

San Marino Environmental Associates

DRAFT

Results of the Year 8 (2008- 2009) Implementation of the Santa Ana Sucker Conservation Program for the Santa Ana River

Annual Report

Prepared For:

Santa Ana Sucker Conservation Team

Composed of:

City of Riverside (Regional Water Quality Control Plant)
City of San Bernardino Municipal Water Department
Orange County Resources Development Management Department
Orange County Water District
Orange County Sanitation District
Riverside County
Riverside County Flood Control and Water Conservation District
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Introduction

In response to the listing of the Santa Ana sucker (*Catostomus santaanae*) as a federally Threatened Species in 2000, the Santa Ana Watershed Project Authority (SAWPA) contracted San Marino Environmental Associates (SMEA) to conduct research in support of the goals of the Santa Ana Sucker Conservation Team under a task order from SAWPA. The principal activities this year included the annual population estimate at the three standard monitoring sites, and a detailed analysis of the data collected since 2001, which included analysis of habitat variation and the biotic condition of Santa Ana suckers.

Santa Ana Sucker Population Monitoring 2001-2008

2008 was the eighth year SMEA has monitored Santa Ana sucker populations at three standard sites in the Santa Ana River (Figure 1): Site 1, upstream of Mission Boulevard (sampled 23 August 2008) (Figures 2 and 3); Site 2, just downstream of Highway 60 (sampled 26 August 2010) (Figures 4 and 5); and Site 3, downstream of Riverside Avenue (sampled 24 August 2010) (Figures 6 and 7). Surveys were conducted in late August/early September of each year to avoid the *C. santaanae* breeding season (breeding occurs in spring and fry can be present into June). Fish densities and 95 percent confidence intervals within each 100 meter site were calculated using maximum likelihood methods based on three-pass depletion as described by Carle and Strub (1978) and Lockwood and Schneider (2000). A triple-pass depletion provides a good balance between effort (cost) and accuracy, and is therefore the standard method used in fish censuses.

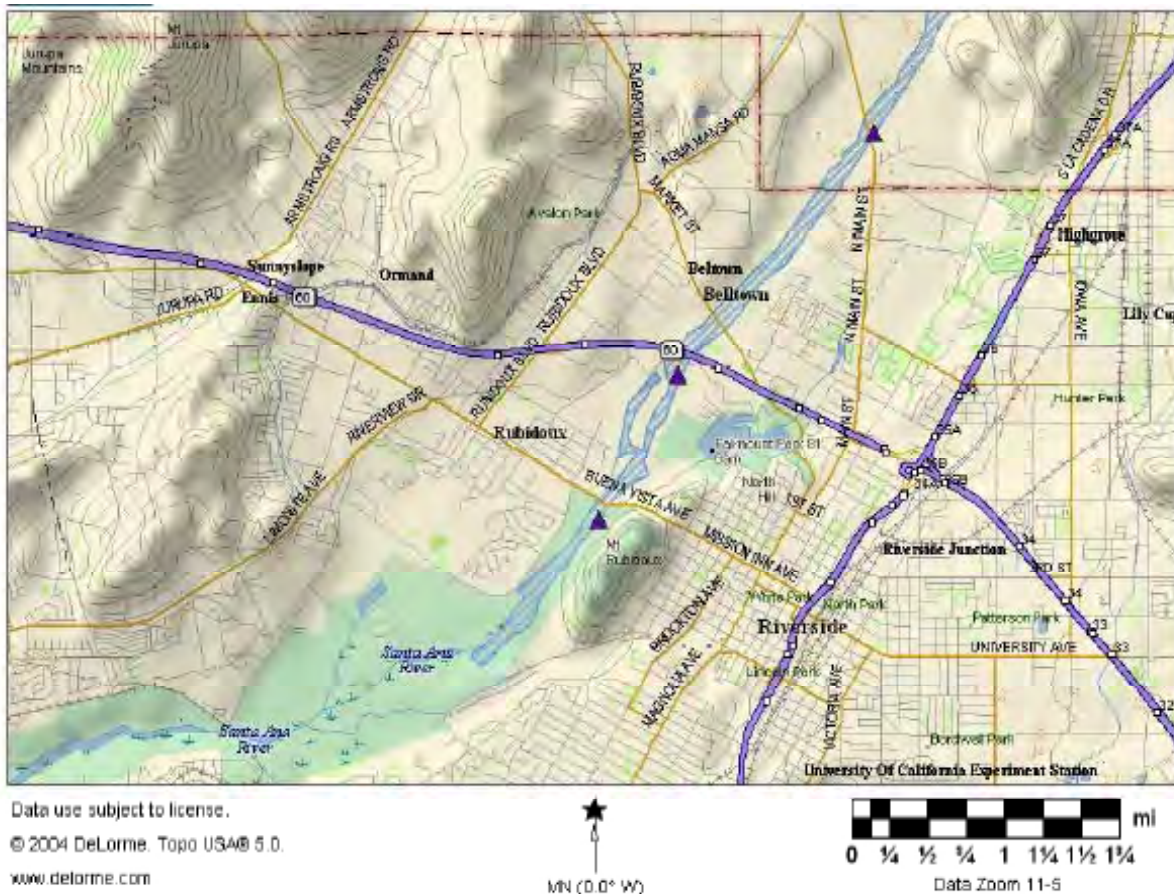


Figure 1. Population monitoring sites marked with purple triangles, Mission Avenue (Buena Vista Ave), Highway 60 and Riverside Avenue (Main Street).



Figure 2. Site 1, Mission Blvd., the broader of the two channels at site.



Figure 3. Site 1, Mission Blvd., the smaller of the two channels at the site.



Figure 4. Site 2, Highway 60, looking downstream.



Figure 5. Site 2, Highway 60, showing the entire section.



Figure 6. Site 3, Riverside Avenue, looking upstream.



Figure 7. Site 3, Riverside Avenue, viewed downstream

Blocking nets were set extending out from the banks at the upstream and downstream extent of each 100 m section to keep fishes from moving out of or into the area during sampling. Habitat characteristics were recorded within each 100 m section by placing a transect line perpendicular to flow at 0, 50 and 100 m upstream of the downstream blocking net. Substrate composition (silt, sand, gravel, cobble, boulder, sandbars, and emergent vegetation), width, depth, and bottom and mid-column current velocity were then measured at 0.5 m intervals along each transect line. These data were analyzed for all years and sites to quantify the habitat observations and compare sites with each other and over the sampling years to determine trends in habitat quality.

In 2008 *C. santaanae* (large adults and small specimens including YOY) and *G. orcutti* (chubs) were found in moderate numbers at Mission Boulevard and Highway 60 and in very high numbers at Riverside Avenue (Table 1 and Figure 8). Habitat selectivity studies completed in previous years (see 2004 Annual Report) show that suckers appear to select deeper water and a gravel/cobble substrate in preference to sand and silt. In 2007, the habitat appeared greatly improved (deeper water and a gravel/cobble substrate) at Mission Boulevard and Highway 60 in comparison to the past few years, but by 2008 the abundance of gravel/cobble substrates declined, the abundance of sand increased and the water was shallower at both sites. Deeper water and gravel/cobble substrate remained abundant and unchanged at Riverside Avenue in 2008.

The California Department of Fish and Game Wild Trout Crew uses a depletion of approximately 100 meters (distances vary) to estimate the number of trout per mile of stream in its annual surveys. We have adopted that method for the presentation of our *C. santaanae* population data in this report. The data are presented below in both a tabular form (Table 1) and in a graphical form (Figure 8 and 9).

Table 1. *Catostomus santaanae* Abundance Expressed as Fish/Mile.

Location	2001	2002	2003	2004	2005	2006	2007	2008
Mission	1,432	2,350	1,014	32	16	0	0	580
Hwy 60	2,639	2,736	1,545	3,235	16	0	1625	322
Riverside	209	756	805	644	1,579	1689	1561	3445
Annual Average	1,427	1,947	1,121	1,304	537	563	1062	1449

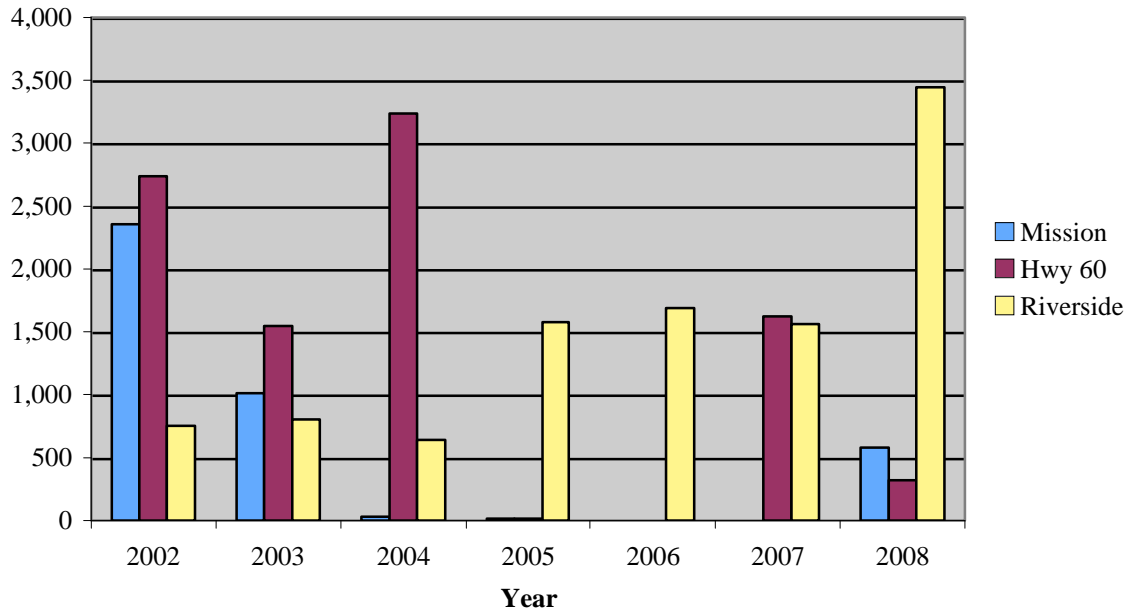


Figure 8. Population estimate of *Catostomus santaanae* expressed as fish/mile at the three monitoring sites, Mission Avenue, Highway 60, and Riverside Avenue.

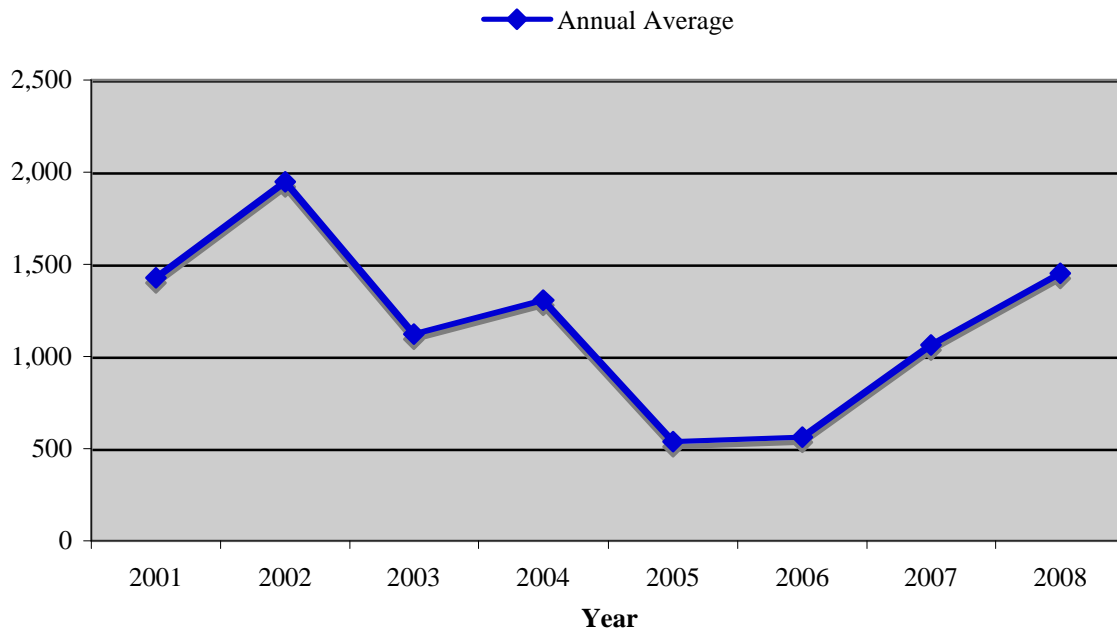


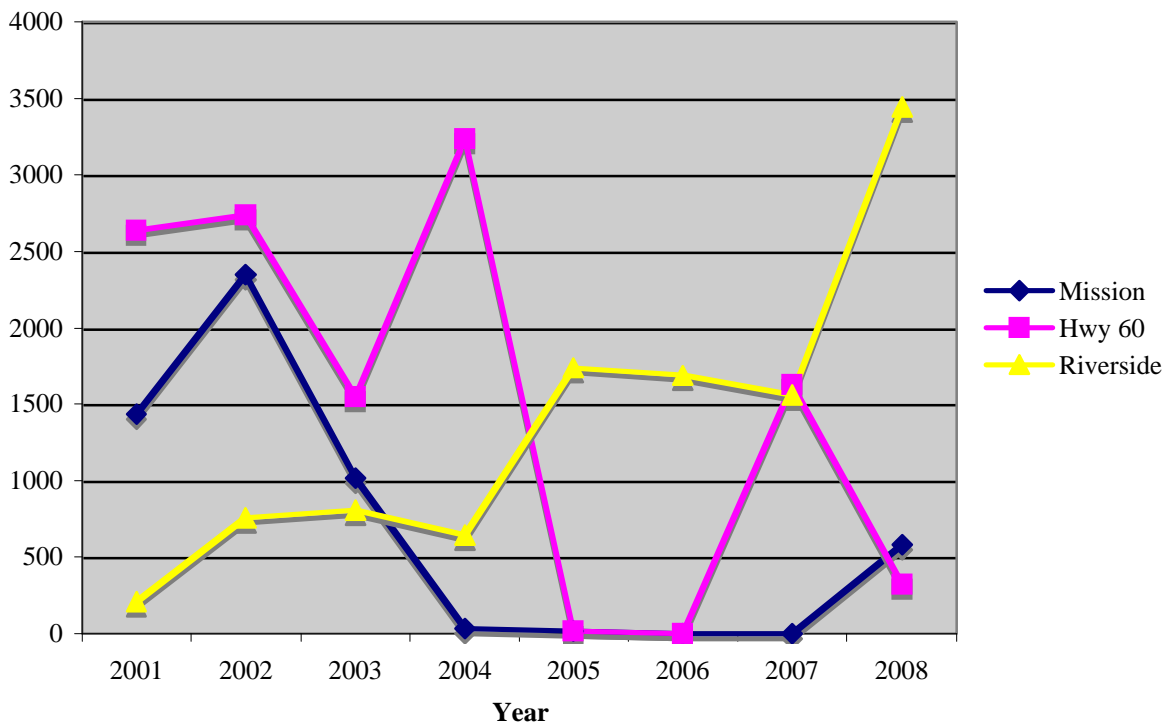
Figure 9. Annual average *Catostomus santaanae*/mile over the sampling period 2001-2008. Annual average measured as the mean of fish densities recorded at the three monitoring sites, Mission Avenue, Highway 60, and Riverside Avenue per year.

Over the first five sampling seasons (2001-2005), the annual average number of *C. santaanae* per mile of river decreased by a factor of almost 3, from a high of 1947 fish per mile in 2002 to a low of 537 fish per mile in 2005. Number of fish remained low at 567 fish per mile in 2006 but by 2007 the number of fish had increased to 1062 fish per mile. By 2008, the average number of fish per mile had increased to 1449 and was similar to densities recorded in 2001.

C. santaanae densities varied annually at each site (Figure 10). At the most downstream site (Mission Boulevard) fish densities increased between 2001 and 2002, declined to 16 fish per mile between 2002 and

2005, were absent from 2006 to 2007, and increased to 580 fish per mile in 2008. At the middle site (Highway 60) densities fluctuated slightly between 2001 and 2004, declined to 16 fish per mile by 2005, were absent from the site in 2006, increased rapidly to 1625 fish per mile by 2007 but again declined to 322 fish per mile in 2008. *C. santaanae* densities at the most upstream site (Riverside Drive) have generally increased over time with fish numbers rising from a low of 209 fish per mile in 2001 to a high of 3445 fish per mile in 2008. Presently, Riverside Drive has the largest number of *C. santaanae*. Mission Boulevard and Highway 60 had similar numbers of fish, but numbers at both sites is considerably lower than at Riverside drive.

Figure 10. Annual number of *Catostomus santaanae* /mile at the three monitoring sites, Mission



Avenue, Highway 60, Riverside Avenue from 2001 to 2008.

Analysis of Covariance (ANCOVA) indicated that neither the effect of sampling location on the mean abundance of fish ($F=2.61$, $P=0.10$) nor the effects of year on the mean abundance of fish were significant ($F=1.34$, $P=0.26$) (Table 2). There was however, a significant interaction between year of sampling and sampling location (location * year, $F=10.42$, $P=0.001$) (Table 2). The *C. santaanae* population increased at Riverside Avenue from 2001-2008 but over the same time period populations have declined at Mission Boulevard and Highway 60 (Figure 11).

Table 2. Analysis of covariance (ANCOVA) effect tests:

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Sampling Location	2	2	3121716.0	2.61	0.10
Year	1	1	800810.0	1.34	0.26

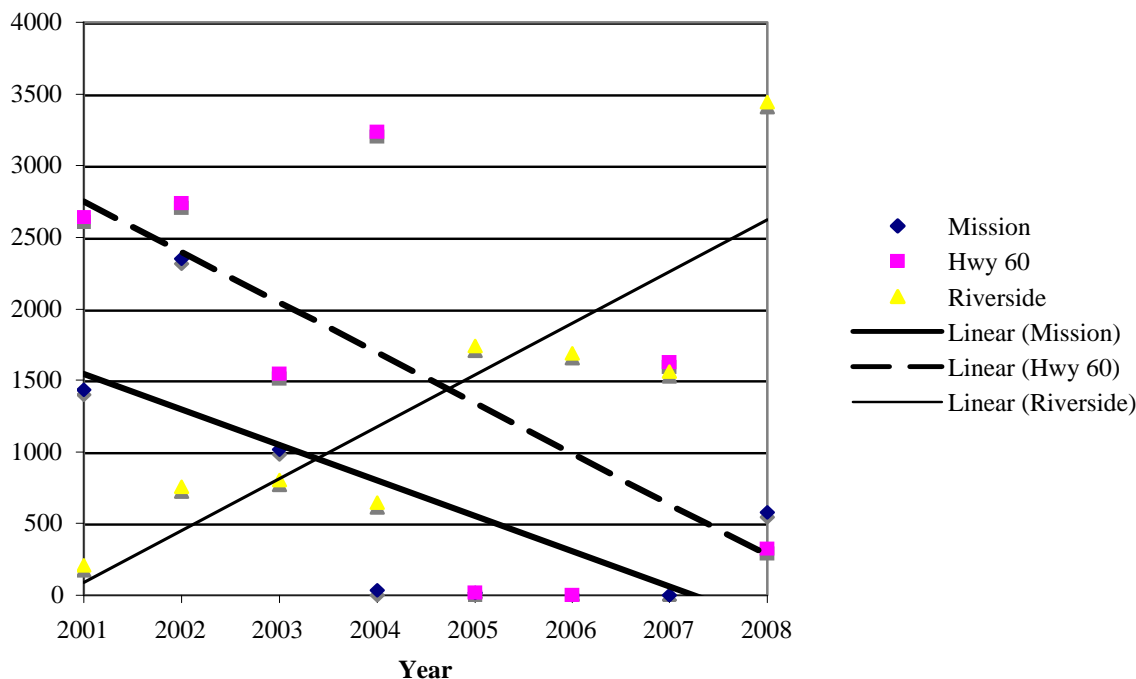


Figure 11. Analysis of covariance (ANCOVA). Response abundance, whole model regression plot (abundance of *C. santaanae* is the estimate of fish per mile over the sampling years 2001-2008).

These results are consistent with SMEA’s field observations that the habitat at Mission Boulevard and at Highway 60 has been changing over this same period of time (2001-2008), and that prior to 2007 Mission and Highway 60 habitats had degraded (shallow water and sand/silt substrate). Both sites improved (deep water and gravel/cobble substrate) in 2007 but again degraded in 2008. These patterns imply that *C. santaanae* are responding to changes in habitat by remaining or seeking out the suitable habitat at Riverside Avenue rather than occupying the less suitable habitat found at Mission and Highway 60. Fish density at Highway 60 has been highly variable year to year so care must be taken in the interpretation of data within individual years. The absence of *C. santaanae* and *G. orcutti* in 2007 and the presence of fish in 2008 at Mission Boulevard is puzzling, given that gravel/cobble substrate was present in 2007 but nearly absent in 2008, and that Highway 60, which had high fish density in 2007, is less than a mile upstream.

To evaluate the relationship between habitat and *C. santaanae* density per site per year, we initially performed a multiple regression analysis. The analysis failed to show any statistically significant relationship (at $p \leq 0.05$) between the number of suckers and any habitat variable (Table 3).

Table 3. The table indicates whether the habitat variable was positively or negatively associated with Santa Ana sucker numbers and the p-value for each relationship. The p-value for the entire multiple regression (all variables combined) was 0.224.

	silt	sand	gravel	cobble	bottom velocity	mid-column velocity	depth
Association	-	-	+	+	+	+	+
p-value	0.483	0.132	0.328	0.060	0.244	0.093	0.407

We then conducted a principle components analysis on the habitat data to identify a single independent variable that most effectively captured habitat characteristics. We examined the relationship between PC score for Axis 1 (independent variable) and *C. santaanae* abundance per site-year (dependent variable) through linear regression analysis. The scores on axis 1 for each site-year are shown in Table 4. The simple linear regression of the data in table 4 is statistically significant ($F=5.1326$, $p = 0.0354$) with an R^2 of 0.2127.

Table 4. Site-year sucker abundance and score on Axis 1 of the PCA. R=Riverside, H=Highway 60 and M=Mission.

Site	Sucker Abundance	Score on Axis 1
2001R	209	-2.5345
2001H	2,639	1.4833
2001M	1,432	0.8729
2003R	805	2.6685
2003H	1,545	0.1446
2003M	1,014	0.8741
2004R	644	1.7393
2004H	3,235	-0.6291
2004M	32	-0.2397
2005R	1,579	-0.3931
2005H	16	-2.0197
2005M	16	-1.8202
2006R	1,689	-0.4211
2006H	0	-2.4296
2006M	0	-2.7521
2007R	1,561	1.2312
2007H	1,625	0.4777
2007M	0	0.9896
2008R	3,445	2.0247
2008H	322	0.7256
2008M	580	0.0079

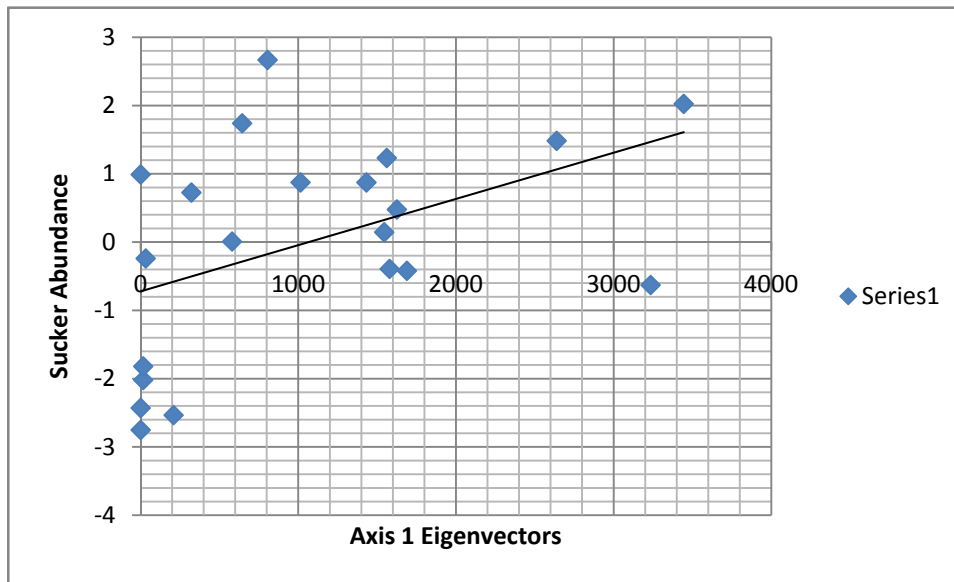


Figure 12. Regression of Santa Ana sucker abundance on Axis 1 eigenvectors from PCA

The habitat eigenvectors for Axis 1 are shown below in Table 5. These values are the correlations between each environmental variable and Axis 1 of the PCA.

Table 5. Eigenvectors for Axis 1 for each habitat component.

Habitat Component	Eigenvectors for Axis 1
Silt	0.1591
Sand	-0.6527
Gravel	0.3655
Cobble	0.4802
Bottom velocity	0.7903
Mid-column velocity	0.9167
Depth	0.2612

The statistically significant positive relationship between sucker abundance and the score on Axis 1 of the PCA means that as the score on Axis 1 of the PCA increases so does the abundance of suckers. As shown by the eigenvectors in Table 5, each of the environmental variables is positively correlated with Axis 1 of the PCA except for amount of sand which has a fairly strong negative correlation. The correlation of sucker abundance with the amount of silt is particularly weak, while other correlations are moderate to strong.

These results are in perfect accord with SMEA’s empirical evidence from sucker habitat selectivity studies conducted in southern California lowland (Santa Ana River) and mountain (San Gabriel River, north and east forks) streams (Haglund and Baskin 2005, Haglund *et al.* 2004, Haglund and Baskin 2003). These studies showed that suckers over utilized and underutilized (compared to availability) particular habitat parameters. Fish utilizing a particular habitat type out of proportion to the availability of that habitat type in the stream were interpreted as displaying a preference for that habitat type. The results of Haglund and Baskin’s work showed that adult suckers prefer deeper water habitats such as pools and runs whereas juvenile suckers occupy primarily riffle habitats, although they also show a slight preference for deeper water.

Adult suckers display a strong preference for gravel/cobble substrates whereas juvenile suckers prefer sand/gravel substrates. Both adult and juvenile suckers show a marked under utilization for fine sediments such as sand and silt. Adult suckers also show a strong preference for deeper water habitats greater than 40 cm in depth. Juveniles prefer deeper water, but not as deep as adults and are typically found in habitats 25-45 cm deep.

Therefore, it is not surprising that the results of the current analyses suggest that sucker populations increase when preferred habitat attributes are more common. Surveys of *C. santaanae* density and habitat characteristics at the three 100-meter sites revealed a strong, negative relationship between the amount of sand/silt substrate and the number of fish at a site. Fish were absent from sites in every year when the percent of sand/silt was greater than ninety percent. By contrast, fish were abundant when the proportion of sand/silt was less than ninety percent. Given that *C. santaanae* feeds heavily on epilithic diatoms and spawns over clean gravel it is not surprising that this fish was absent in sites that contained primarily sand/silt substrate and lacked cobble/gravel substrate.

Whereas an abundance of sand/silt substrate and a lack of gravel/cobble substrate precluded the presence of *C. santaanae* within the 100 m sites, seemingly appropriate habitat did not necessarily guarantee the presence of this fish. Specifically, *C. santaanae* was absent from the downstream site (Mission Boulevard) in 2007 even though habitat composition was very similar to the middle and upstream sites (these sites both contained gravel/cobble substrate and *C. santaanae* in 2007). A potential explanation for the lack of *C. santaanae* at the downstream site in 2007 is that gravel had only recently become exposed at this site and fish had not yet moved into this location. An alternative explanation for the lack of *C. santaanae* at Mission Boulevard in 2007 is that populations were limited by recruitment rather than habitat availability in this year. In 2008, substrate and depth conditions (deep water and gravel/cobble substrate) continued to be unchanged and favorable for fish at Riverside Avenue, whereas habitat degraded (shallow water and sand/silt substrate) from 2007 conditions at Mission Boulevard and Highway 60. Correspondingly, density of fishes increased at Riverside Drive but declined at Highway 60 presumably in response to an increase in sand/silt substrate and a corresponding decrease in gravel/cobble substrate at Highway 60. Substrate and depth characteristics were similar at Mission Boulevard and Highway 60 in 2008 and both sites contained similar densities of fishes.

Thompson *et al.* (2010) used SMEA's Santa Ana sucker population data and habitat data and a regional habitat dataset to evaluate the relationship(s) between habitat parameters and Santa Ana sucker abundance. This paper found that the proportion of coarse substrate and discharge accounted for 65% of the variation of sucker abundance. The previous analyses of SMEA data did not evaluate discharge, but the results of Thompson *et al.* (2010) are in accord with the results presented above that coarse sediments are correlated with sucker abundance.

It is true that while all analyses so far have indicated that the amount of coarse substrates is positively correlated with Santa Ana sucker population size, a substantial amount of the year-to-year variation in sucker populations remains unexplained. The results of Thompson *et al.* (2010) suggest that flow parameters need to be more carefully examined.

In order to initiate a closer examination of flow attributes that could affect sucker population variation, SMEA regressed average Santa Ana sucker population size (average annual fish/mile) on mean April monthly flow (Figure 13).

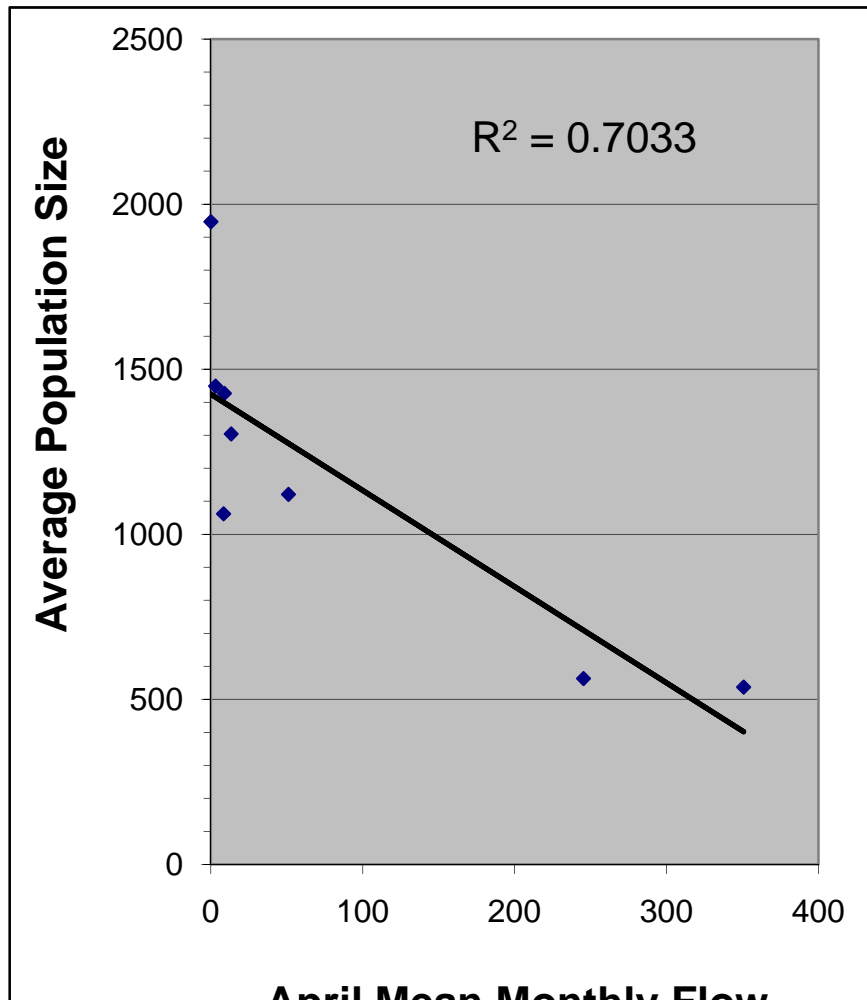


Figure 13. Regression of average annual Santa Sucker population size (expressed as fish/mile) on April mean monthly flow in the Santa Ana River measured at USGS gauging station at E Street in San Bernardino.

Flow is linked to substrate characteristics, affects reproduction and other habitat characteristics. The importance of flow in explaining variation in Santa Ana sucker populations is clear in Figure 13. Differences in April mean monthly flow explains 70% of the observed variation in sucker populations. As previously mentioned in this document and discussed in Thompson *et al.* (2010), 2007 data are somewhat anomalous compared to other years. If 2007 data are removed from the regression, the R^2 value rises to 0.7902. It is clear that further analyses on flow attributes and their correlation to habitat values and Santa Ana sucker populations is required and may provide additional insights.

Preliminary Analysis of Population Structure of Suckers 2001- 2008

The following are the length histograms of captured *C. santaanae* for the eight sampling years (Figure 14). The sizes of Santa Ana sucker age classes were determined by Drake and Sasaki (1987) for the West Fork of the San Gabriel River.

<u>Age class</u>	<u>Santa Ana sucker</u>
	<u>Length (mm)</u>
YOY	0 - 70
1+	71 - 130
2+	131 - 160
3+	161 - 185
4+	186 -

These data are relatively similar to the data presented in Greenfield *et al.* (1973) for the lowland Santa Clara River population. Thus, age class structure of the population can be estimated from length data.

The data presented in Figure 14 appears to show two primary size classes, which in the absence of the Drake and Sasaki (1987) and Greenfield *et al.* (1970) data might be interpreted as year classes; and concluded that Santa Ana suckers in the Santa Clara River live for about two years. This could mean that they reproduce and die in the second year, thus having a single reproductive year. This would make the populations extremely vulnerable to annual variation.

SMEA's population sampling takes place late in the summer or early fall to avoid sucker fry. Consequently, young-of-the-year (YOY) fish will have grown and it appears as if the first peak is a composite of YOY and 1+ fish. The second peak on the graphs would appear to be almost entirely 2+ fish with a very few 3+ fish in some years such as 2002. These data suggest suckers in the Santa Ana River regularly reach 2+, but very few fish reach 3+. This is different than either the San Gabriel River or the Santa Clara River where fish regularly reach 3+ and occasionally reach 4+. If this is true Santa Ana suckers in the Santa Ana River regularly live one year less than in other Southern California River systems.

With the exception of 2007, it appears that there has been a general decline in the abundance of 2+ fish from 2001 to 2008. It is important to collect length-age data from Santa Ana suckers in the Santa Clara River in order to understand these data and be able to interpret the population dynamics of the population.

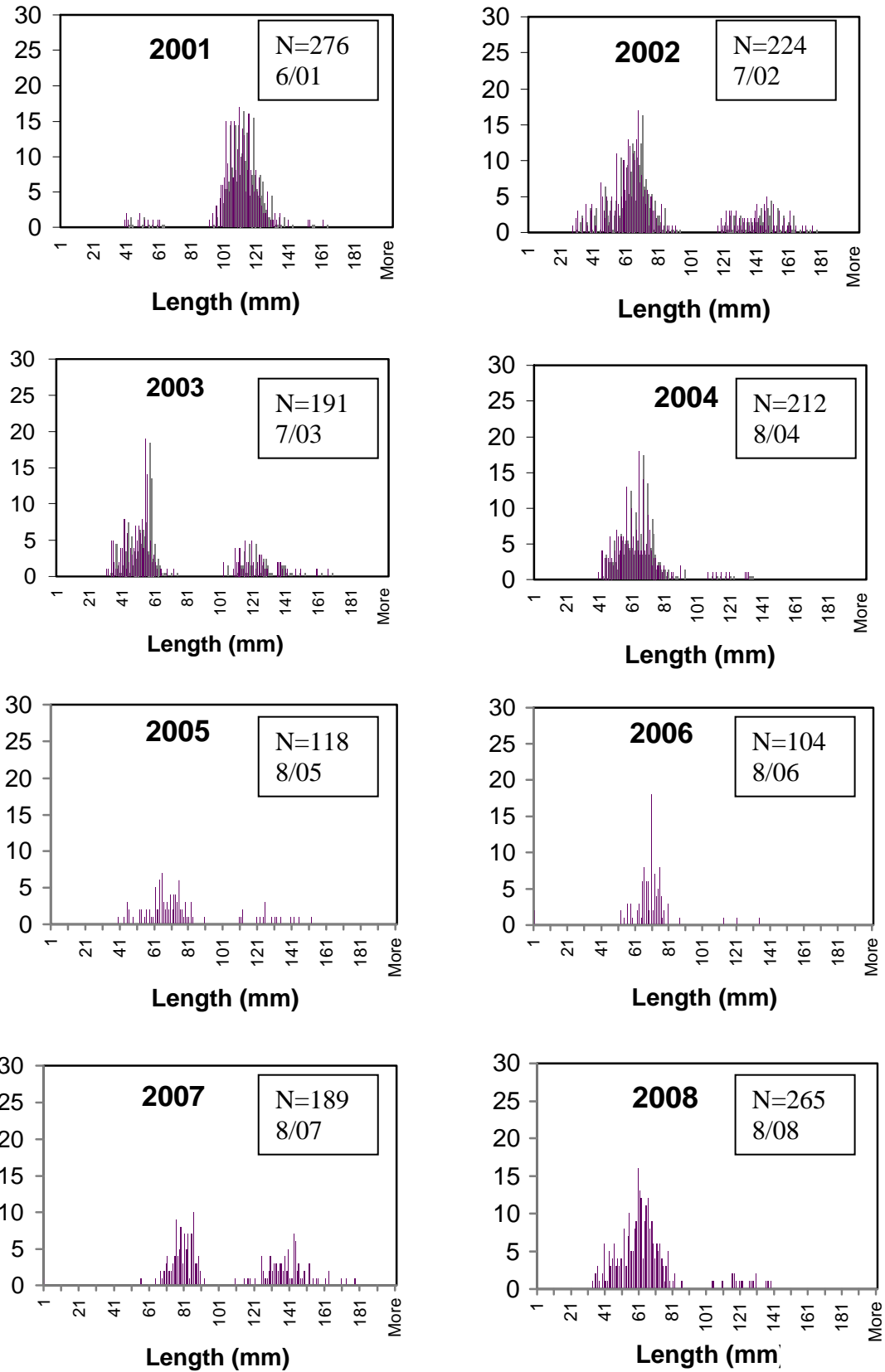


Figure 14. Length histograms of captured Santa Ana sucker (*Catostomus santaanae*) for the eight sampling years (2001-2008). Data is from specimens captured during the annual population estimate described above.

Condition of Suckers at Population Sampling Sites 2001-2008

SMEA is also investigating the length-mass relationship of *C. santaanae* in the Santa Ana River. In general, excess food (that is, mass) is converted into reproduction, so a heavier fish (of a given length) is thought to be in better condition. One measure of condition is simply the mass of a fish divided by the cube of it's length ("gmm" condition) (Figure 15) (Page et.al. 2007). For this measure of condition, we looked for differences among years and among sites (Figure 16 A, B), and also examined whether condition changes with time in years (Table 6 and Figure 17).

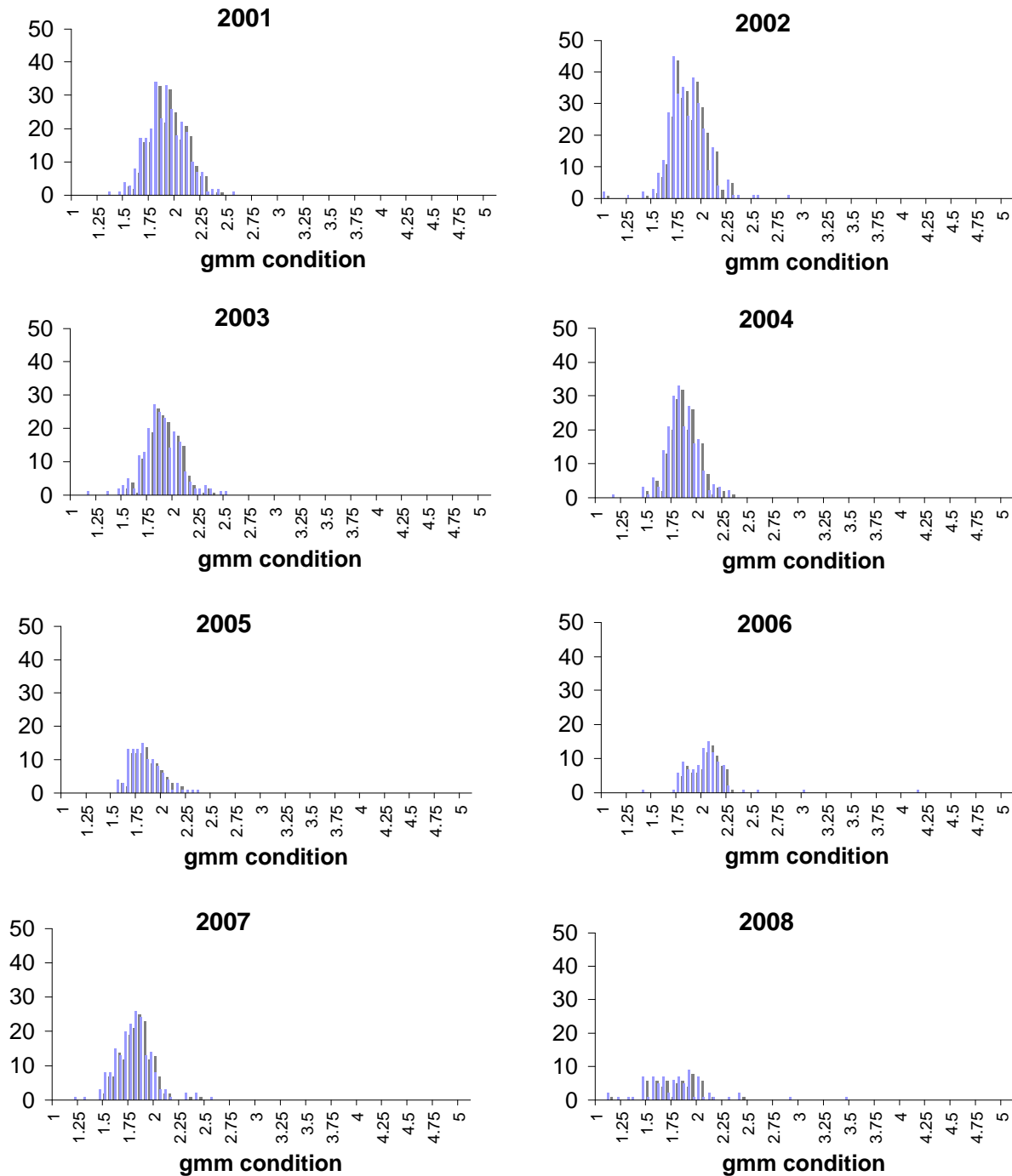


Figure 15. Gmm condition ($\text{weight}/\text{length}^3$) 10^5 for captured Santa Ana sucker (*Catostomus santaanae*) for the sampling years 2001-2008.

The gmm condition of fish showed no differences between sites (Figure 16A), which can be attributed to considerable variation in gmm condition for fishes captured at Mission Boulevard. There were, however, year-to-year differences in the gmm condition of suckers (ANOVA: $F=18.48$, $P<0.0001$, Tukey-Kramer HSD, $P\leq 0.05$). Gmm condition was higher in 2006 than in all other sampling years (Figure 16B) and the gmm condition of fish captured in 2001 and 2005 were higher than those of fish captured in 2002, 2004, 2005, 2007 and 2008 (Figure 16B). Fish captured in 2005 had similar gmm condition to all other years with the exception of 2006 in which gmm condition was higher (Figure 16B).

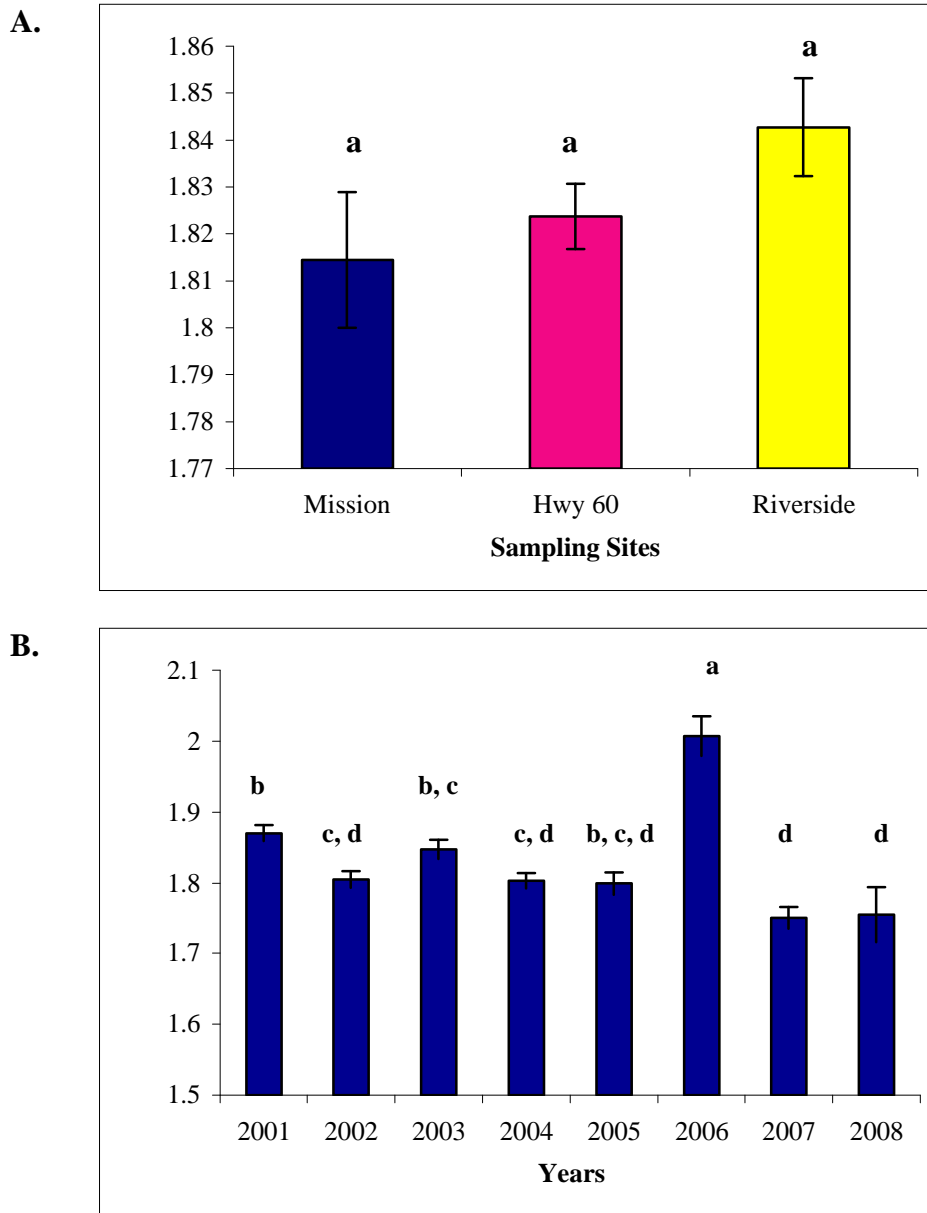


Figure 16. Graphics represent the relationship between A. the mean gmm condition (wt/length³)10⁵ of *C. santaanae* per site (Mission Boulevard, Highway 60, Riverside Drive) over the sampling period 2001-2008 and B. the mean gmm condition (wt/length³)10⁵ of *C. santaanae* per year over the sampling time 2001-2008. Years or sites represented by the same symbol a, b, c or d are not significantly different at $p\leq 0.05$ (Tukey-Kramer HSD). Error bars represent 1 SE. Vertical axis is gmm condition.

Analysis of Covariance (ANCOVA) indicated that the effect of sampling location and year on the gmm condition of *C. santaanae* were significant ($F=4.02$, $P=0.02$ and $F=15.71$, $P<0.001$, respectively) (Table 4). There was

also a significant interaction between year of sampling and sampling location (location * year, $F=5.01$, $P=0.007$) (Table 6).

Table 6. Analysis of Covariance (ANCOVA) Effect Tests:

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Sampling Location	2	2	0.37	4.02	0.02
Year	1	1	0.71	15.71	< 0.001
Sampling Location*Year	2	2	0.46	5.01	0.007

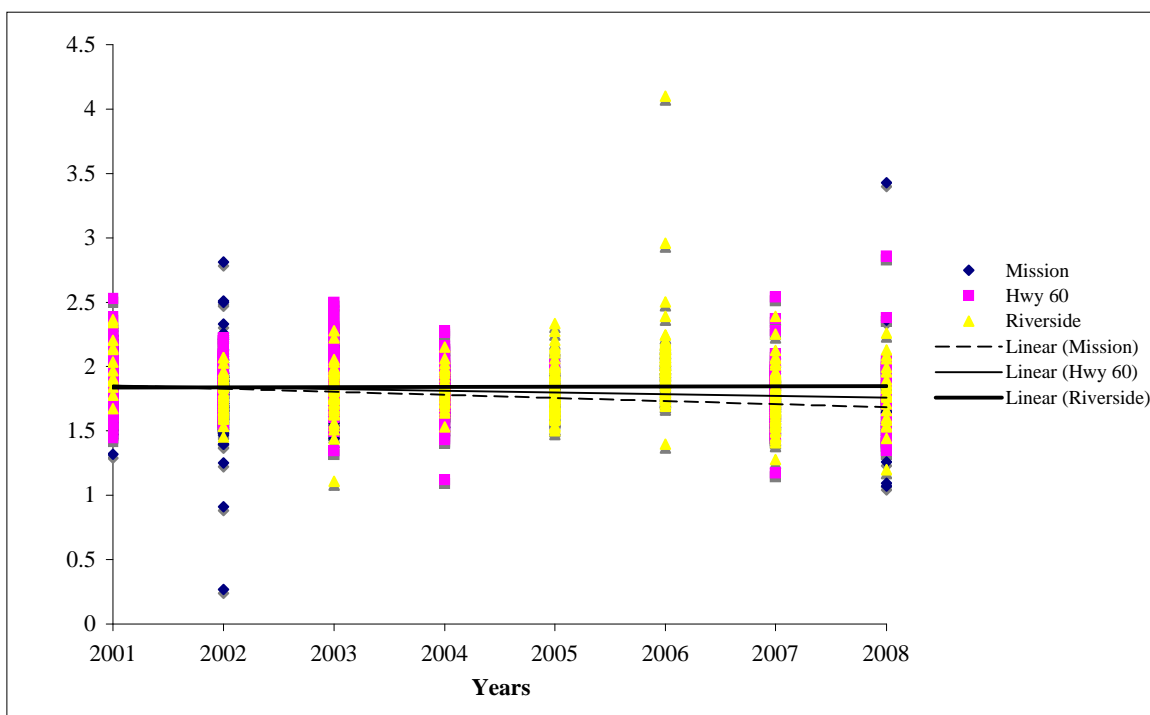


Figure 17. Analysis of covariance (ANCOVA). Response gmm condition, whole model regression plot (gmm condition index measured as *C. santaanae* (wt/length³)10⁵ over the sampling years 2001-2008).

These results indicate that the gmm condition of *C. santaanae* has remained relatively stable over time at the most upstream site (Riverside Avenue) but has declined at both the midstream site (Highway 60) and the most downstream site (Mission Boulevard). Fish density at Mission Boulevard and Highway 60 has been highly variable year to year so care must be taken in the interpretation of data within individual years.

Summary

Annual average abundance of sucker declined from 1427 fish/mile in 2001 to a low of 537 fish/mile in 2005, and then rebounded to 1449 fish/mile by 2008. *C. santaanae* abundance, however, was highly variable among sites annually. *C. santaanae* abundance increased at the most upstream site (Riverside Avenue) from 2001-2008 but over the same time period, fish abundance has declined at both the most downstream site (Mission Boulevard) and the midstream site (Highway 60). At present, Riverside Avenue has the highest numbers of *C. santaanae*, whereas Mission Boulevard and Highway 60 have similar abundance of fish, but numbers at both sites are considerably lower than at Riverside Avenue.

Habitat utilization studies have shown that suckers select deeper water and a gravel/cobble substrate in preference to shallow water with sand and silt substrates. Substrate composition and depth varied among years and between sampling sites, presumably affecting habitat quality and the population dynamics of *C. santaanae*. Analyses presented in this document, based on data collected during the population monitoring, show that in general, as the proportion of sand/silt substrate has increased, the proportion of gravel/cobble substrate has decreased. Also the availability of deeper water has declined at Mission Boulevard and Highway 60 over time (2001-2008), while the percentage of gravel/cobble substrate and availability of deeper water have remained abundant and relatively unchanged at Riverside Avenue. These changes are correlated with the size of the Santa Ana sucker populations at these sites.

Surveys of *C. santaanae* density and habitat characteristics at Mission Boulevard, Highway 60 and Riverside Avenue revealed a strong, negative relationship between the proportion of sand substrate and the density of fish per site-year. Fish were typically absent from sites in every year when the percent of sand/silt was greater than ninety percent and present when the proportion of sand was less than ninety percent. Given that *C. santaanae* feeds on epilithic materials and spawns over clean gravel, it is not surprising that this fish was absent in sites that contained primarily sand/silt substrate and lacked cobble/gravel substrate.

Based on interpreting the size distribution data it appears that suckers in the Santa Ana River generally survive only to 2+. This is one year less than in the San Gabriel and Santa Clara River systems. Furthermore, there appears to have been a decline in the abundance of the 2+ age class from 2001 to 2008 (with the exception of 2007).

The condition of *C. santaanae* (measured as the mass of a fish divided by the cube of its length (gmm)) was similar, at Mission Boulevard, Highway 60 and Riverside Avenue but the condition of fishes varied annually. The condition of *C. santaanae* has remained relatively stable over time at the most upstream site (Riverside Avenue) but has declined at the downstream (Mission Boulevard) and middle site (Highway 60). In general, these results are consistent with our field observations that Riverside Avenue provides high quality habitat (deep water and gravel/cobble substrate) for *C. santaanae* and that this habitat has remained relatively unchanged over time. In contrast, at Mission Boulevard and Highway 60 habitats have degraded (more shallow water and sand/silt substrate) over time, and there has been a corresponding decline in the abundance and condition of *C. santaanae* at these sites.

Although the forces driving sediment dynamics in the Santa Ana River are unclear, our results strongly suggest that deposition of fine sediments has a negative impact on *C. santaanae*. A primary focus of management should be to maintain and enhance riffle/run (locations that are moderately deep, have a relatively swift current velocity, and contain cobble/gravel substrate) and pool (areas that are relatively deep, have a moderate current velocity and contain cobble/gravel substrate) complexes in the Santa Ana River and its tributaries.

Recommendations for 2009-2010 Research Activities

The following research recommendations cover 2009 and 2010:

- Population monitoring should be continued.
- Conditions of various drains as breeding sites should be monitored.
- Further data should be collected on the timing of the appearance of fry and environmental correlates.
- An attempt should be made to obtain length-age data for Santa Ana suckers from the Santa Ana River
- If suckers continue to be absent from Sunnyslope Drain, steps to open this site to access by suckers from the main channel should be considered, and potential reproductive habitat should be evaluated.
- Sucker management options should be considered and experimental management research projects proposed.

Acknowledgements

San Marino Environmental Associates wishes to acknowledge the proactive leadership of the Santa Ana Sucker Conservation Team has taken in the funding and implementation of the *Conservation Program for the Santa Ana Sucker in the Santa Ana Watershed*. Created in 1998, two years before the listing of the Santa Ana sucker as

Threatened by the U.S. Fish and Wildlife Service, the Team began funding studies, which have been instrumental in developing an understanding of the biology of the Santa Ana sucker. The Santa Ana Watershed Project Authority serves as the overall administrator of the Team's efforts, but the funding comes from the Conservation Program participants: City of Riverside (Regional Water Quality Control Plant), City of San Bernardino Municipal Water Department, Orange County Resources Development Management Department, Orange County Water District, Orange County Sanitation District, Riverside County, Riverside County Flood Control and Water Conservation District and San Bernardino County Flood Control District. Many others have provided assistance, support (including field time), and encouragement for this ongoing study of the Santa Ana sucker. We gratefully acknowledge all those others who were not specifically named above.

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Appendix I

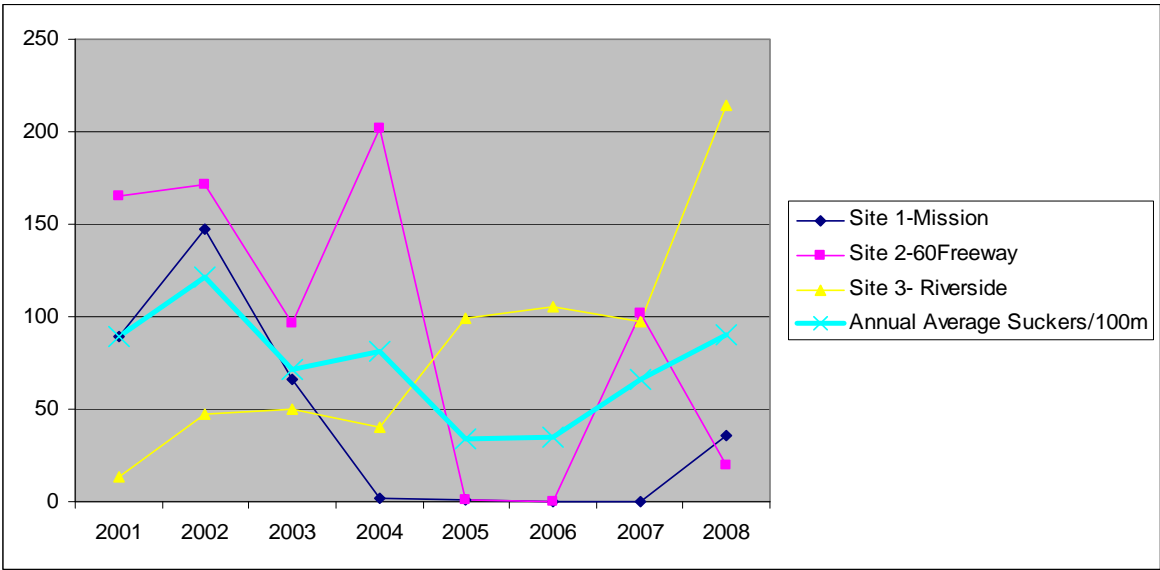
Progress Reports

Memo

To: Santa Ana Sucker Conservation Team
From: Drs. Jonathan Baskin and Thomas Haglund
Date: December 17, 2008
Re: DRAFT - Sucker Research Progress Report

Below is the data for the population estimates for the Santa Ana sucker in the Santa Ana River at our three standard sites using the multiple pass depletion method. This includes our most recent sampling on August 23 and 24, 2008. Note the recovery of suckers at the Mission Bridge site and the increase in the annual average. A more rigorous analysis will be done shortly. Preliminary examination of the habitat data shows that the Mission and 60 Freeway sites had an almost entirely sand substrate, while the Riverside Avenue Bridge site had a predominately cobble/sand dominated substrate.

Location	2001	2002	2003	2004	2005	2006	2007	2008
Site 1-Mission	89.5	146.9	66.4	2	1	0	0	36
Site 2-60Freeway	164.9	171	96.6	202.2	1	0	101.6	20
Site 3- Riverside	13.1	47.3	50.3	40.3	98.7	105.6	97.5	214
Annual Average Suckers/100m	89.2	121.7	71.1	81.5	33.6	35.2	66.4	90



Memo

To: Santa Ana Sucker Conservation Team
From: Drs. Jonathan Baskin and Thomas Haglund
Date: February 19, 2009
Re: DRAFT – Santa Anna sucker (*Catostomus santaanae*) Research Progress
Report

In view of our interest in Sunnyslope Creek as sucker habitat, and our concern that the fish may no longer have access to the creek, we did another survey here on February 12, 2009 to see if suckers were present. We used a Smith Root 12B backpack electroshocker with a crew of three Fishery Biologists, and shocked most of the best microhabitat sites in the natural part of the creek for a total of 340 seconds of shocking. Only catfish, sunfish and mosquito fish were found. No suckers or chubs (*Gila orcutti*) were observed.

If suckers are moving into this site from the main Santa Ana River channel we would expect them to be present at this time of the year, and we feel fairly confident that if suckers were present on this date we would have found them given the sampling we did.

The conditions in the creek were fairly normal (Photo 1), with water levels a bit high. Recent high flows in the creek were evident, as the creek mouth was some what more open (Photo 2.) where it empties into the flood plain of the river. Flow from here to where this water connects to the main channel is still densely vegetated.

This site was also sampled by shocking on February 16, 2008, and no suckers or chubs were found at that time.



Photo 1. Sunnyslope Creek on 2 February viewed in an upstream direction about halfway between the two bridges.



Photo 2. Sunnyslope Creek mouth. Viewed in a downstream (southerly) direction, where it opens into the flood plain of the Santa Ana River. Flow from here to where this water connects to the main channel is still densely vegetated.

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Memo

To: Santa Ana Sucker Conservation Team
From: Dr. Jonathan Baskin
Date: March 26, 2009
Re: DRAFT – Santa Anna sucker (*Catostomus santaanae*) Research Progress
Report

In view of our interest in making Sunnyslope Creek more accessible to suckers we examined the present area of the Santa Anna river flood plain adjacent to the creek and the present alignment of Sunnyslope flow there. The figure below shows this area in arial view with some site specific ground level pictures taken on March 19. Addition pictures will be shown at the meeting today.

We also did some additional shocking in the creek and found no suckers. This was done at a site where a recent sighting so suckers was reported.



Memo

To: Santa Ana Sucker Conservation Team
From: Drs. Jonathan Baskin and Thomas Haglund, Principal Senior Scientists
Date: September 10, 2009
Re: DRAFT – Santa Anna sucker (*Catostomus santaanae*) Research Progress Report

On August 10, 2009 David Woelfel and Jonathan Baskin explored two tributaries, Tequesquite and Crestmore drains.

Crestmore drain is located just north of Sunnyslope drain and runs parallel to it through Rancho Jurupa Park, on the west side of the Santa Ana River in the Santa Ana River Wildlife Area. The park is located on Crestmore Road, TG map 685, although the drain is not marked on the map. No appropriate sucker habitat was found, and the drain ends in a marsh habitat without reaching the river.

Tequesquite drain is located on the same TG map page on the east side of the river, just south of Rubidoux Mountain. This drain has good flowing water but is heavily overgrown with vegetation and has a substrate consisting mostly of mud with some sand. We judged it to be poor sucker habitat. Seining produced only mosquito fish (*Gambusia affinis*) and green sunfish (*Lepomis cyanellus*). Both were common. Water Quality data for this site is given below in Table 1.

Table 1. Water Quality on August 10, 2009, 1:30 P.M. in Tequesquite drain.

Temperature (°C)	24.0
Conductivity (µS)	0.740
Salinity (ppt)	0.03
Turbidity (NTU)	3
Dissolved Oxygen (mg/L)	8.76
pH	6.94

We also visited Sunnyslope Drain and received a verbal report from Ms. Sherri Chandler, the naturalist at Rubidoux Nature Center, that Riverside County Flood Control had recently removed vegetation from the upper, hard sided, part of the drain resulting in a large sediment load being deposited in the downstream natural bank parts of the drain.

On August 27, 28 and 29th we implemented our annual sucker population estimation at the three fixed sites, Mission Bridge, Freeway 60 Bridge and Riverside Avenue Bridge. Suckers were found at all three sites. The results of data analysis will be presented at our next meeting.

Appendix II

Annual Peak Flows



USGS 11059300 SANTA ANA R A E ST NR SAN BERNARDINO CA

