0	23.0
Substrate (%)																					
Fines	5	0	0	0	0	0	6.3	5	5	5	5	5	20	0	0	0	0	0	0	10	0
Sand	0	90	95	90	95	90	25	0	80	85	85	90	20	15	0	70	70	80	80	0	12.5
Gravel	0	0	0	0	0	0	27.5	10	0	0	0	0	0	18.8	0	0	0	0	0	0	0
Rubble	60	5	0	0	0	0	32.5	80	10	5	5	5	40	46.3	90	10	10	15	15	60	63.8
Boulder	20	5	5	5	5	0	8.8	5	5	5	5	0	20	16.3	10	15	15	5	5	30	23.8
Bedrock	0	0	0	5	0	10	0	0	0	0	0	0	0	3.8	0	5	5	0	0	0	0

[1] During the January 2001 site visit, Site A was filled in with sand.
[2] January 2001 streamflow data was recorded in the field at Site B.
[3] Estimated flow, no measurements were made due to equipment malfunction.
[4] November 2003 streamflow data was recorded in the field at Site A.
[5] October 2004 streamflow value was averaged from the streamflow measured at each study Site.

Table 2-1. Physical Characteristics of Electrofishing Stations, October 2006, October 2004, November 2003, October 2002, October 2001, January 2001 and October 1999 (continued).

Site	D							E						
Distance Downstream of Democrat Dam (km)	9							11.4						
Road Marker (mi)	20							18.5						
Site Information														
Date Sampled	10/24/06	10/26/04	11/21/03	10/30/02	10/27/01	1/23/01	10/14/99	10/27/06	10/26/04	11/23/03	10/29/02	10/25/01	1/20/01	10/12/99
Flow at Democrat Dam m^3/s(cfs)[2,4,5]	1.22(43.1)	0.74(26.1)	0.74(26.1)	0.54(19.1)	0.47(16.6)	0.93(32.8)	1.44(50.8)	1.42(50.1)	0.74(26.1)	0.74(26.1)	0.57(20.1)	~0.47[3](16.6)	0.93(32.8)	0.65(23.0)
Reach Length (m)	45.7	45.7	45.7	45.7	45.7	45.7	45.7	45.7	45.7	45.7	45.7	45.7	45.7	45.7
Average Width (m)	14.6	15.1	15.1	14.7	12.7	11.5	14.1	15.7	16.1	16.1	15.5	16.8	16.4	16.1
Average Depth (m)	0.5	0.5	0.6	0.3	0.2	0.6	0.6	1.2	0.5	0.6	0.9	0.8	0.8	0.7
Maximum Depth (m)	1.1	1	1.1	0.8	0.4	1.1	1.2	2.2	1.4	1.5	1.6	1.7	1.5	1.5
Water Temp (°C)	x	14.1	11.5	14.0	16.0	8.0	18.0	13.0	13.9	6.8	14.0	16.0	5.0	18.0
Air Temp (°C)	x	16.3	9.7	23.0	24.0	19.0	25.0	21.0	16.2	11.6	23.0	23.0	7.0	28.0
Substrate (%)														
Fines	0	0	0	0	0	30	0	0	0	0	0	0	0	0
Sand	5	65	65	80	80	10	18.8	0	20	10	10	10	10	5
Gravel	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Rubble	40	15	15	10	5	40	47.5	65	30	40	40	40	40	47.5
Boulder	40	20	20	10	15	20	27.5	35	50	50	50	50	50	48.8
Bedrock	10	0	0	0	0	0	6.3	0	0	0	0	0	0	0

[1] During the January 2001 site visit, Site A was filled in with sand.
[2] January 2001 streamflow data was recorded in the field at Site B.
[3] Estimated flow, no measurements were made due to equipment malfunction.
[4] November 2003 streamflow data was recorded in the field at Site A.
[5] October 2004 streamflow value was averaged from the streamflow measured at each study Site.

sediment were observed throughout the reach indicating that high flows in 2005 and 2006 transported these sediments downstream. As in 2004, turbidity in 2006, at the time of sampling, and during subsequent checks was relatively high.

2.1.1.1 Site A

Site A is the site located furthest upstream of the five sites sampled, 4.3 km (2.7 miles) below Democrat Dam, at Road Mile Marker 23 (Figure 2-1). During the October 2006 sampling event, Site A was composed entirely of pool habitat. Approximately 95 percent of the site was shallow pool habitat and 5 percent was deep pool habitat (>1.5 m, 5 feet). The average depth of Site A was 0.9 m (3.0 ft) with an average width of 19.5 m (65 ft) (Table 2-1). The average and maximum depths at this site were greater than any of the previous years both before and after the sediment release. However, the stream flow was greater by 0.59 m^3/s (20.8 cfs) at the site in October 2006 compared to the measured stream flows in 2004 and 2003 and was 0.76 m^3/s (26.8 cfs) greater than during the 1999 sampling, which also may have contributed to the increased depth observed. Rubble (60 percent) and boulders (20 percent) were the dominant surficial substrates. A paucity of fine sediment was observed in 2006 compared to previous years. The length of the site surveyed (50.5 m or 165.7 ft) was extended during the October 2002 survey trip, due to changes in the habitat structure resulting from the movement of sediment. In 2003, the site was shortened in response to changes in sediment presence that returned the site to characteristics more similar to those originally observed. This site length was retained in 2004 and 2006.

2.1.1.2 Site B

Site B is the second site downstream of Democrat Dam, located 5.1 km (3.2 miles) below Democrat Dam at Road Mile Marker 22.4 (Figure 2-1). During the October 2006 sampling event, Site B was composed of a mixture of pool (65 percent), riffle (25 percent) and run (10 percent) habitat. The average depth of Site B was 0.8 m (2.65 ft) with an average width of 15.5 m (51.2 ft) (Table 2-1). The average depth at this site was similar to that measured in 2004 while the maximum depth was 0.7m (2.3 ft) deeper in 2006. Additionally, it was deeper than in 1999, before the sediment release. The stream flow at this site was greater by 0.76 m^3/s (26.8 cfs) in October 2006 compared to the measured stream flow in 1999. This may account for some of the increase in depth. In October 2006 rubble (80 percent) was the dominant surficial substrate and there was little evidence of sand and other fines in contrast to 2004 and 2003 when sand remained the dominant substrate type (Table 2-1). The length of the site surveyed was 45.7 m (150 ft), the same as the original survey parameters, after having been extended during the October 2002 survey trip. Due to changes in habitat structure resulting from the movement of sediment, the site was extended for the October 2002 sampling trip. In 2003, the site was shortened in an attempt to gradually return the site length surveyed to the original parameters. The site length used in 2003 was used again in 2004. The original study length of site B was used in 2006.

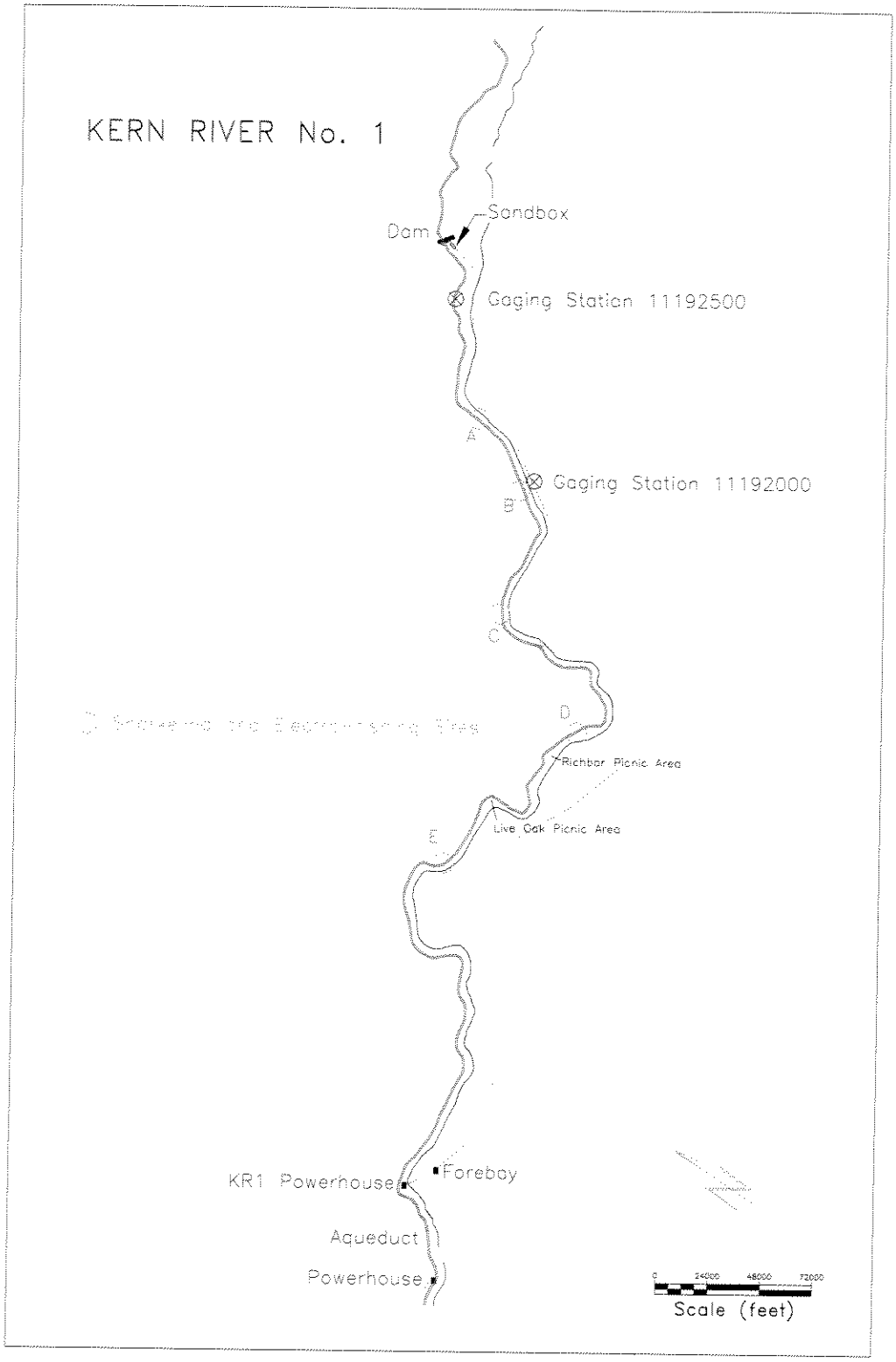


Figure 2-1. Kern River No. 1 Fish Population Sampling Site Locations. Non-Internet Public.

2.1.1.3 Site C

Site C is the third site downstream of Democrat Dam, 6.6 km (4.1 miles) below Democrat Dam at Road Mile Marker 21.5 (Figure 2-1). During the October 2006 sampling event, Site C was composed of pool (55 percent) and run habitat (35 percent). The average and maximum depths of the site were 0.9 m (3.0 ft) and 1.8 m (6.0 ft), respectively, and the average width of the site was 13.5 m (44.6 ft). The average depth in 2006 was slightly lower than in 2004 and 2003, which were deeper than those recorded since 1999. However, the maximum depth was slightly deeper than in 2004. The surficial substrate at Site C in 2006 was primarily composed of rubble (90 percent) with boulders forming the remainder (Table 2-1). There was very little evidence of sand in 2006, which composed the majority of substrate with lesser amounts of rubble and boulder in 2004. Stream flow at this site was higher in October 2006 than any other sampling trips. The increase in stream flow over the past three sample years may account for some of the change in maximum and average depths. However, most of the change in maximum depth is likely due to movement of sand downstream of the bypass reach.

2.1.1.4 Site D

Site D is the fourth site downstream of Democrat Dam, nine km (5.6 miles) below Democrat Dam, at Road Mile Marker 20, at a day-use area. During October 2006, the electrofishing station consisted primarily of run habitat. The average depth at the site was 0.5 m (1.6 ft) with a maximum depth of 1.1 m (3.6 ft), and an average width of 14.6 m (48.2 ft). The average and maximum depths measured at Site D in October 2006 were very similar to those in October 2004 and November 2003, but were deeper than the depths recorded at this site in October 2001 and October 2002. Flow during the 2006 study periods was greater than all years except for the initial survey in 1999. In 2006, the substrate contained a much lower proportion of sand than previous years. Consequently, a greater proportion of boulder and rubble sized materials was observed (Table 2-1). This suggests sediment composition within the bypass reach, has returned to those present before the sediment release from Democrat Dam.

2.1.1.5 Site E

Site E is the site located furthest downstream of the five sites sampled, 11.4 km (7.1 miles) downstream of Democrat Dam, at Road Mile Marker 18.5. During the October 2006 sampling event, Site E was primarily composed of pool habitat, with several large boulders and one deeper spot in the center of the unit. The average and maximum depths at the site were 1.2 m (4.0 ft) and 2.2 m (7.3 ft), respectively, with an average width of 15.7 m (51.8 ft). The average depth measured at Site E in October 2006 was the deepest recorded at this site over the course of the study. Stream flow at this site in October 2006 (1.42 m^3/s) (50.1 cfs) was also the greatest recorded over the course of the study. The substrate percentages at the site were similar to conditions in previous years, rubble and boulders dominating. However, there was no sand observed at the site in 2006 (Table 2-1).

2.2 SAMPLING

Electrofishing site locations were set up and marked using t-bar fence posts in 1999 and sampled during subsequent sampling trips. Flow measurements were made in the area of each site and stage measurements were collected on the day sampling occurred.

Due to significant changes in habitat, the multiple-pass depletion method was used in conjunction with electrofishing. It was anticipated that in the shallower sites (Sites A through D), there would continue to be fewer fish than during the initial sampling and that the multiple pass depletion would provide more efficient population estimates. The multiple pass depletion method also was used for Site E during the first six sampling trips, because the depth of the site was sufficiently shallow to allow for the technique. However, increased depths and water velocities prevented the field crew from safely electrofishing in 2006. Given the overall shallow stream conditions, two backpack electrofishing units were used to sample Site D. Sites A, B, and C were sampled using a barge electrofishing unit, which is better suited to the deeper depth of those sites. Site E also normally would be sampled with the barge shocker.

Snorkel site locations were also established in 1999 and generally consisted of deeper pool units located either upstream or downstream of the electrofishing site. These were sampled by divers snorkeling the sampling area when turbidity was sufficiently low to count and identify fish. Turbidity has been too high for adequate sampling after 2000.

2.2.1 ELECTROFISHING

Electrofishing was conducted at five sites within the Project area, using either a Smith-Root barge electrofishing unit with two leads or multiple backpack shockers, depending upon site conditions. In 1999, all of the sample sites were approximately 45.7 m (150 ft) long with varying widths. Due to changes in habitat conditions, the lengths of sites A and B were adjusted in 2002 and 2003 to maintain similar area sampled between years and to more effectively sample the sites. The same site lengths established in 2003 were used again in 2004. Conditions in October 2006 allowed for a return to the original 1999 site lengths. Multiple removal electrofishing was generally conducted as described by Reynolds (1996). After the first pass, each subsequent pass was consistent with the effort and pattern used in the first pass. Population abundance was estimated using the multiple-pass depletion method at all sites.

All captured fish were identified to species. Fish were measured to the nearest millimeter fork length. Individual weights from a representative sample of the catch were measured to the nearest gram. For each site, scales were collected from smallmouth bass and hardhead from above the lateral line and approximately midway down the length of the dorsal fin. On each scale envelope the species, length, weight, date, and site of capture were recorded. All smallmouth bass larger than 175 mm were tagged with a uniquely coded Floy tag so that these individuals can be uniquely identified in future years of monitoring if recaptured, or if taken by fisherman. Any rainbow trout (*Oncorhynchus mykiss*) captured were to be examined and characterized as either wild or hatchery trout.

Fish captured were retained in live nets and returned to their sampling unit after they were processed.

Multiple pass depletion methods use the principle of diminishing returns with each electrofishing sampling pass. A minimum of three passes was used to sample each site. The number of fish captured in each pass was used in a linear regression formula to estimate the population.

Routine observations were made of habitat and physical conditions in the specific areas sampled. Water temperature and dissolved oxygen measurements were taken at all sample sites. Water transparency was characterized, habitats sampled were measured for length and width, photographs were taken, and other data collected (Platts et. al. 1983). In addition, observations were made to characterize each habitat unit sampled. These observations included characterization of substrate and depth, riparian conditions, and the presence of woody debris or other cover. These data provide useful information for characterizing sampling conditions between monitoring periods.

2.3 ABUNDANCE ESTIMATES

Abundance estimates using data collected from multiple pass depletion methods used linear regression formulae.

Total biomass was estimated for each station by multiplying the population estimate for each age class by the mean weight of fish in each size class sampled.

Six species of fish were collected during the 2006 sampling effort: smallmouth bass (*Micropterus dolomieui*), largemouth bass (*Micropterus salmoides*), hardhead (*Mylopharodon conocephalus*), Sacramento sucker (*Catostomus occidentalis*), Sacramento pikeminnow (*Ptychocheilus grandis*) and white catfish (*Ameiurus catus*).

3.1 ELECTROFISHING

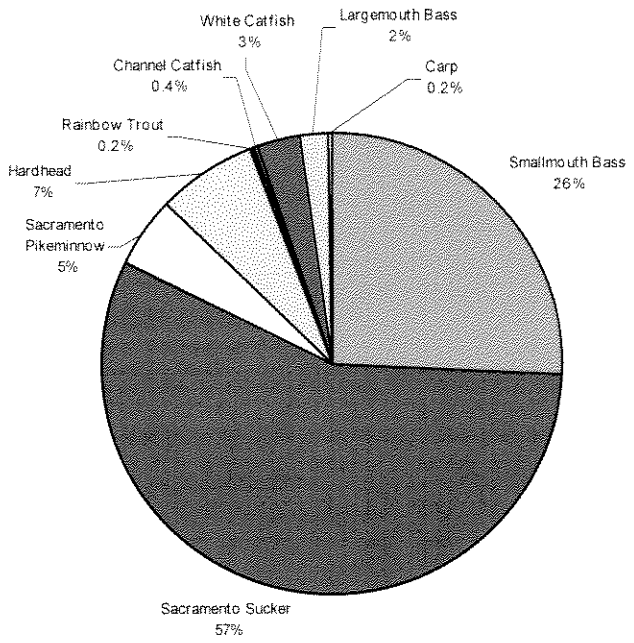
3.1.1 OVERALL RESULTS

In 2006, smallmouth bass were less abundant and represented a smaller component of the total catch than during previous sampling efforts. Of the 116 fish caught, just 15 fish or 13 percent of the total catch were smallmouth bass. The inability to sample Site E in 2006, explains some of the change in smallmouth bass abundance and biomass from 2004. The 2006 results are compared to those for 2004 for Sites A through E in Section 3.1.3.

Sacramento pikeminnow was the most abundant species captured during sampling in 2006, (Figure 3-1), comprising approximately 36 percent of the overall catch collected from all sites. All but four of the Sacramento pikeminnow were young of year (YOY) and therefore only contributed to four percent of the overall biomass. Most of the biomass collected during sampling in 2006 was from Sacramento sucker, including data from all sites (Figure 3-2). Based on the lengths of the collected smallmouth bass, at least two age classes were represented including YOY (Figure 3-3). The length-frequency distribution of the 15 smallmouth bass collected during October 2006 mirrored the bi\modal trend seen in most other years, although YOY comprised a much smaller proportion of the population in 2006. The absence of a sample from Site E may have contributed to this change. Five smallmouth bass collected in 2006 measured over 200 mm. The most recent previous sampling trip in October 2004 also resulted in several fish larger than 200mm.

The second most abundant species in October 2006 was hardhead. The twenty fish caught constituted 17 percent of the total number of fish collected. In previous study years hardhead have been much less abundant. The only other year with a substantial proportion of hardhead was 1999 with hardhead comprising seven percent of the total catch. More recently, only two hardhead were collected in October 2004, while six were collected in November 2003. The hardhead collected in 2003 ranged in size from 42 mm to 85 mm, while the hardhead collected in 2004 ranged in size from 186 mm to 227 mm. Hardhead caught in 2006 all ranged from 40 mm to 60 mm (Figure 3-4) and therefore were all YOY. Hardhead were not significant to the site's biomass. Hardhead were collected exclusively at Site B in 2003, 2004 and 2006.

Composition of Fish Species Captured in the KR1 Reach of the Kern River, October 1999 (N=465)



Composition of Fish Species Captured in the KR1 Reach of the Kern River, January 2001 (N=189)

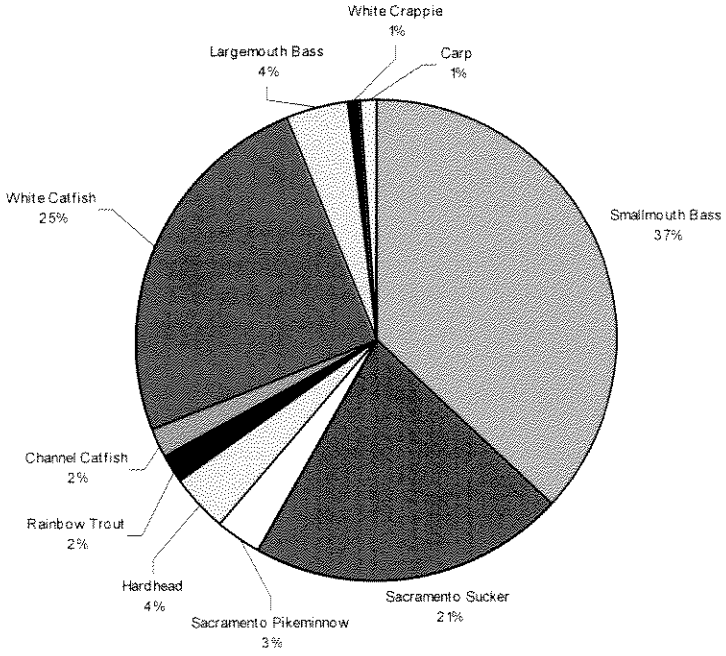
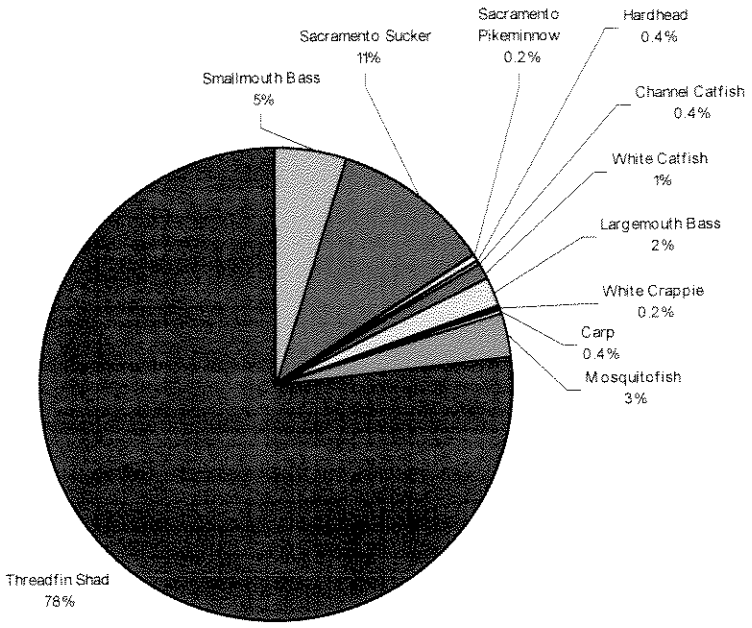


Figure 3-1. Species Composition for Electrofishing Stations in the Kern River No. 1 Project Reach (Based on Fish Numbers).

Composition of Fish Species (All) Captured in the KR1 Reach of the Kern River, October 2001 (N=862)



Composition of Fish Species (Not Including Threadfin Shad) Captured in the KR1 Reach of the Kern River, October 2001 (N=115)

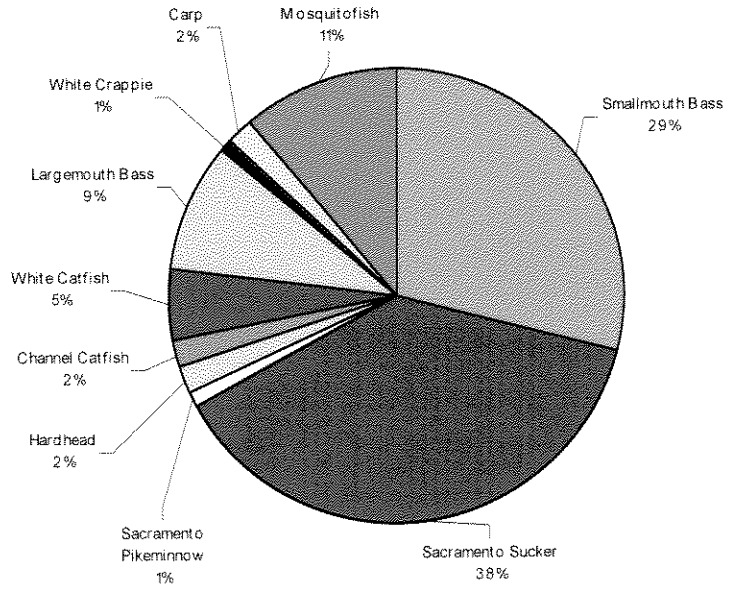
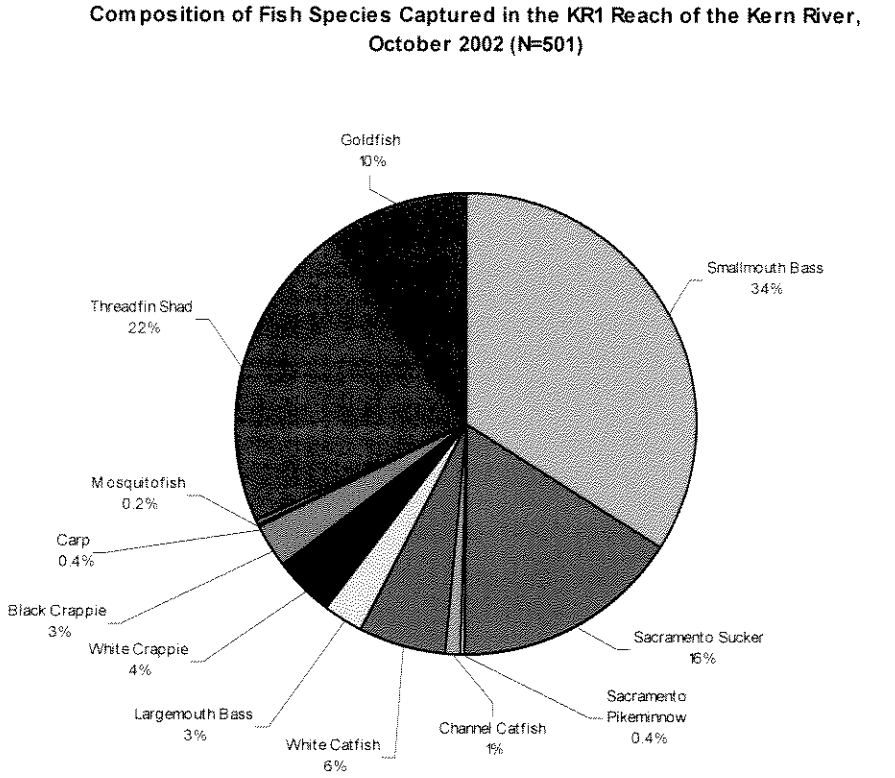


Figure 3-1. Species Composition for Electrofishing Stations in the Kern River No. 1 Project Reach (Based on Fish Numbers) (continued).



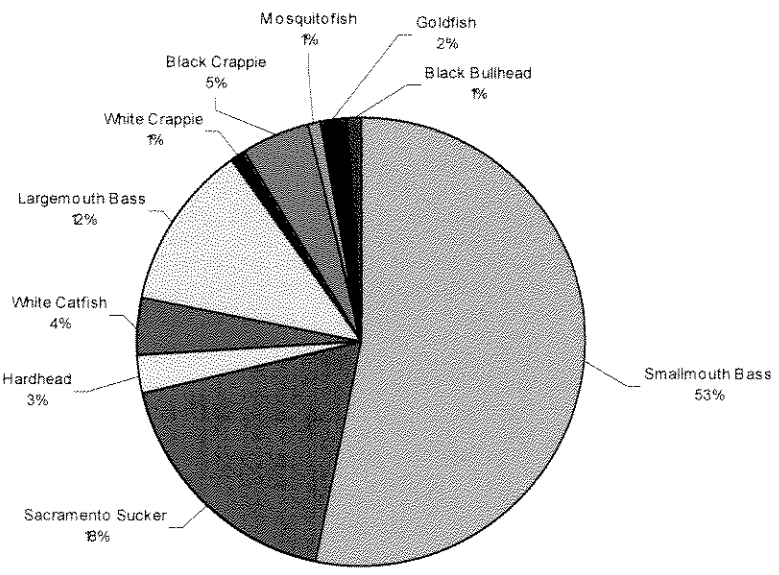
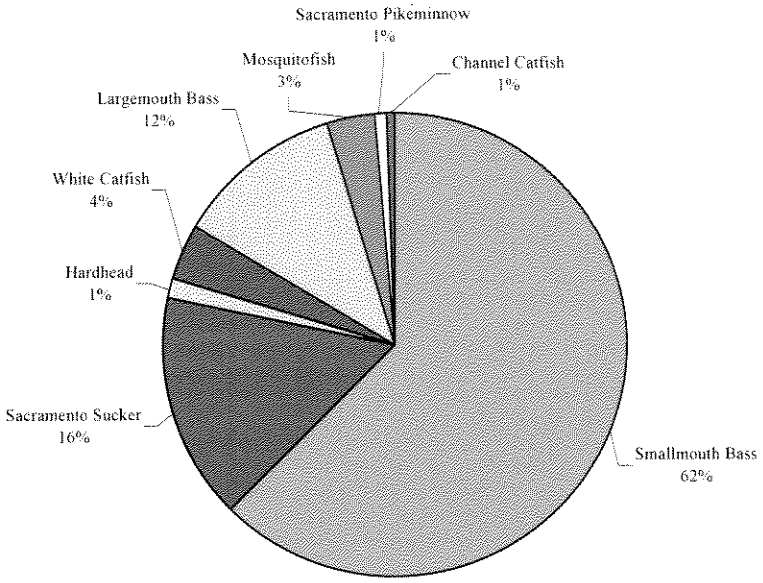


Figure 3-1. Species Composition for Electrofishing Stations in the Kern River No. 1 Project Reach (Based on Fish Numbers) (continued).

Composition of Fish Species Captured in the KR1 Reach of the Kern River, October 2004 (N=147)



Composition of Fish Species Captured in the KR1 Reach of the Kern River, October 2006 (N=116)

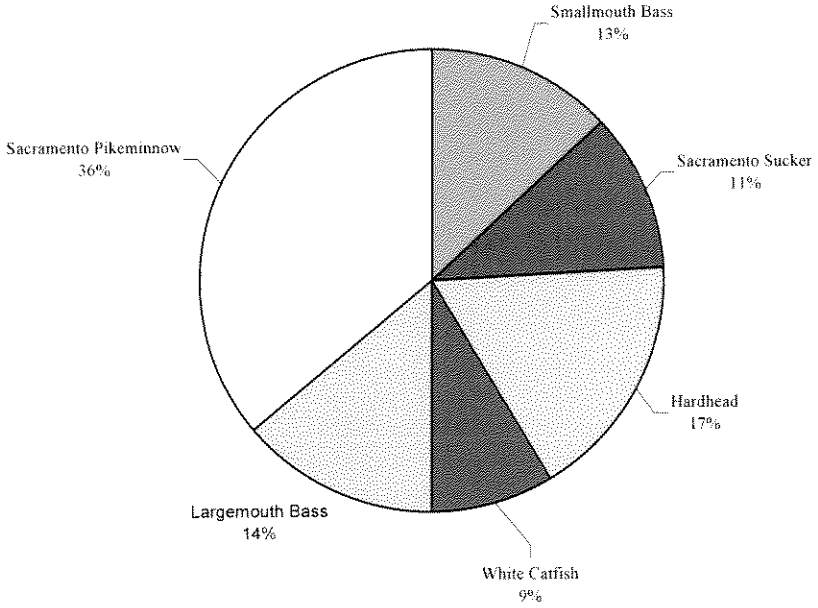
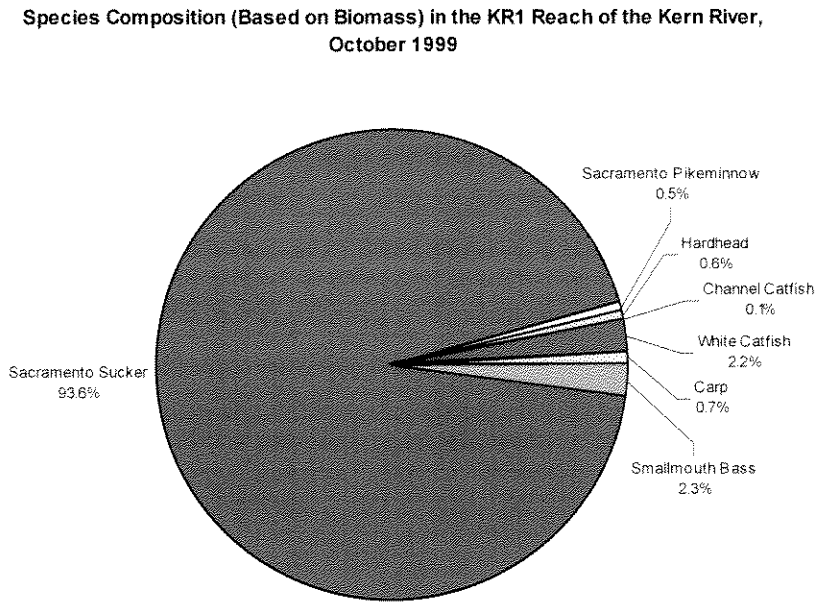


Figure 3-1. Species Composition for Electrofishing Stations in the Kern River No. 1 Project Reach (Based on Fish Numbers) (continued).



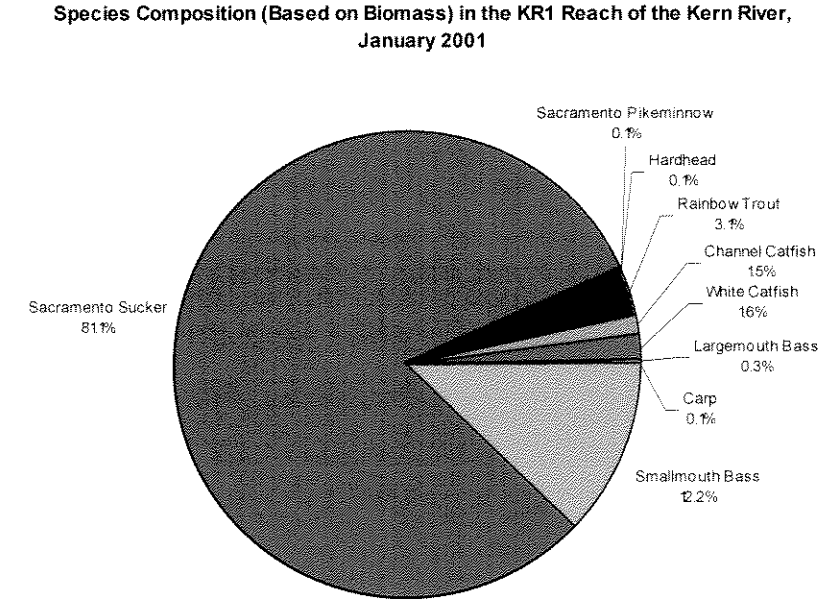
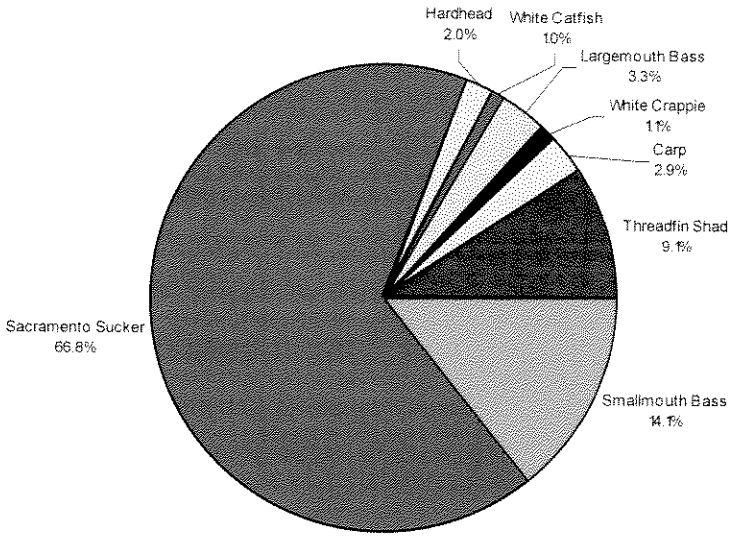


Figure 3-2. Species Composition for Electrofishing Stations in the Kern River No. 1 Project Reach (Based on Biomass).

Species Composition (Based on Biomass) in the KR1 Reach of the Kern River, October 2001



Species Composition (Based on Biomass) in the KR1 Reach of the Kern River, October 2002

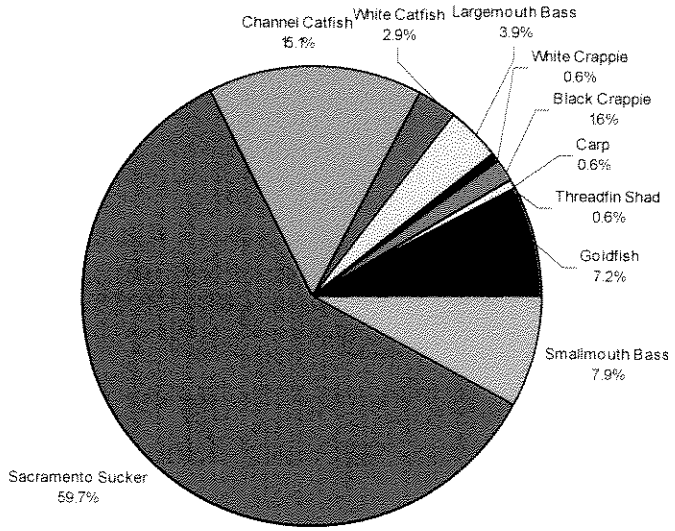
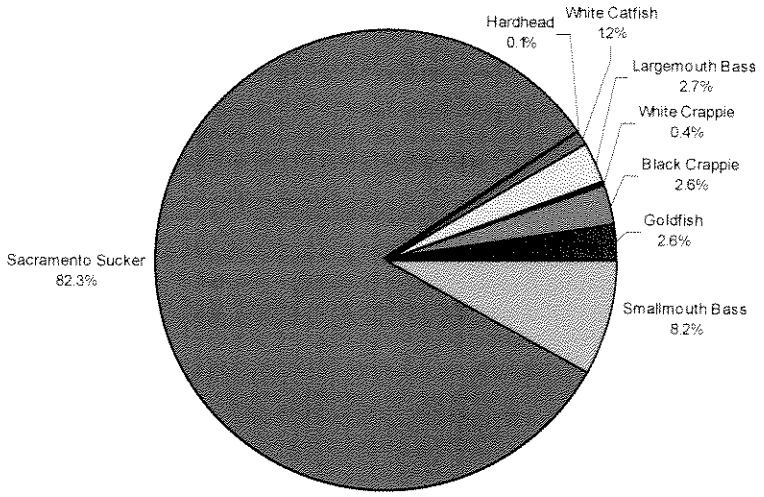


Figure 3-2. Species Composition for Electrofishing Stations in the Kern River No. 1 Project Reach (Based on Biomass) (continued).

Species Composition (Based on Biomass) in the KR1 Reach of the Kern River, November 2003



Species Composition (Based on Biomass) in the KR1 Reach of the Kern River, October 2004

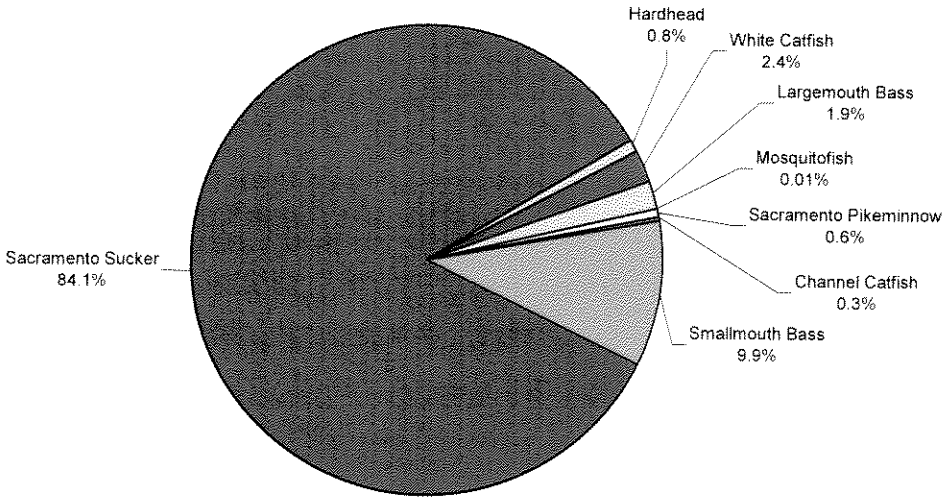


Figure 3-2. Species Composition for Electrofishing Stations in the Kern River No. 1 Project Reach (Based on Biomass) (continued).

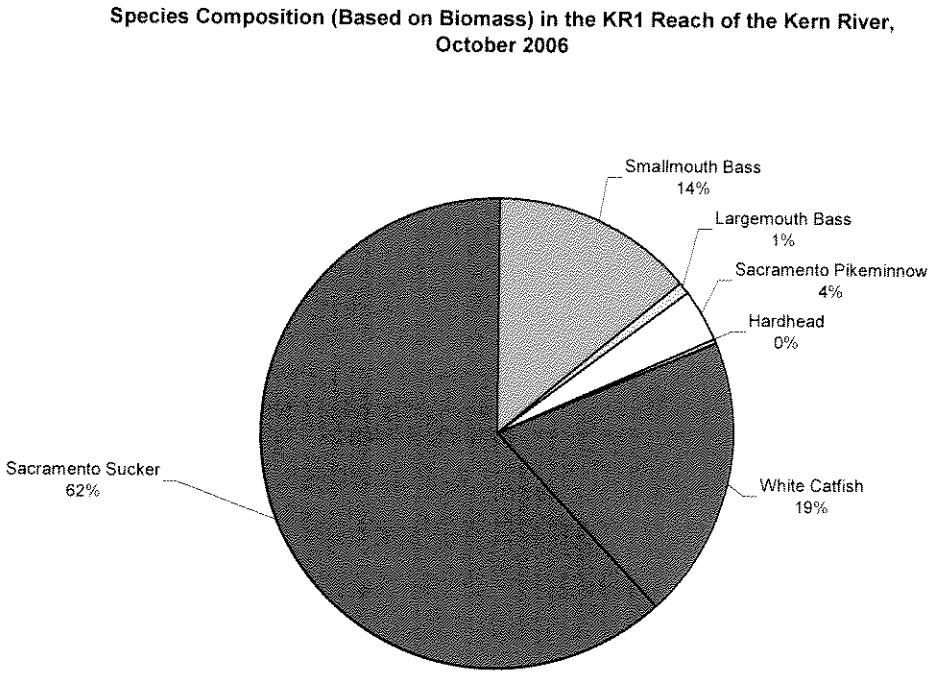


Figure 3-2. Species Composition for Electrofishing Stations in the Kern River No. 1 Project Reach (Based on Biomass) (continued).

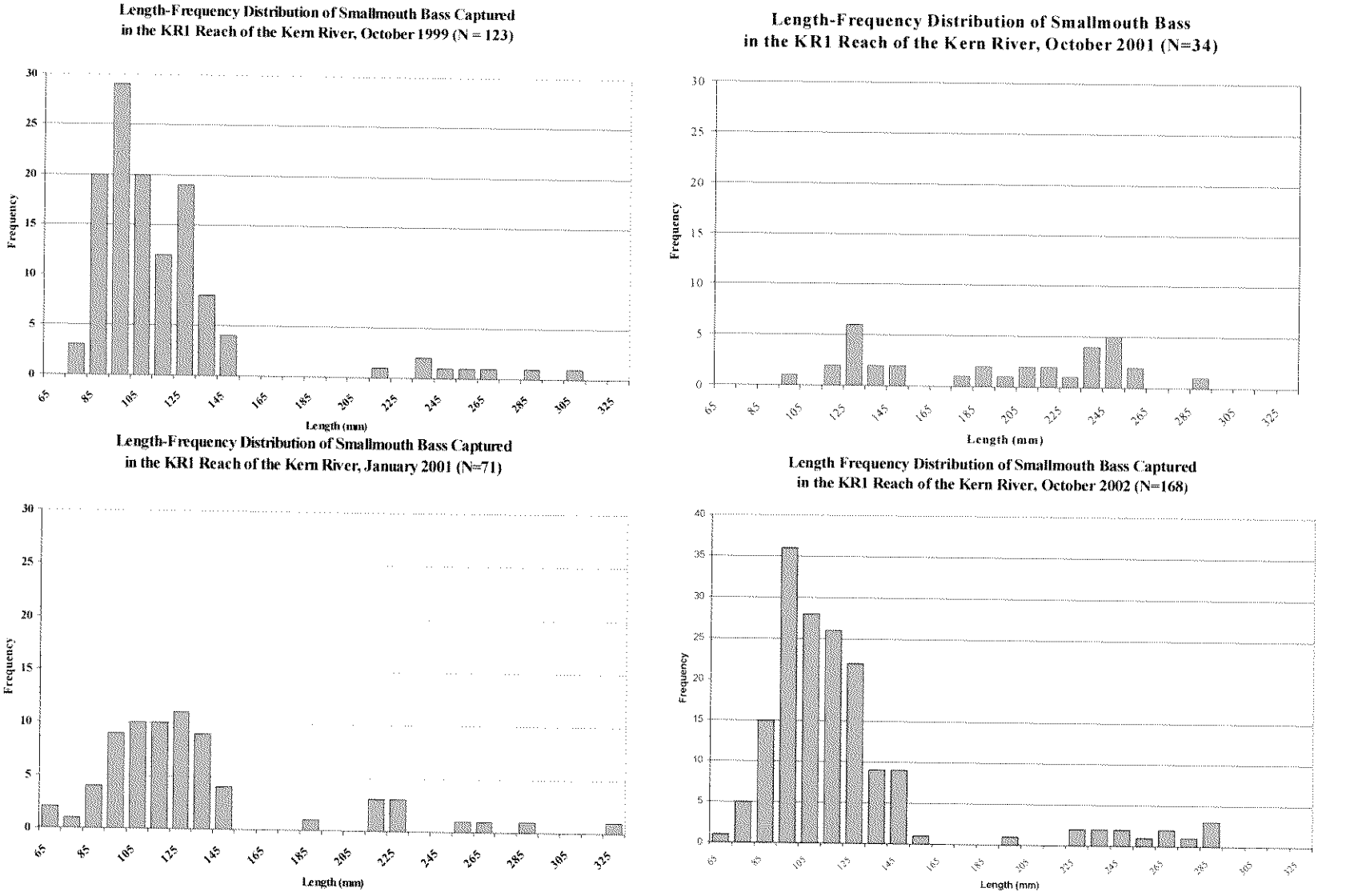
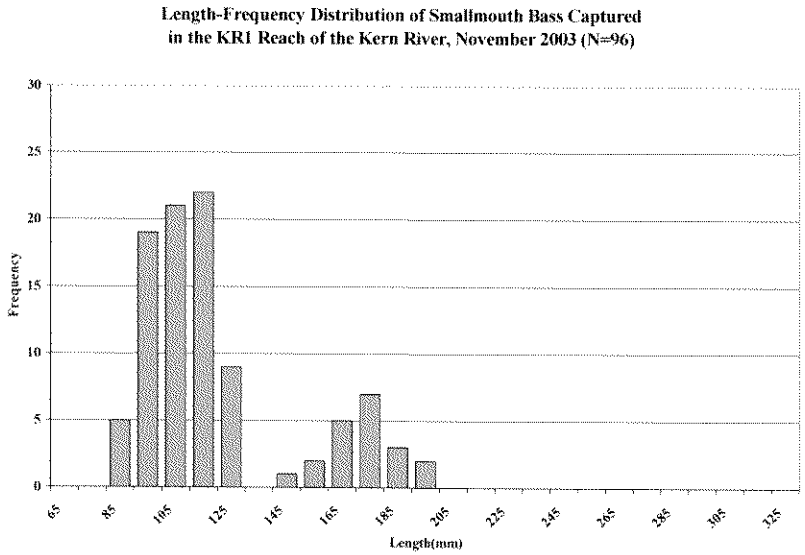
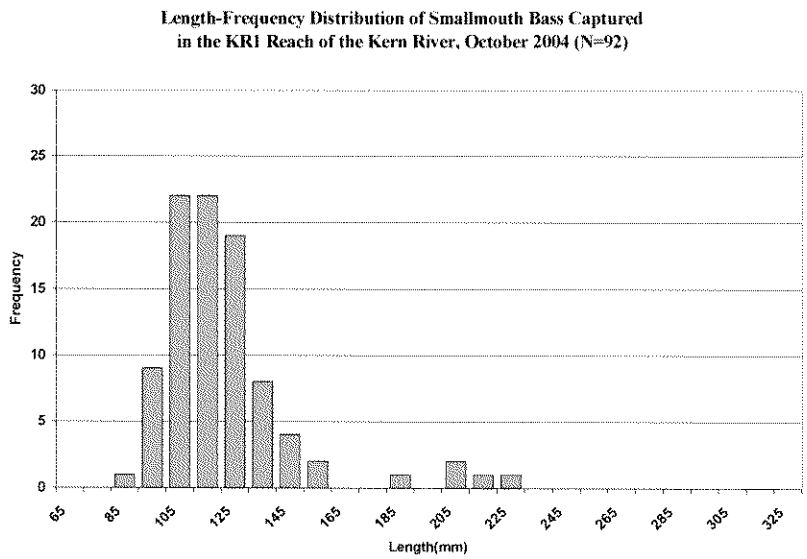


Figure 3-3. Comparison of Length Frequency of Smallmouth Bass Captured During Electrofishing Surveys.





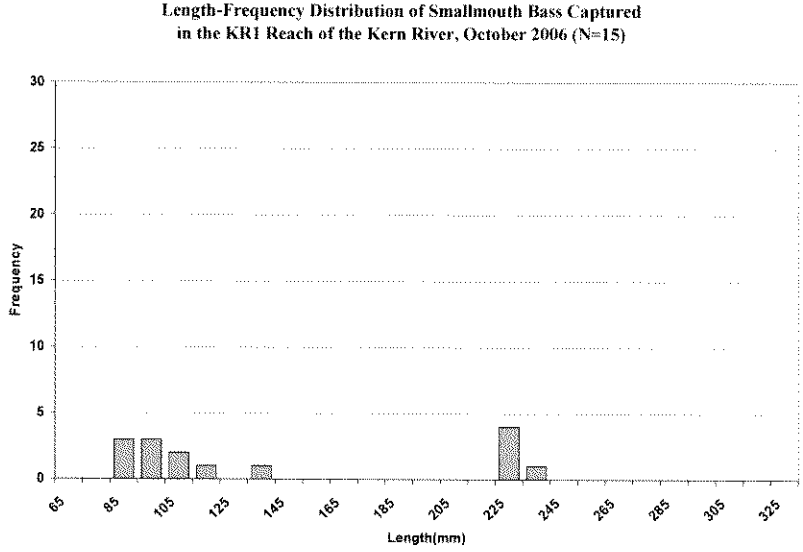


Figure 3-3 Comparison of Length Frequency of Smallmouth Bass Captured During Electrofishing Surveys (continued).

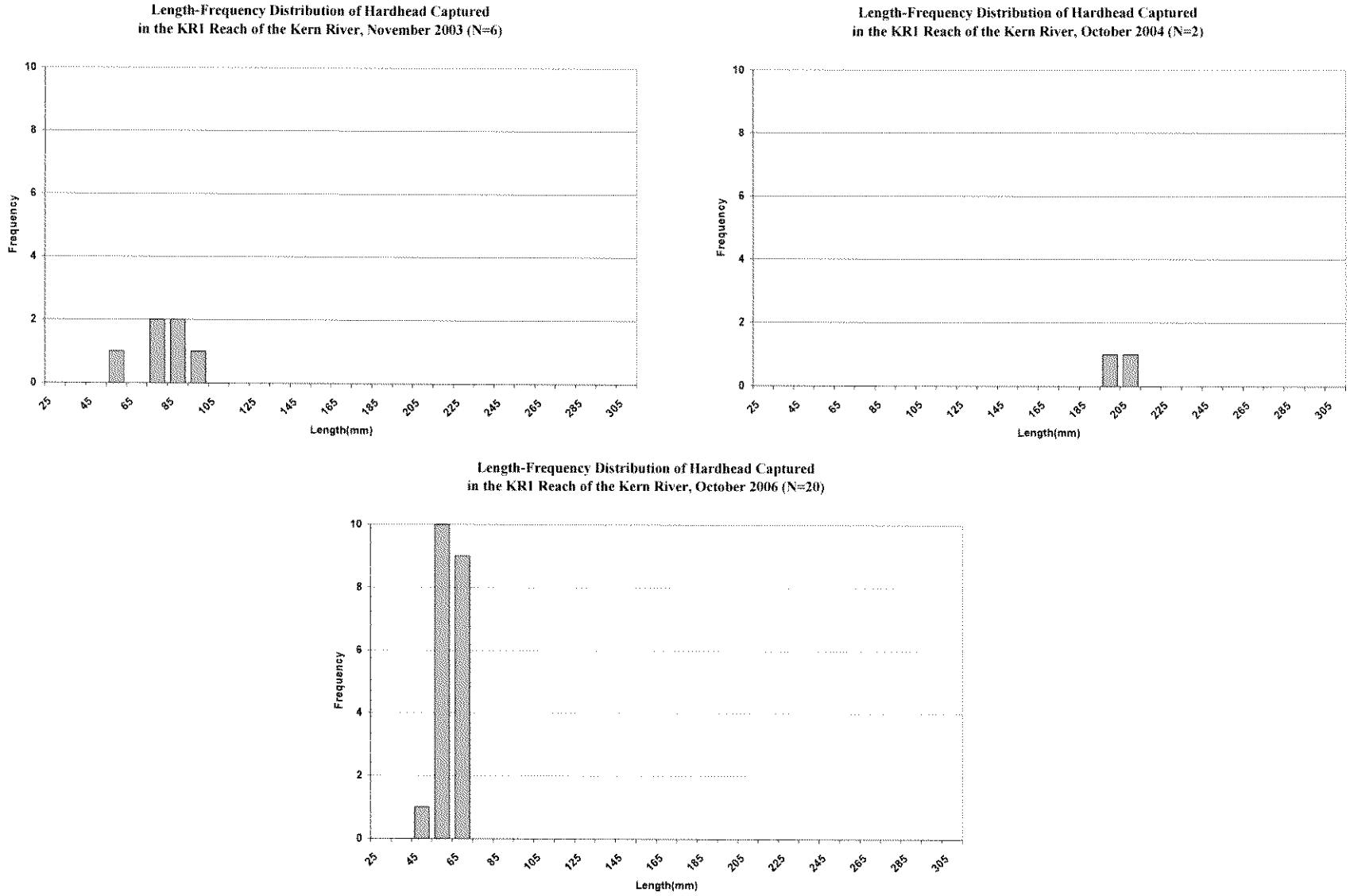


Figure 3-4. Comparison of Length Frequency of Hardhead Captured During Electrofishing Surveys, 2003, 2004 and 2006.

Largemouth bass was the third-most abundant species, constituting 14 percent of the fish collected. The percentage composition of largemouth bass in October 2006 was similar to October 2004 and November 2003. The number of largemouth bass collected in 2006 (16 fish) was down slightly from the number in October 2004 (17 fish) and November 2003 (21 fish). October 2006 was the second year that largemouth bass numbers declined since the initial sampling event in 1999. There were six largemouth bass collected in October 1999, eight collected in January 2001, eight collected in October 2001, 17 collected in October 2002, and 21 collected in November 2003.

The number of Sacramento sucker collected in 2006 (13 fish) continues to decline since October 2002 (79 fish), 33 fish in 2003, and 23 fish in October 2004. Greater maximum depths and high turbidities at sampling sites in 2006, could have contributed to the decreases of Sacramento sucker captures.

3.1.2 Results by Site

Site A. At Site A, four smallmouth bass were captured, representing 80 percent of the Site's total catch (Table 3-1). Table 3-2 presents the site population estimates and confidence intervals. Smallmouth bass density was estimated to be 87.5 fish/km, with a biomass of 3.77 kg/ha (Tables 3-3, 3-4, and 3-5). The total fish density for all species for this portion of the river was 109.4 fish/km with a biomass density estimate of 4.07 kg/ha (Tables 3-3, 3-4, and 3-5).

Two fish species (smallmouth bass and white catfish) were captured at Site A in October 2006 (Table 3-1), which represents a stable number of species collected compared to the October 2004 results but a decrease from November 2003 (three species) and October 2002 (six species). In January 2001, no fish were collected at Site A. Overall, the number of fish species collected at Site A increased until the November 2003 sampling period when the number of fish species collected began to decline.

Site B. At Site B, three smallmouth bass were captured, representing 4 percent of the total catch (Table 3-1). Smallmouth bass density was estimated to be 6.06 fish/km, with a biomass of 3.91 kg/ha (Tables 3-3, 3-4, and 3-5). The total fish density for all species for this portion of the river was 1597.4 fish/km and the biomass estimate was 25.09 kg/ha (Tables 3-3, 3-4, and 3-5).

Twenty hardhead were collected at this site, representing over 27 percent of the total number of fish caught. Hardhead were also collected at this site in October 1999 (13 fish), January 2001 (three fish), November 2003 (six fish), October 2004 (two fish) but were not collected there in October 2001 and October 2002.

Site B had the highest diversity during October 2006 with six fish species captured (Table 3-1). This was an increase from five species in 2004 and four species in 2003, which was the lowest number of fish species collected at this site over the course of the study.

Site C. At site C, eight smallmouth bass were captured, representing over 23 percent of the total catch (Table 3-1). Smallmouth bass in this portion of the river had a population

Table 3-1. Comparison of Number of Fish Captured and Relative Abundance for 1999, 2000/2001, 2002, 2003, 2004 and 2006 and Summary Statistics for Kern River No. 1 Fish Sampling Stations, 2006.

		Oct 1999		Jan 2001		Oct 2001		Oct 2002		Nov 2003		Oct 2004		Oct 2006		Oct 2006 WEIGHT (g)					Oct 2006 FORKLENGTH (mm)				
Site	Species	Number of Fish Captured	Percent of Species per Site	Number of Fish Captured	Percent of Species per Site	Number of Fish Captured	Percent of Species per Site	Number of Fish Captured	Percent of Species per Site	Number of Fish Captured	Percent of Species per Site	Number of Fish Captured	Percent of Species per Site	Number of Fish Captured	Percent of Species per Site	Avg.	Lower 95% CI	Upper 95% CI	Min.	Max.	Avg.	Lower 95% CI	Upper 95% CI	Min.	Max.
A	Smallmouth Bass	35	66	0	0	2	1	10	17	13	68	5	45	4	80	84.0	6.0	86.9	6.0	157.0	154.8	80.5	229.0	76	224
	Sacramento Pikeminnow	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Sacramento Sucker	9	17	0	0	0	0	2	3	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Largemouth Bass	4	8	0	0	1	1	2	3	4	21	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Channel Catfish	1	2	0	0	0	0	0	0	0	0	6	55	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	White Crappie	0	0	0	0	0	0	6	10	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	White Catfish	4	8	0	0	0	0	0	0	2	11	0	0	1	20	27.0	-	-	27.0	27.0	126.0	0.0	0.0	126	126
	Threadfin Shad	0	0	0	0	144	98	37	64	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
B	Smallmouth Bass	6	6	12	27	1	0	9	43	6	30	17	71	3	4	92.3	12.6	172.1	11.0	136.0	174.7	96.5	252.8	95	218
	Hardhead	13	14	3	7	0	0	0	0	6	30	2	8	20	27	1.4	1.1	1.6	0.5	2.5	50.4	48.0	52.7	40	60
	Sacramento Pikeminnow	8	9	5	11	1	0	0	0	0	0	1	4	29	40	4.7	0.5	9.6	0.5	59.0	58.2	46.5	70.0	35	183
	Sacramento Sucker	65	70	16	36	2	1	1	5	5	25	1	4	8	11	162.6	5.0	466.2	5.0	1247.0	133.6	81.0	221.0	81	445
	Rainbow Trout	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Largemouth Bass	1	1	5	11	1	0	2	10	3	15	3	13	12	16	1.9	1.0	2.8	0.5	5.0	54.0	45.8	62.2	38	79
	White Crappie	0	0	2	4	0	0	1	5	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	White Catfish	0	0	1	2	1	0	2	10	0	0	0	0	1	1	4.0	-	-	4.0	4.0	48.0	-	-	48	48
	Threadfin Shad	0	0	0	0	207	97	6	29	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
C	Smallmouth Bass	21	17	15	43	22	22	38	14	19	28	13	30	8	24	27.9	3.0	61.0	3.0	144.0	106.3	72.9	139.6	72	219
	Hardhead	4	3	0	0	2	2	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Sacramento Pikeminnow	7	6	0	0	0	0	1	0	0	0	0	0	13	38	11.9	1.0	22.8	1.0	49.0	69.7	46.8	92.6	45	168
	Sacramento Sucker	87	69	13	37	42	41	66	24	28	41	22	50	4	12	602.8	4.0	1303.3	4.0	1450.0	258.3	68.5	958.8	68	435
	Rainbow Trout	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Largemouth Bass	1	1	1	3	2	2	12	4	3	4	2	4	1	3	<1.0	-	-	<1.0	<1.0	40.0	-	-	40	40
	Channel Catfish	0	0	2	6	2	2	7	3	0	0	1	2	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	White Catfish	5	4	2	6	2	2	14	5	2	3	6	14	8	24	142.6	22.9	262.4	1.0	458.0	164.1	100.1	228.2	38	288
	Bullhead Catfish	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Goldfish	0	0	0	0	0	0	51	18	4	6	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Carp	1	1	1	3	2	2	2	1	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Threadfin Shad	0	0	0	0	27	26	68	24	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Black Crappie	0	0	0	0	0	0	14	5	10	14	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	White Crappie	0	0	0	0	1	1	7	3	2	3	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
D	Smallmouth Bass	11	12	29	35	1	1	61	94	35	73	25	69	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Hardhead	10	11	4	5	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Sacramento Pikeminnow	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Sacramento Sucker	65	70	4	5	0	0	1	2	0	0	0	0	1	25	4.0	-	-	4.0	4.0	76.0	-	-	76	76
	Rainbow Trout	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Largemouth Bass	0	0	2	2	6	3	1	2	11	23	6	17	3	75	7.7	3.0	12.8	3.0	12.0	80.3	63.3	97.4	63	90
	Channel Catfish	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	White Crappie	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	White Catfish	2	2	41	50	2	1	1	2	1	2	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Mosquitofish	0	0	0	0	13	7	0	0	1	2	5	14	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
	Threadfin Shad	0	0	0	0	158	88	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0

Table 3-1. Comparison of Number of Fish Captured and Relative Abundance for 1999, 2000/2001, 2002, 2003, 2004 and 2006 and Summary Statistics for Kern River No. 1 Fish Sampling Stations, 2006 (continued).

		Oct 1999		Jan 2001		Oct 2001		Oct 2002		Nov 2003		Oct 2004		Oct 2006		Oct 2006 WEIGHT (g)					Oct 2006 FORKLENGTH (mm)				
Site	Species	Number of Fish Captured	Percent of Species per Site	Number of Fish Captured	Percent of Species per Site	Number of Fish Captured	Percent of Species per Site	Number of Fish Captured	Percent of Species per Site	Number of Fish Captured	Percent of Species per Site	Number of Fish Captured	Percent of Species per Site	Number of Fish Captured	Percent of Species per Site	Avg.	Lower 95% CI	Upper 95% CI	Min.	Max.	Avg.	Lower 95% CI	Upper 95% CI	Min.	Max.
E	Smallmouth Bass	45	83	15	56	7	3	50	65	23	88	32	100	-[1]	-	-	-	-	-	-	-	-	-	-	-
	Sacramento Sucker	8	15	7	26	1	0	9	12	0	0	0	0	-[1]	-	-	-	-	-	-	-	-	-	-	-
	White Catfish	1	2	5	19	1	0	14	18	2	8	0	0	-[1]	-	-	-	-	-	-	-	-	-	-	-
	Bullhead Catfish	0	0	0	0	0	0	0	0	1	4	0	0	-[1]	-	-	-	-	-	-	-	-	-	-	-
	White Crappie	0	0	0	0	0	0	3	4	0	0	0	0	-[1]	-	-	-	-	-	-	-	-	-	-	-
	Mosquitofish	0	0	0	0	0	0	1	1	0	0	0	0	-[1]	-	-	-	-	-	-	-	-	-	-	-
	Threadfin Shad	0	0	0	0	211	96	0	0	0	0	0	0	-[1]	-	-	-	-	-	-	-	-	-	-	-

[1] Site E could not be sampled with electrofishing due to safety concerns related to increased depth, adequate snorkeling could not take place due to high turbidity.

Table 3-2. Species Population Abundance Estimates for Kern River No. 1 Electrofishing Sites.

Site	Species	Fish Population by Site								
		Oct 1999 Pop. Est./Site	Jan 2001 Pop. Est./Site	Oct 2001 Pop. Est./Site	Oct 2002 Pop. Est./Site	Nov 2003 Pop. Est./Site	Oct 2004 Pop. Est./Site	Oct 2006 Pop. Est./Site	Oct 2006 Lower 95% Conf. Limit	Oct 2006 Upper 95% Conf. Limit
A	Smallmouth Bass	40	-	2	10	13	5	4	4	7
	Sacramento Sucker	11	-	-	2	-		-		
	Largemouth Bass	4	-	1	2	4	6	-		
	Channel Catfish	1	-	-	-	-		-		
	White Catfish	4	-	-	-	2		1	-	-
	Threadfin Shad	-	-	150	37	-		-		
	Sacramento Pikeminnow	-	-	-	2	-		-		
	White Crappie	-	-	-	6	-		-		
B	Smallmouth Bass	14	12	1	12	6	17	3	-	-
	Hardhead	17	1	-	-	8	2	20	20	20
	Sacramento Pikeminnow	10	8	1	-	-	1	29	29	30
	Sacramento Sucker	108	17	2	1	5	1	8	8	8
	Rainbow Trout	-	1	-	-	-		-		
	Largemouth Bass	1	7	1	2	3	3	12	12	14
	White Crappie	-	1	-	1	-		-		
	White Catfish	-	-	1	2	-		1	-	-
	Threadfin Shad	-	-	207	6	-		-		
C	Smallmouth Bass	29	21	22	40	19	13	8	8	10
	Hardhead	8	-	2	-	-		-		
	Sacramento Pikeminnow	17	-	-	1	-		13	13	15
	Sacramento Sucker	355	19	42	66	28	22	4	4	5
	Rainbow Trout	1	1	-	-	-		-		
	Largemouth Bass	-	1	2	12	3	2	1	-	-
	Channel Catfish	-	2	2	7	-	1	-		
	White Catfish	9	2	2	14	2	6	8	8	9
	Bullhead Catfish	-	-	-	-	1		-		
	Carp	1	1	2	2	-		-		
	White Crappie	-	-	1	8	2		-		
	Threadfin Shad	-	-	27	68	-		-		
	Black Crappie	-	-	-	14	10		-		
	Goldfish	-	-	-	51	4		-		

Table 3-2. Species Population Abundance Estimates for Kern River No. 1 Electrofishing Sites (continued).

Site	Species	Fish Population by Site								
		Oct 1999 Pop. Est./Site	Jan 2001 Pop. Est./Site	Oct 2001 Pop. Est./Site	Oct 2002 Pop. Est./Site	Nov 2003 Pop. Est./Site	Oct 2004 Pop. Est./Site	Oct 2006 Pop. Est./Site	Oct 2006 Lower 95% Conf. Limit	Oct 2006 Upper 95% Conf. Limit
D	Smallmouth Bass	15	31	1	76	44	25	-		
	Hardhead	12	4	-	-	-		-		
	Sacramento Pikeminnow	4	0	-	-	-		-		
	Sacramento Sucker	94	8	-	1	-		1	-	-
	Rainbow Trout	-	1	-	-	-		-		
	Largemouth Bass	-	2	6	1	11	6	3	3	6
	Channel Catfish	1	1	-	-	-		-		
	White Catfish	3	76	2	1	1		-		
	Mosquitofish	-	-	13	-	1	5	-		
	Threadfin Shad	-	-	162	-	-		-		
	White Crappie	-	-	-	1	-		-		
E	Smallmouth Bass	51	17	7	52	27	32	-		
	Sacramento Sucker	10	7	1	9	-		-		
	White Catfish	1	5	1	14	2		-		
	Bullhead Catfish	-	-	-	-	1		-		
	Threadfin Shad	-	-	224	-	-		-		
	Mosquitofish	-	-	-	1	-		-		
	White Crappie	-	-	-	3	-		-		

Table 3-3. Species Population Density Estimates for Kern River No. 1 Electrofishing Sites.

Site	Species	Fish Density (No./km)									Fish Density (No./Ha)								
		Oct 1999 Pop. Est./km	Jan 2001 Pop. Est./km	Oct 2001 Pop. Est./km	Oct 2002 Pop. Est./km	Nov 2003 Pop. Est./km	Oct 2004 Pop. Est./km	Oct 2006 Pop. Est./km	Oct 2006 Lower 95% Conf. Limit	Oct 2006 Upper 95% Conf. Limit	Oct 1999 Pop. Est./Ha	Jan 2001 Pop. Est./Ha	Oct 2001 Pop. Est./Ha	Oct 2002 Pop. Est./Ha	Nov 2003 Pop. Est./Ha	Oct 2004 Pop. Est./Ha	Oct 2006 Pop. Est./Ha	Oct 2006 Lower 95% Conf. Limit	Oct 2006 Upper 95% Conf. Limit
A	Smallmouth Bass	881	-	44	162	257	99	88	20	155	501	-	31	142	159	61	45	10	79
	Sacramento Sucker	241	-	-	32	-		-			137	-	-	28	-		-		
	Largemouth Bass	87	-	22	32	79	119	-			50	-	15	28	49	73	-		
	Channel Catfish	22	-	-	-	-		-			12	-	-	-	-		-		
	White Catfish	87	-	-	-	40		22	-	-	50	-	-	-	25		11	-	-
	Threadfin Shad	-	-	3282	598	-		-			-	-	2311	524	-		-		
	Sacramento Pikeminnow	-	-	-	32	-		-			-	-	-	28	-		-		
	White Crappie	-	-	-	97	-		-			-	-	-	85	-		-		
B	Smallmouth Bass	306	267	22	242	125	355	66	-	-	215	184	16	173	73	208	42	-	-
	Hardhead	363	22	-	-	167	42	438	436	440	255	15	-	-	98	24	282	281	284
	Sacramento Pikeminnow	208	175	22	-	-	21	635	606	663	146	121	16	-	-	12	409	391	428
	Sacramento Sucker	2367	366	44	20	104	21	175	169	181	1660	252	33	14	61	12	113	109	117
	Rainbow Trout	-	22	-	-	-		-			-	15	-	-	-		-		
	Largemouth Bass	22	153	22	40	63	63	263	217	308	15	106	16	29	37	37	169	140	199
	White Crappie	-	22	-	20	-		-			-	15	-	14	-		-		
	White Catfish	-	-	22	40	-		22	-	-	-	-	16	29	-		14	-	-
	Threadfin Shad	-	-	4530	121	-		-			-	-	3406	87	-		-		
C	Smallmouth Bass	643	451	481	875	473	323	175	120	230	443	289	332	576	241	165	130	89	170
	Hardhead	175	-	44	-	-		-			121	0	30	-	-		-		
	Sacramento Pikeminnow	372	-	-	22	-		285	233	336	256	0	-	14	-		211	172	249
	Sacramento Sucker	7773	416	919	1444	697	547	88	73	102	5358	266	634	950	355	279	65	54	75
	Rainbow Trout	22	22	-	-	-		-			15	14	-	-	-		-		
	Largemouth Bass	-	22	44	263	75	50	22	-	-	-	14	30	173	38	25	16	-	-
	Channel Catfish	-	44	44	153	-	25	-			-	28	30	101	-	13	-		
	White Catfish	197	44	44	306	50	149	175	149	202	136	28	30	202	25	76	130	110	149
	Bullhead Catfish	-	-	-	-	25		-			-	-	-	-	13		-		
	Carp	22	22	44	44	-		-			15	14	30	29	-		-		
	White Crappie	-	-	22	175	50		-			-	-	15	115	25		-		
	Threadfin Shad	-	-	591	1487	-		-			-	-	407	979	-		-		
	Black Crappie	-	-	-	306	249		-			-	-	-	202	127		-		
	Goldfish	-	-	-	1116	100		-			-	-	-	734	51		-		
D	Smallmouth Bass	323	667	22	1662	1060	602	-			228	579	17	1131	675	384	-		
	Hardhead	252	95	-	-	-		-			178	82	-	-	-		-		
	Sacramento Pikeminnow	95	-	-	-	-		-			67	0	-	-	-		-		
	Sacramento Sucker	2057	175	-	22	-		22	-	-	1455	152	-	15	-		15	-	-
	Rainbow Trout	-	22	-	-	-		-			-	19	-	-	-		-		
	Largemouth Bass	-	44	131	22	265	145	66	5	136	-	38	103	15	169	92	45	3	93
	Channel Catfish	22	22	-	-	-		-			15	19	-	-	-		-		
	White Catfish	66	1662	44	22	24		-			46	1444	34	15	15		-		
	Mosquitofish	-	-	284	-	24	120	-			-	-	224	-	15	77	-		
	Threadfin Shad	-	-	3545	-	-		-			-	-	2791	-	-		-		
	White Crappie	-	-	-	22	-		-			-	-	-	15	-		-		

Table 3-3. Species Population Density Estimates for Kern River No. 1 Electrofishing Sites (continued).

Site	Species	Fish Density (No./km)									Fish Density (No./Ha)								
		Oct 1999 Pop. Est./km	Jan 2001 Pop. Est./km	Oct 2001 Pop. Est./km	Oct 2002 Pop. Est./km	Nov 2003 Pop. Est./km	Oct 2004 Pop. Est./km	Oct 2006 Pop. Est./km	Oct 2006 Lower 95% Conf. Limit	Oct 2006 Upper 95% Conf. Limit	Oct 1999 Pop. Est./Ha	Jan 2001 Pop. Est./Ha	Oct 2001 Pop. Est./Ha	Oct 2002 Pop. Est./Ha	Nov 2003 Pop. Est./Ha	Oct 2004 Pop. Est./Ha	Oct 2006 Pop. Est./Ha	Oct 2006 Lower 95% Conf. Limit	Oct 2006 Upper 95% Conf. Limit
E	Smallmouth Bass	1118	369	153	1137	587	696	-			695	225	91	734	347	412	-		
	Sacramento Sucker	208	153	22	197	-		-			129	93	13	127	-		-		
	White Catfish	22	109	22	306	44		-			14	67	13	198	26		-		
	Bullhead Catfish	-	-	-	-	22		-			-	-	-	-	13		-		
	Threadfin Shad	-	-	4902	-	-		-			-	-	2918	-	-		-		
	Mosquitofish	-	-	-	22	-		-			-	-	-	14	-		-		
	White Crappie	-	-	-	66	-		-			-	-	-	42	-		-		

Table 3-4. Species Population Biomass Estimates for Kern River No. 1 Electrofishing Sites.

Site	Species	Fish Biomass by Site								
		Oct 1999 Biomass (kg) / Site	Jan 2001 Biomass (kg) / Site	Oct 2001 Biomass (kg) / Site	Oct 2002 Biomass (kg) / Site	Nov 2003 Biomass (kg) / Site	Oct 2004 Biomass (kg) / Site	Oct 2006 Biomass (kg) / Site	Oct 2006 Lower 95% Conf. Limit	Oct 2006 Upper 95% Conf. Limit
A	Smallmouth Bass	0.66	-	0.04	0.2	0.24	0.05	0.34	0.34	0.59
	Sacramento Sucker	0.13	-	-	2.6	-	-	-	-	-
	Largemouth Bass	0.09	-	0.02	0	0.25	0.02	-	-	-
	Channel Catfish	0.11	-	-	-	-	-	-	-	-
	White Catfish	0.27	-	-	-	0.15	-	0.03	-	-
	Threadfin Shad	-	-	0.61	0.2	-	-	-	-	-
	Sacramento Pikeminnow	-	-	-	0	-	-	-	-	-
	White Crappie	-	-	-	0.1	-	-	-	-	-
B	Smallmouth Bass	0.72	0.32	0.03	0.5	0.13	0.42	0.28	-	-
	Hardhead	0.26	0.01	-	-	0.02	0.18	0.03	0.03	0.03
	Sacramento Pikeminnow	0.17	0.04	0	-	-	0.12	0.15	0.15	0.15
	Sacramento Sucker	1.83	14.42	0.66	0.6	4.08	1.16	1.30	1.30	1.34
	Rainbow Trout	-	0.56	-	-	-	-	-	-	-
	Largemouth Bass	0.01	0.1	0.01	0	0.21	0.01	0.02	0.02	0.03
	White Crappie	-	0.01	-	0	-	-	-	-	-
	White Catfish	-	-	0	0	-	-	0.00	-	-
	Threadfin Shad	-	-	0.66	0	-	-	-	-	-
C	Smallmouth Bass	0.97	3.72	3.71	4.8	0.59	0.43	0.22	0.22	0.29
	Hardhead	0.86	-	0.58	-	-	-	-	-	-
	Sacramento Pikeminnow	0.85	-	-	n/a	-	-	0.10	0.10	0.11
	Sacramento Sucker	190.91	13.58	18.98	57	21.85	17.62	2.41	2.41	2.80
	Rainbow Trout	-	0.7	-	-	-	-	-	-	-
	Largemouth Bass	-	0.01	0.7	3.8	0.32	0.37	0.00	-	-
	Channel Catfish	-	0.68	n/a	15.3	-	0.08	-	-	-
	White Catfish	4.23	0.32	0.07	2.2	0.13	0.53	1.14	1.14	1.31
	Bullhead Catfish	-	-	-	-	0.01	-	-	-	-
	Carp	1.5	0.05	0.84	0.6	-	-	-	-	-
	White Crappie	-	-	0.32	0.4	0.12	-	-	-	-
	Threadfin Shad	-	-	0.11	0.4	-	-	-	-	-
	Black Crappie	-	-	-	1.6	0.82	-	-	-	-
	Goldfish	-	-	-	7.3	0.81	-	-	-	-

Table 3-4. Species Population Biomass Estimates for Kern River No. 1 Electrofishing Sites (continued).

Site	Species	Fish Biomass by Site								
		Oct 1999 Biomass (kg) / Site	Jan 2001 Biomass (kg) / Site	Oct 2001 Biomass (kg) / Site	Oct 2002 Biomass (kg) / Site	Nov 2003 Biomass (kg) / Site	Oct 2004 Biomass (kg) / Site	Oct 2006 Biomass (kg) / Site	Oct 2006 Lower 95% Conf. Limit	Oct 2006 Upper 95% Conf. Limit
D	Smallmouth Bass	0.21	0.57	0.01	0.9	0.73	0.49	-	-	-
	Hardhead	0.05	0.02	-	-	-	-	-	-	-
	Sacramento Pikeminnow	0.04	0	-	-	-	-	-	-	-
	Sacramento Sucker	1.33	0.26	-	0	-	-	0.00	-	-
	Rainbow Trout	-	0.2	-	-	-	-	-	-	-
	Largemouth Bass	-	0.01	0.23	0.2	0.07	0.02	0.02	0.02	0.05
	Channel Catfish	0.03	0	-	-	-	-	-	-	-
	White Catfish	0.01	0.31	0.09	0	0.01	-	-	-	-
	Mosquitofish	-	-	-	-	0	0.00	-	-	-
	Threadfin Shad	-	-	0.59	-	-	-	-	-	-
	White Crappie	-	-	-	0	-	-	-	-	-
E	Smallmouth Bass	2.21	1.08	0.35	1.6	0.88	0.82	-	-	-
	Sacramento Sucker	0.19	9.67	0.03	0.4	-	-	-	-	-
	White Catfish	0.06	0.11	0.12	0.7	0.1	-	-	-	-
	Bullhead Catfish	-	-	-	-	0	-	-	-	-
	Threadfin Shad	-	-	0.7	-	-	-	-	-	-
	Mosquitofish	-	-	-	0	-	-	-	-	-
	White Crappie	-	-	-	0.1	-	-	-	-	-

Table 3-5. Species Population Biomass Density Estimates for Kern River No. 1 Electrofishing Sites.

Site	Species	Fish Density (kg/km)									Fish Density (kg/Ha)								
		Oct 1999 Biomass (kg) / km	Jan 2001 Biomass (kg) / km	Oct 2001 Biomass (kg) / km	Oct 2002 Biomass (kg) / km	Nov 2003 Biomass (kg) / km	Oct 2004 Biomass (kg) / km	Oct 2006 Biomass (kg) / km	Oct 2006 Lower 95% Conf. Limit	Oct 2006 Upper 95% Conf. Limit	Oct 1999 Biomass (kg) / Ha	Jan 2001 Biomass (kg) / Ha	Oct 2001 Biomass (kg) / Ha	Oct 2002 Biomass (kg) / Ha	Nov 2003 Biomass (kg) / Ha	Oct 2004 Biomass (kg) / Ha	Oct 2006 Biomass (kg) / Ha	Oct 2006 Lower 95% Conf. Limit	Oct 2006 Upper 95% Conf. Limit
A	Smallmouth Bass	14.4	-	0.93	3.2	4.81	1.0	7.35	7.35	13.02	8.19	-	0.65	2.8	2.97	0.6	5.77	5.77	6.68
	Sacramento Sucker	2.82	-	-	42.2	-		-	-	-	1.6	-	-	37	-		-	-	-
	Largemouth Bass	1.93	-	0.37	0.3	5.03	0.4	-	-	-	1.1	-	0.26	0.2	3.1	0.2	-	-	-
	Channel Catfish	2.34	-	-	-	-		-	-	-	1.33	-	-	-	-		-	-	-
	White Catfish	5.81	-	-	-	2.97		0.57	-	-	3.31	-	-	-	1.83		0.30	-	-
	Threadfin Shad	-	-	13.35	3.3	-		-	-	-	-	-	9.41	2.9	-		-	-	-
	Sacramento Pikeminnow	-	-	-	0.1	-		-	-	-	-	-	-	0.1	-		-	-	-
	White Crappie	-	-	-	2	-		-	-	-	-	-	-	1.7	-		-	-	-
B	Smallmouth Bass	15.7	7.06	0.63	9.3	2.67	8.8	6.06	-	-	11.01	4.87	0.47	6.7	1.56	5.1	3.91	-	-
	Hardhead	5.65	0.17	-	-	0.5	3.7	0.59	0.59	0.59	3.96	0.12	-	-	0.29	2.1	0.38	0.38	0.38
	Sacramento Pikeminnow	3.81	0.77	0.04	-	-	2.6	3.18	3.18	3.33	2.67	0.53	0.03	-	-	1.5	2.05	2.05	2.15
	Sacramento Sucker	39.94	315.33	14.53	11.8	85.26	24.2	28.47	28.47	29.39	28.02	217.56	10.93	8.4	49.86	14.2	18.37	18.37	18.96
	Rainbow Trout	-	12.25	-	-	-		-	-	-	-	8.45	-	-	-		-	-	-
	Largemouth Bass	0.19	2.18	0.21	0.2	4.45	0.2	0.50	0.50	0.59	0.13	1.5	0.16	0.2	2.6	0.1	0.32	0.32	0.38
	White Crappie	-	0.11	-	0.4	-		-	-	-	-	0.08	-	0.3	-		-	-	-
	White Catfish	-	-	0.09	0.1	-		0.08	-	-	-	-	0.07	0.1	-		0.06	-	-
	Threadfin Shad	-	-	14.53	0.7	-		-	-	-	-	-	10.93	0.5	-		-	-	-
C	Smallmouth Bass	21.21	81.36	81.1	105.3	14.63	10.8	4.88	4.88	6.40	14.62	52.11	55.95	69.3	7.46	5.5	3.61	3.61	4.74
	Hardhead	18.79	-	12.62	-	-		-	-	-	12.95	-	8.71	-	-		-	-	-
	Sacramento Pikeminnow	18.57	-	-	n/a	-		2.08	2.08	2.46	12.8	-	-	n/a	-		1.54	1.54	1.82
	Sacramento Sucker	4175.72	296.95	415.17	1247.8	543.63	438.4	52.76	52.76	61.37	2878.06	190.19	286.45	820.9	277.36	223.7	39.08	39.08	45.46
	Rainbow Trout	-	15.31	-	-	-		-	-	-	-	9.81	-	-	-		-	-	-
	Largemouth Bass	-	0.3	15.24	83.1	7.99	9.1	0.01	-	-	-	0.19	10.52	54.7	4.07	4.7	0.01	-	-
	Channel Catfish	-	14.87	-	334.2	-	1.9	-	-	-	-	9.52	-	219.9	-	1.0	-	-	-
	White Catfish	92.52	6.99	1.53	47.9	3.23	13.2	24.97	24.97	28.75	63.77	4.48	1.06	31.5	1.65	6.7	18.49	18.49	21.30
	Bullhead Catfish	-	-	-	-	0.3		-	-	-	-	-	-	-	0.15		-	-	-
	Carp	32.81	1.01	18.34	12.9	-		-	-	-	22.61	0.65	12.65	8.5	-		-	-	-
	White Crappie	-	-	6.92	7.7	3.06		-	-	-	-	-	4.77	5.1	1.56		-	-	-
	Threadfin Shad	-	-	2.4	9.6	-		-	-	-	-	-	1.66	6.3	-		-	-	-
	Black Crappie	-	-	-	33.9	20.42		-	-	-	-	-	-	22.3	10.42		-	-	-
	Goldfish	-	-	-	158.9	20.15		-	-	-	-	-	-	104.5	10.28		-	-	-
D	Smallmouth Bass	4.49	12.54	0.26	19.7	17.69	11.8	-	-	-	3.17	10.89	0.21	13.4	11.27	7.5	-	-	-
	Hardhead	1.08	0.5	-	-	-		-	-	-	0.77	0.43	-	-	-		-	-	-
	Sacramento Pikeminnow	0.84	-	-	-	-		-	-	-	0.59	-	-	-	-		-	-	-
	Sacramento Sucker	28.99	5.65	-	0.3	-		0.09	-	-	20.5	4.91	-	0.2	-		0.06	-	-
	Rainbow Trout	-	4.37	-	-	-		-	-	-	-	3.8	-	-	-		-	-	-
	Largemouth Bass	-	0.13	5.14	3.5	1.58	0.4	0.50	0.50	1.04	-	0.11	4.05	2.4	1.01	0.3	0.34	0.34	0.71
	Channel Catfish	0.76	0.11	-	-	-		-	-	-	0.54	0.09	-	-	-		-	-	-
	White Catfish	-	-	1.93	0.1	0.19		-	-	-	0.17	-	1.52	0	0.12		-	-	-
	Mosquitofish	-	-	-	-	0.02	0.0	-	-	-	-	-	-	-	0.02	0.0	-	-	-
	Threadfin Shad	0.24	6.7	12.96	-	-		-	-	-	-	-	10.21	-	-		-	-	-
	White Crappie	-	-	-	0.4	-		-	-	-	-	-	-	0.3	-		-	-	-

Table 3-5. Species Population Biomass Density Estimates for Kern River No. 1 Electrofishing Sites (continued).

Site	Species	Fish Density (kg/km)									Fish Density (kg/Ha)								
		Oct 1999 Biomass (kg) / km	Jan 2001 Biomass (kg) / km	Oct 2001 Biomass (kg) / km	Oct 2002 Biomass (kg) / km	Nov 2003 Biomass (kg) / km	Oct 2004 Biomass (kg) / km	Oct 2006 Biomass (kg) / km	Oct 2006 Lower 95% Conf. Limit	Oct 2006 Upper 95% Conf. Limit	Oct 1999 Biomass (kg) / Ha	Jan 2001 Biomass (kg) / Ha	Oct 2001 Biomass (kg) / Ha	Oct 2002 Biomass (kg) / Ha	Nov 2003 Biomass (kg) / Ha	Oct 2004 Biomass (kg) / Ha	Oct 2006 Biomass (kg) / Ha	Oct 2006 Lower 95% Conf. Limit	Oct 2006 Upper 95% Conf. Limit
E	Smallmouth Bass	48.25	23.59	7.73	35.4	19.19	17.9	-	-	-	29.98	14.38	4.61	22.8	11.36	10.6	-	-	-
	Sacramento Sucker	4.23	211.53	0.56	8.8	-		-	-	-	2.63	128.88	0.33	5.7	-		-	-	-
	White Catfish	1.41	2.33	2.65	15.5	2.09		-	-	-	0.88	1.42	1.58	10	1.23		-	-	-
	Bullhead Catfish	-	-	-	-	0.09		-	-	-	-	-	-	-	0.05		-	-	-
	Threadfin Shad	-	-	15.24	-	-		-	-	-	-	-	9.07	-	-		-	-	-
	Mosquitofish	-	-	-	0	-		-	-	-	-	-	-	0	-		-	-	-
	White Crappie	-	-	-	2.4	-		-	-	-	-	-	-	1.6	-		-	-	-

density of 175.1 fish/km, and a biomass of 3.61 kg/ha (Tables 3-3, 3-4, and 3-5). The total fish density for all species for this portion of the river was 744.1 fish/km, and the biomass estimate was 62.73 kg/ha (Tables 3-3, 3-4, and 3-5).

Sacramento pikeminnow was the most abundant species at this site and comprised 38 percent of the total catch, but only 2.5 percent of the total biomass. Sacramento sucker contributed the greatest biomass (62.3 percent) despite being less than 12 percent of the total catch. The number of Sacramento sucker collected in October 2006 (four fish) was down from 2004 (22 fish), 2003 (28 fish) and 2002 (66 fish). Therefore, the number of Sacramento sucker captured at Site C has been decreasing over the past four sample years.

Five fish species were collected at Site C in October 2006 (Table 3-1) equaling 2004. However, this was the lowest number of species captured since the initial sampling event in 1999. Additionally, there were fewer smallmouth bass, Sacramento sucker and largemouth bass collected in October 2006 than the previous six sampling events. However, 2006 saw the greatest abundance of Sacramento pikeminnow since the study began and a greater number of white catfish were collected in 2006, than in 2004 and 2003.

Site D. At site D, there were no smallmouth bass captured in 2006 (Table 3-1). This is in contrast to all previous years which recorded high abundances of smallmouth bass.

Two fish species (largemouth bass, and Sacramento sucker) were captured at this site in 2006 (Table 3-1). Fewer largemouth bass were collected in 2006 (three fish) than in 2004 (six fish) and 2003 (11 fish).

Site E. Site E was not sampled due to high flow and consequently deep water conditions that made it unsafe for electrofishing. Visibility was poor, so snorkel observations were precluded. The absence of a sample from this site that contained numerous smallmouth bass in other years may lead to an overall reduction in total number of smallmouth bass collected. It could not be determined whether the abundance of smallmouth bass at this site had declined.

3.1.3 Comparison to Earlier Electrofishing Results

2006 had the lowest number of smallmouth bass since the study began in 1999 although Site E, in past years a productive site for smallmouth bass, was not sampled in 2006 and may account for this reduction in catch. Therefore the results of the October 2006 survey only relate to Sites A-D. Sacramento pikeminnow was the most abundant fish species collected followed in abundance by Hardhead. Previously, both Sacramento pikeminnow and hardhead were two of the least abundant species. Following the trend of 2003 and 2004.

Figure 3-1 presents the relative species compositions for each of the years sampled. In 2006, smallmouth bass comprised 13 percent of the total number of fish, which was the smallest percentage for any of the previous years (absent threadfin shad). In October 2004, all sites were successfully sampled. The abundance of smallmouth bass in 2004 for

sites A-D was 60 fish or 52 percent of the catch in those sites. Therefore, the abundance of smallmouth bass sampled in October 2006 remained lower than the corresponding sites in October 2004. This may be related to the effect of two years of very high flows on recruitment of smallmouth bass.

Sacramento pikeminnow represented 36 percent of the total composition, the largest percentage of any of the previous years. Sites B and C proved to be the most productive in terms of abundance and diversity in October 2006.

The catch of Sacramento pikeminnow in 2006 showed an increase over past years and represented 36 percent of the total catch. However, all but four of these fish were YOY. It is a possibility high flows during 2005 and 2006 displaced young Sacramento pikeminnow and hardhead into the bypass reach. A single adult Sacramento pikeminnow was found in 2004, while in 2003 they were absent from the catch. In 2002 and 2001 Sacramento pikeminnow represented 0.4 percent and one percent of the total catch, respectively. In 1999 pikeminnow comprised five percent of the total number of fish.

During October 1999, hardhead comprised seven percent of the total number of fish, this declined to four percent in January 2001, and down to two percent (absent threadfin shad) in October 2001. Hardhead were not collected in 2002, but were once again collected during the 2003 sampling (only at Site B), representing 3.3 percent of the total. In 2004 two hardhead were collected, again at Site B. In 2006 hardhead represented 17 percent of the total number of fish, the highest percentage of any previous year. All 2006 individuals were YOY so contributed little to the overall biomass and, like the Sacramento pikeminnow, may have been displaced from upstream by high flows during 2006.

Figure 3-2 presents the relative biomass composition for each of the years sampled. Sacramento sucker comprised the majority of the biomass for all years sampled; smallmouth bass comprised the second highest percentage, except October 2002 and October 2006. Again, the inability to sample site E in October 2006 leads to a possible underestimation of the total biomass for smallmouth bass. In October 2006, white catfish had the second highest percentage biomass followed by smallmouth bass while in October 2002; channel catfish had the second highest percentage biomass, again followed by smallmouth bass.

During October 2001, a large number of threadfin shad was collected at the electrofishing sites. The threadfin shad numerically dominated the species composition in October 2001 (Figure 3-1). However, the composition of species based on biomass was dominated by the Sacramento sucker population (Figure 3-2). Threadfin shad made up about nine percent of the total biomass in that year.

Sacramento sucker comprised the majority of the biomass for each year sampled. However, the proportion of biomass represented by the Sacramento sucker population dropped from 93.6 percent in October 1999 to 59.7 percent in October 2002 (with decreases in percentage observed for each subsequent sampling trip between the two dates). In November 2003, the biomass percentage represented by the Sacramento sucker

population had increased to 82.3 percent, which coincides with the increase in relative abundance observed in Figure 3-1. In October 2004 Sacramento sucker biomass increased to 84.1 percent despite a slight decrease in abundance. In October 2006, Sacramento sucker biomass dropped to 62 percent, which coincides with the decrease in relative abundance observed in Figure 3-1. Sacramento sucker were collected at three of the four sites sampled in October 2006 (Sites B, C and D) compared to two of the five sites in November 2003 and October 2004 (Sites B and C). In October 2002 Sacramento sucker were collected at all five sites.

Figure 3-3 presents the length frequencies of smallmouth bass for the six sampling trips. This figure suggests that there are at least three age groups representing the overall population. However, there seems to be a considerable amount of overlap between age groups. The smallmouth bass collected between sites A through D in 2006 likely was composed primarily two age classes, 1+ and 2+ year old fish. However, some Age 0+ fish may have been included in this sample.

Figure 3-5 presents estimated abundance and 95 percent confidence intervals for smallmouth bass by sampling site and trip. At Site A, the estimated abundance of smallmouth bass was four fish in October 2006. This abundance was similar to the five fish caught in October 2004, but a reduction from November 2003 (13 fish), and October 2002 (10 fish). Smallmouth bass estimated abundance at this site was greater than 2001, but was still less than the estimate for 1999 (40 fish). At Site B, the estimated number of smallmouth bass had decreased from 17 fish in 2004 to three fish in October 2006. The estimated number of smallmouth bass at Site B in 2006 was only greater than in October 2001. At Site C, estimated smallmouth bass abundance dropped from 13 fish in October 2004 to 8 fish in October 2006. The estimated number of smallmouth bass at this site has decreased over the last three sample years. Site D yielded no smallmouth bass during October 2006. This is a change from previous years: an estimated 25 and 44 fish in October 2004 and November 2003 respectively. Additionally, October 2002 yielded an estimated 76 fish at this site, which was the highest estimate of any study site and year to date. At Site E, high flows and consequently deep water conditions in October 2006 made sampling extremely difficult and therefore unreliable as a method to estimate fish populations. In October 2004, during better sampling conditions, the estimated number of smallmouth bass at Site E (32 fish) was greater than all other sampled sites in October 2004. The 2004 estimate was up slightly from 2003 (27 fish) but down from the October 2002 total of (52 fish).

Overall, the abundance of smallmouth bass during the October 2006 sampling event declined from the numbers of fish observed in October 2004, which had also decreased from November 2003. Site D had consistently yielded relatively high numbers of smallmouth bass until 2006. Site E was not sampled in 2006.

Figure 3-6 presents comparisons of estimated abundance and 95 percent confidence intervals for total numbers of fish by site and sampling trip. For the October 2001 sampling trip, numbers are shown with and without threadfin shad to facilitate comparisons to October 2006 and with previous field trips. The figure indicates that the abundance at each site sampled during October 2006 was generally less than the same

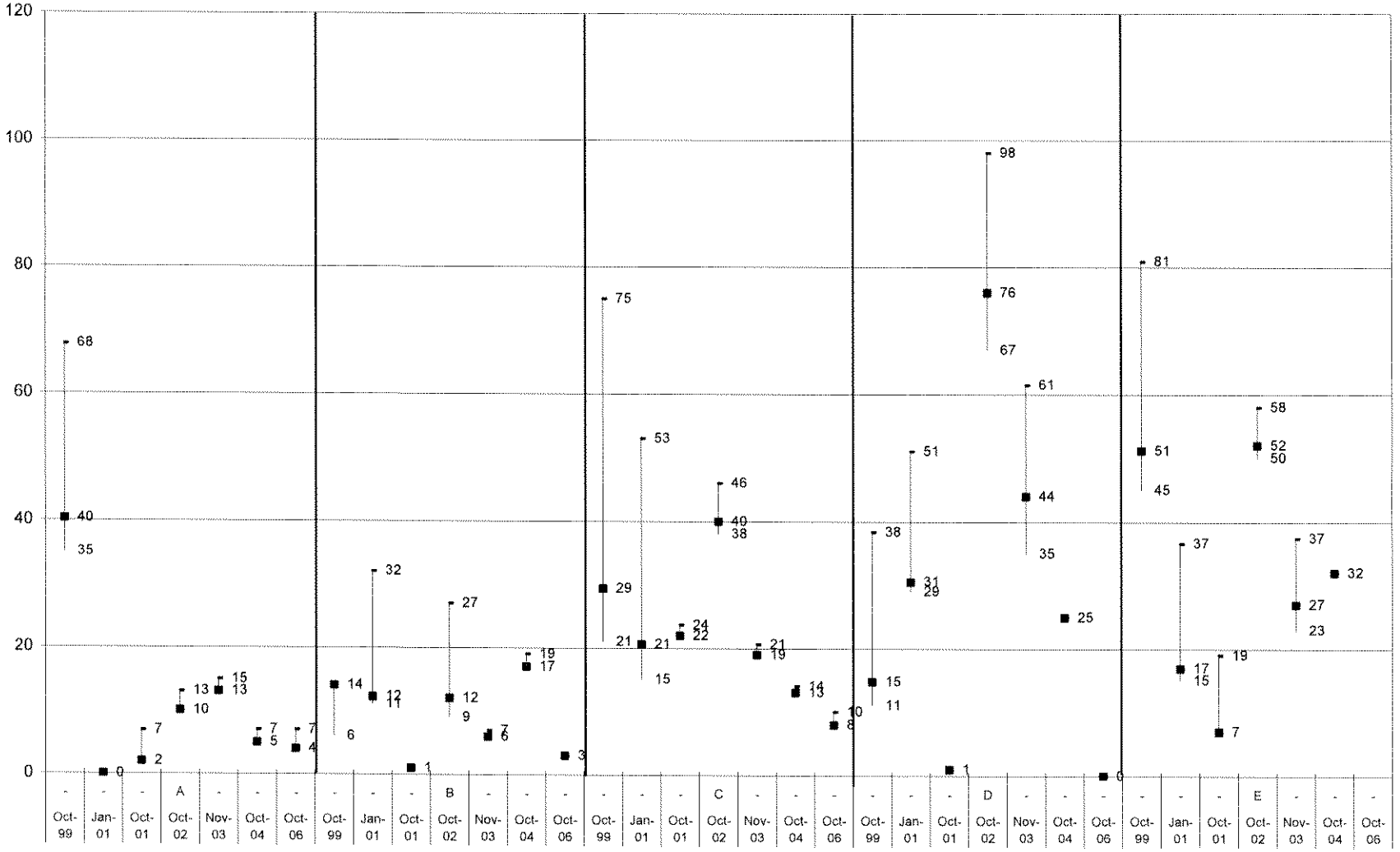
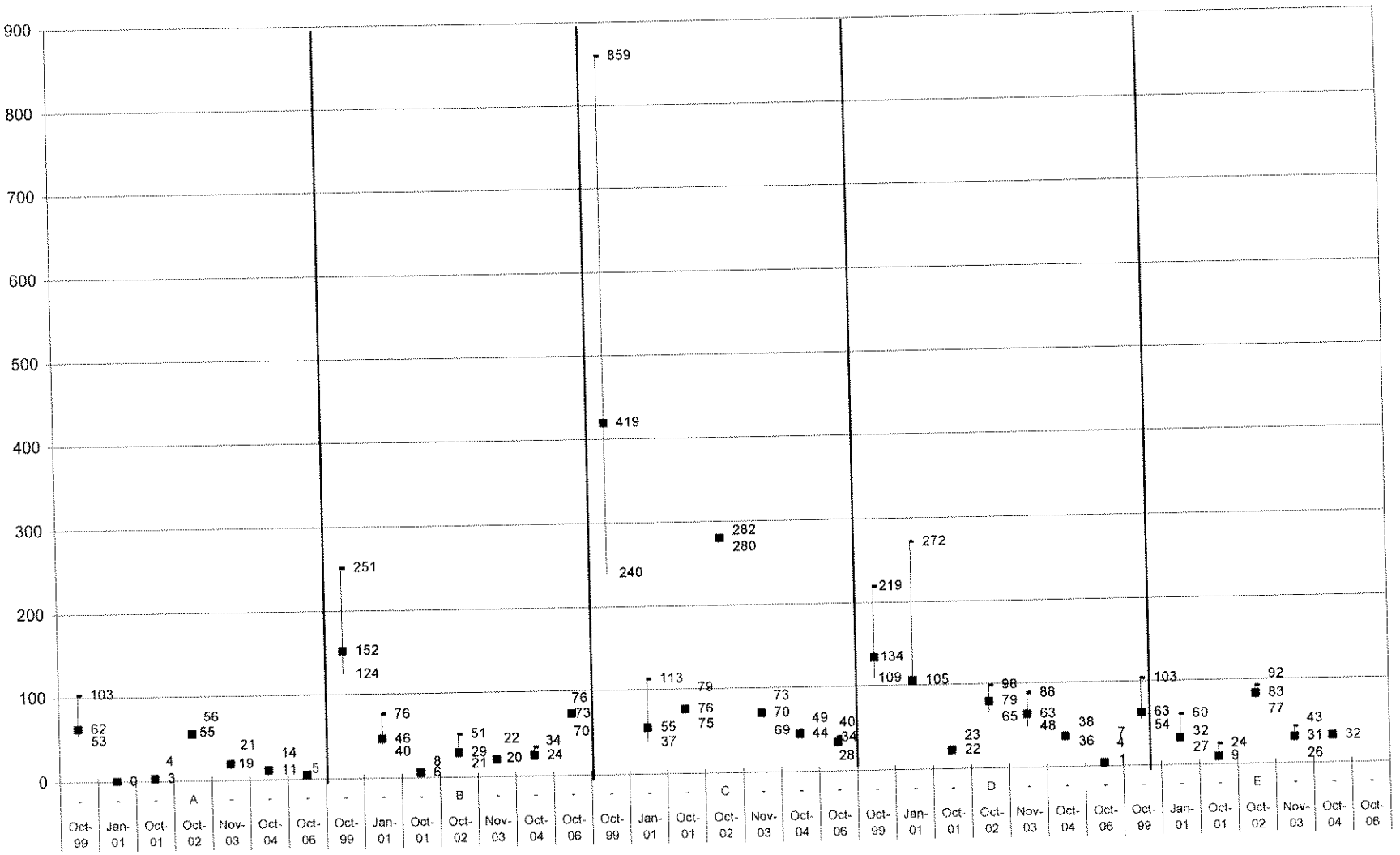


Figure 3-5. Comparison of Smallmouth Bass Abundances per Site with 95 Percent Confidence Intervals in the KR1 Reach of the Kern River.



Note: + Indicates estimates including threadfin shad for October 2001, no + indicates threadfin shad not included.

Figure 3-6. Comparison of Fish Abundances per Site with 95 Percent Confidence Intervals in the KR1 Reach of the Kern River.

sites sampled during October 2004, November 2003 and October 2002. Site B was the exception with October 2006 demonstrating the greatest estimated abundance since October 1999. During October 2006, with the exception of Site B, there was a decrease in the abundance of fish collected at each site (Figure 3-7).

Figure 3-8 presents comparisons of the estimated abundance and 95 percent confidence intervals for hardhead by site and sampling trip. The greatest numbers of hardhead were collected in October 1999. In October 2006, hardhead were only collected at Site B, as they were in November 2003, October 2004, and October 2006. Hardhead were not collected at any of the sites in October 2002.

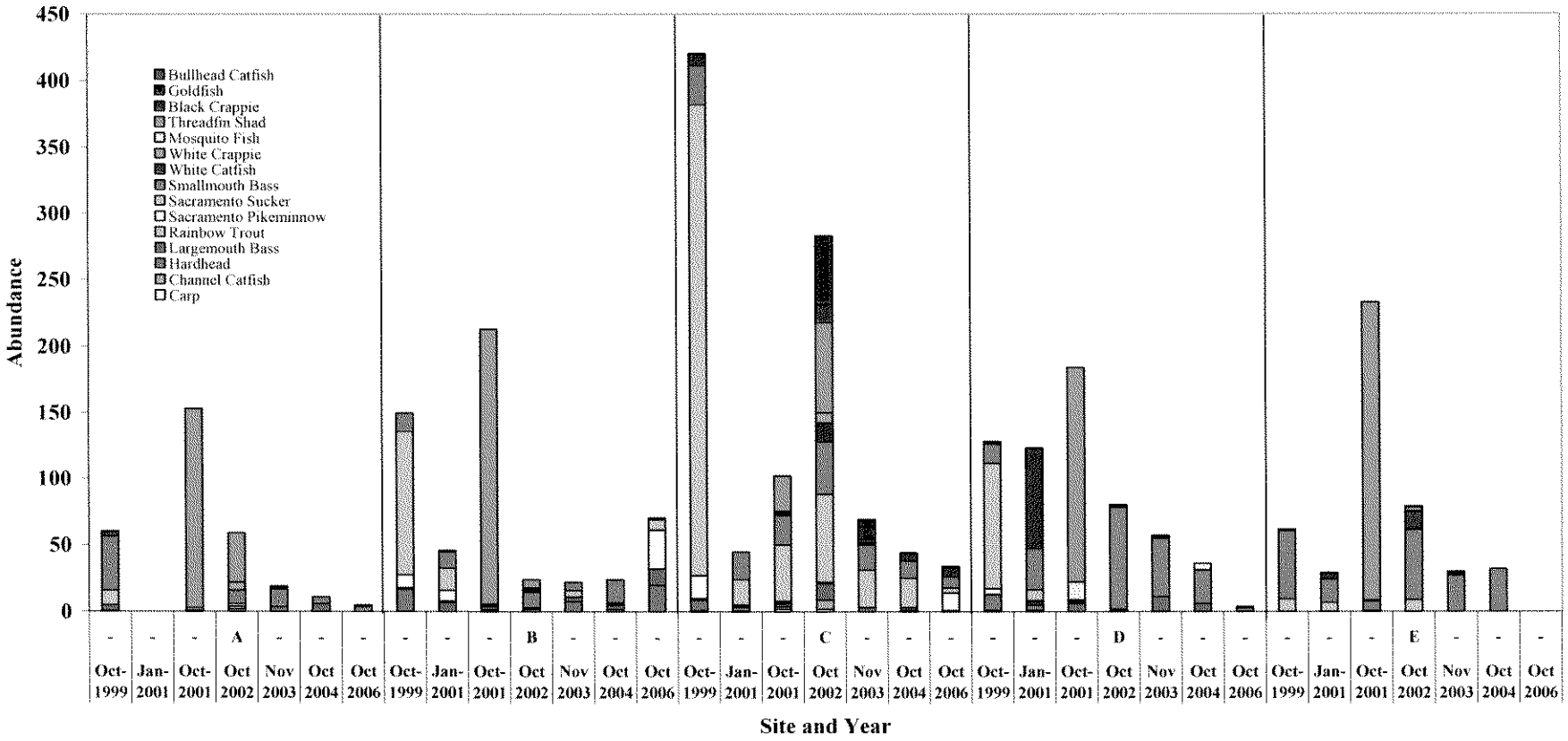


Figure 3-7. Comparison of KR1 Site Abundances by Year and Species.

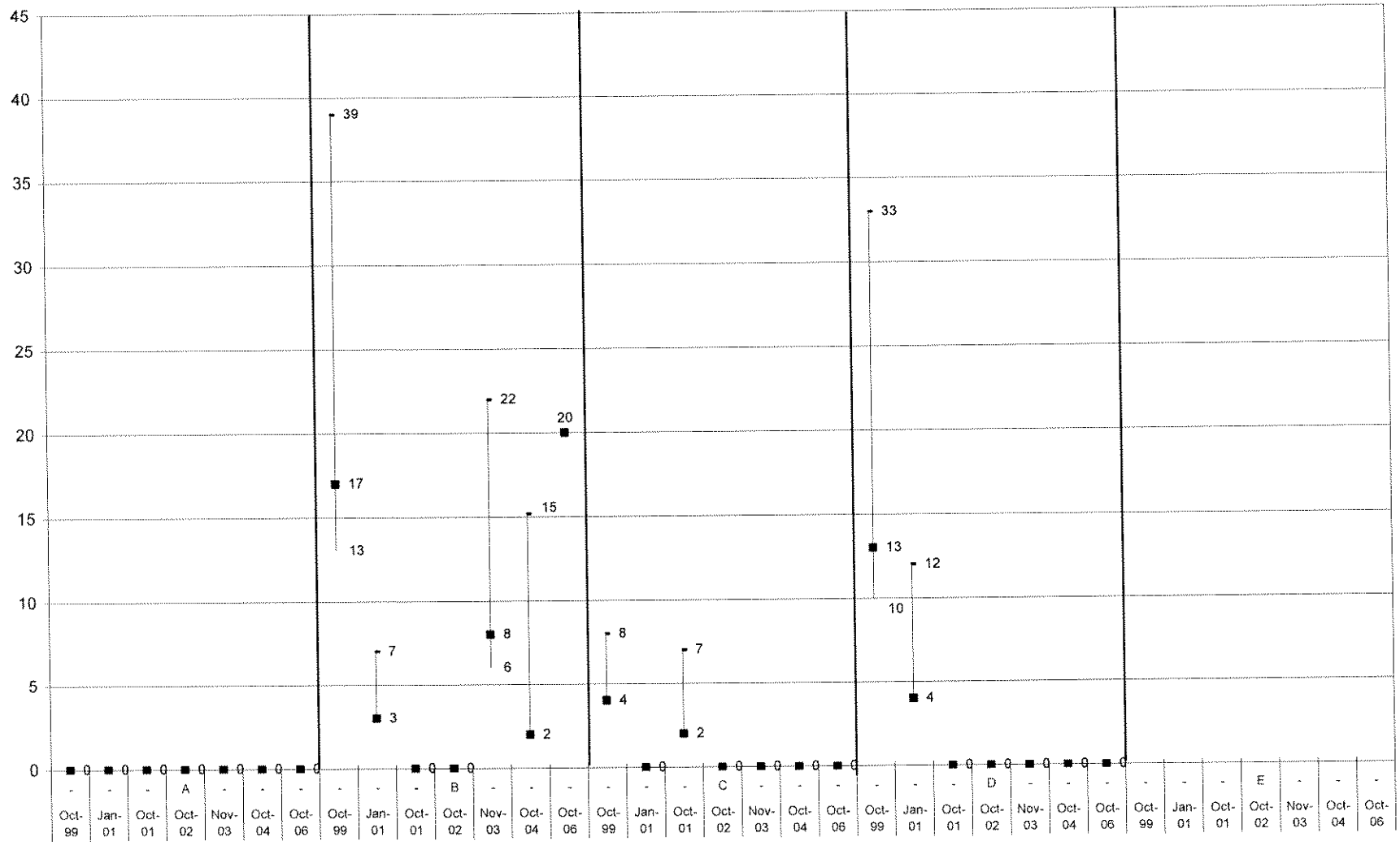


Figure 3-8. Comparison of Hardhead Abundances per Site with 95 Percent Confidence Intervals in the KR1 Reach of the Kern River.

4.0
SUMMARY AND RECOMMENDATIONS

This report summarizes the results of the seventh round of sampling required by the conditions of the Project License for the Kern River No. 1 Hydroelectric Project. It is intended to document that sampling was conducted and to provide recommendations for future sampling efforts.

Between the October 2000 and the January 2001 site visits, sand and fines were deposited in the KR1 reach, which affected the entire river reach downstream from Democrat Dam to Site A. Site A was filled with sand to an average depth of 0.5 feet. By the time of the October 2001 sampling trip, sand and fines had been transported further downstream. The sediments had moved as far downstream as Site D and dominated the surficial substrates at those sites. During November 2003, an increase in depth was observed at Sites A and B, but a decrease in depth was observed at Site E. During October 2006, after two summers with high flows, very little sand was recorded in the study sites indicating that it has been transported further downstream. Increased flow and depth precluded electrofishing at Site E.

Turbidity from sources upstream of the KR1 Project was present in both 2003 and 2004. The turbidity increase is directly correlated to a decrease in visibility, which affected our ability to conduct direct observation surveys. Visibility in 2004 was less than half of that measured in 1999. Turbidity also may have adversely affected primary production and the success of sight-feeding fish. This may be affecting the abundance and species composition of fish in this study. Turbidity was high in October 2006, and again during two reconnaissance visits in December 2006 and January 2007. However in 2006, winds were relatively high during field visits, observed turbidity may have been affected by wind borne materials.

There were several changes observed in species composition during the October 2006 field trip. During October 2006, the number of smallmouth bass collected was lower than any other sample year. The distribution of smallmouth bass in 2006 showed that there was some recruitment of Age 0+ and 1+ fish and some recruitment of older age classes to the population. In November 2003 no smallmouth bass over 200 mm were collected. October 2004 saw the collection of three smallmouth bass over 200 mm while October 2006 had five such individuals. Lower abundance may have been related to high summer flows in 2004 and 2006. These flows may have affected transport and survival of YOY.

Hardhead were not collected during October 2002, but were found in November 2003 and October 2004. Hardhead were also collected in October 2006 but were restricted to Site B. As in October 2004, black bullhead, black crappie and white crappie were absent from the catch in October 2006.

A full analysis of the data will be conducted at the conclusion of the eight years of population monitoring. At that time, population trends for smallmouth bass will be

evaluated. This evaluation will include estimations of age and growth and will relate these estimations to pertinent environmental factors such as flow and habitat characteristics. Additional emphasis will be placed on the hardhead population based on consultation with the resource agencies. Also, the considerable amount of year-to-year variability in both species composition and biomass will be evaluated and put into perspective.

Variability in physical conditions including depth, flow, and visibility affect our ability to safely and adequately monitor fish at the sampling locations. These conditions affected our ability to sample Site E as part of this year's effort. Our recommendation for 2007 is to closely coordinate with SCE onsite personnel regarding sampling conditions and to adjust the timing of the sampling trip to maximize use of available water visibility so that Site E may be snorkeled, if conditions permit.

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