Habitat variability and distribution of the Santa Ana sucker, *Catostomus santaanae*, in the Santa Ana River from the confluence of the Rialto channel to the Prado Basin

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Submitted to:

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On behalf of:

Santa Ana Sucker Conservation Team

Composed of:
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San Bernardino Valley Municipal Water District (SBVMWD)
Orange County Water District (OCWD)
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INTRODUCTION

The Santa Ana sucker, *Catostomus santaanae*, was listed by the U.S. Fish and Wildlife Service (USFWS) in 2000 as a threatened species (USFWS 2000). This native catostomid is only found in three watersheds: Big Tujunga, San Gabriel and Santa Ana Rivers (Moyle 2002). Unlike most other *Catostomus*, the Santa Ana sucker is smaller in size (<175mm standard length (SL)) and requires clear, cool running streams (<22ºC) with an upper tolerance limit of 38ºC (SMEA 2010, Feeney 2008).Similar in appearance to the mountain sucker, the Santa Ana sucker possesses deep notches at the junctions of the upper and lower lips. There is a shallow median notch in the lower lip that has 3-4 rows of papillae crossing it. Inside the lips there are cartilaginous edges used for scraping. The external row of the first arch contains 21-28 gill rakers and 27-36 gill rakers on the internal row. *C. santaane* have 67-86 lateral line scales, 8-10 pelvic fin rays and usually 10 dorsal fin rays, but this ranges from 9-11. Their axillary process can be found at the base of the pelvic fins and is simple in nature. 8-11 percent of the sucker's SL is made up of their deep caudal peduncle. In spawning males, tubercles can be found along most of their body; however, they are most abundant on the anal and caudal fins and the lower half of the caudal peduncle. Females will only grow tubercles on the caudal peduncle and fin in the breeding season (Moyle 2002).

As a benthic fish that feeds predominantly on algae and detritus found on cobble, gravel and other hard surfaces, distribution of the population is not random, but was shown to be overrepresented in a reach along the Santa Ana River (SAR) with cobble and gravel (SMEA 2001). Their ability to live in perennial streams that are subject to periodic, severe flooding is linked primarily to their high fecundity and early maturity. These factors allow the fish to repopulate quickly following a flood (Moyle 2002). Habitat requirements of gravel and cobble have been shown to relate not only to their feeding habits, but also to their spawning, as fertilized eggs of the sucker adhere to the gravelly substrate (Greenfield *et al*. 1970). According to the USFWS, the volume and flow of the river plays an important role in shaping the habitat of the threatened sucker. At times of high flow, new sources of gravel and cobble are distributed along the river, whereas maintaining a constant low flow in areas that are occupied by suckers allow the undesirable sand and silt to be moved out of the area (USFWS 2012).

Sections of the Santa Ana River were listed in 2010 as part of the sucker's critical habitat in the Federal Register. Studies have shown that suckers can be found in the main reach of the SAR from the confluence of the Rialto Channel to Prado Dam in

Corona. The majority of the sucker population in the main reach of the SAR can currently be found in the Riverwalk points located upstream of Mission Inn Avenue, with little to none found downstream of the Metropolitan Water Districts (MWD) pipeline crossing (Swift 2001; SMEA 2011). Besides the need for a constant flow of water, suckers are affected by several factors including, but not limited to, off-highway vehicles (OHVs), water quality, nonnative vegetation (*Arundo donax*) and nonnative predators (USFWS 2012).

The main reach of the SAR has a highly urbanized surrounding, which increases urban runoff and recreational use. Evidence of vehicles, bicycles, wheelchairs, OHV's have been observed in the river system throughout this survey and previous surveys (Swift 2001).

Along the SAR, specifically from Riverside Avenue to Van Buren Boulevard, it was observed that there are several large transient camps. While no photos were taken of these camps as part of the survey, these camps in the river may be the cause of artificial barriers used for bathing, washing, or, as observed during our survey, fishing. Moving rock based substrate may affect fish habitat or physically damage fish; if done during the breeding season it can disrupt spawning efforts. The artificial structures formed by *A. donax*, observed by the survey team but not documented using photos, can possibly limit flow and cause sandy pools to form. The survey team's experience at the SAWA habitat restoration site at Sunnyslope demonstrated that sandy pools can accommodate nonnative predators, such as large-mouth bass (*Micropterus salmoides*) and green sunfish (*Lepomis cyanellus*) (OCWD 2012).

Previous sucker research in the SAR has occurred. In 1996 Chadwick and Associates produced a report summarizing surveys done in 1991, 1995 and 1996 as an assessment of the status of the sucker in the SAR. They focused their surveys on the abundance and seasonal variation in population size of suckers in the mainstream of the SAR and its tributaries. Saiki's study in 2000 surveyed the San Gabriel River and sections of the SAR, which included the Imperial Highway Bridge in Orange County. The focus of this study was water quality parameters and estimates of general condition of suckers. A survey on the distribution of suckers along the SAR was conducted in 2001 (Swift). Spawning areas of the sucker along the SAR were identified during this study, as well as the impacts of exotic predators on the sucker population. Annual surveys between the years 2001 and 2011 were carried out by San Marino Environmental Associates (SMEA) in three 100m sites downstream of the Rialto channel confluence; a forth site was added between the years 2008-2011. These same sites were studied between 2001 and 2011with an emphasis on analyzing the population dynamics of the sucker and changes in habitat (SMEA 2011). Thompson et al (2010) did annual quantitative surveys of *C. Santaanae* abundance and habitat at three 100 meter sites along the Santa Ana River from 2001 and 2008 and annual surveys of habitat composition within a 30 km stretch of the River between 2006 and 2008 and found that the variability in the distribution of coarse sediment likely had a large effect on the population dynamics of the *C santaanae* in the Santa Ana River.

In 2006, the Santa Ana Watershed Association initiated the first Riverwalk survey. It was administered in 2007 by the USFWS and then in 2008 it was handed over to the Santa Ana Sucker Conservation Team. The annual survey is used to monitor the movement of the river in the stream bed and evaluate the substrate makeup along the river. By monitoring the movement of the river and its substrate, an annual assessment can be made of the potential habitat for suckers along the SAR.

During the Riverwalk survey, 114 points spaced approximately 300 meters apart were surveyed by volunteers from the Rialto Channel confluence to the Prado Basin. The goal of the following survey was to determine the current distribution and relative abundance of the Santa Ana Sucker along the Santa Ana River.

STUDY AREA

Based upon prior year's Riverwalk survey area, which is an annual survey that assesses the distribution of *C. Santaanae* habitat in the Santa Ana River, the area sampled along the Santa Ana River during this survey was from the Rialto Channel confluence to the Prado Basin (Figure 1). Of the 122 Riverwalk points, only 114 were available to survey as the first 8 were dry. The Riverwalk survey groups these 122 points into the following 13 sections:

Section 1: from Agua Mansa Rd. next to the drainage right before Dunn Ranch Rd. to Riverside Ave.

Section 2: from Riverside Ave. to Market St.

Section 3: from Market St to Mission Inn Ave. at the Carlson Bark Park.

Section 4: from Mission Inn Ave. at the Carlson Bark Park to Rubidoux Ave.

Section 5: from Rubidoux Ave. to Martha McLean/Anza Narrows Park.

Section 6: from Martha McLean/Anza Narrows Park to Van Buren Blvd.

Section 7: from Van Buren Blvd. to the corner of Downey St. and 64th St.

Section 8: from the corner of Downey St. and 64th St to Bain St.

Section 9: from Bain St. to Ridgeview Ave.

Section 10: from Ridgeview Ave. to Pedley Ave.

Section 11: from Pedley Ave. to the end of Old Hamner Ave.

Section 12: from the end of Old Hamner Ave. to the end of Tisdale St.

Section 13: from the end of Tisdale St. to Prado Basin.

METHODS

This fish survey used the 32 randomly stratified points from the annual Riverwalk points between May 2013 and August 2013 (Figure 1) to monitor fish presence and habitat characteristics. These surveys included at least one point from each of the 13 Riverwalk sections, which are specified GPS points shown in Figure 1A. At each selected point, water quality data were taken in addition to all of the measurements made during the Riverwalk (Figure 2). 50m were sampled on each bank. From the Riverwalk point, a meter tape was used to measure out 25m upstream and downstream in order to flag the beginning and end of each survey point. While flagging, surveyors walked in the center of the channel to avoid disturbing fauna and flora. Water quality measurements were taken prior to the start of seining (Figure 3). Starting downstream and working up along the bank, a 6' x 10' x 1/8''mesh seine net was used to collect fish. Seining was used, and not an electroshocker, to avoid damage to fry that were potentially present during the time of the surveys. Seining time and number of net pulls on each bank were noted to calculate effort/fish. The length and number of net pulls varied at each location depending on the substrate, flow, catch load, etc. One pass was made per bank. As fish were captured they were placed in an aerated bucket, processed and released at the completion of each survey. A single sucker was captured without use of a seine; it was caught with a dip net along the bank by a surveyor. Trained surveyors processed the buckets of fauna noting and banking all non-native species, measuring arroyo chub, *Gila orcuttii*, and tallying those less than or greater than 50mm SL. We took the SL and weight (g) of all Santa Ana suckers with the exception of fry, which were not processed to avoid any potential stress to the animal. Suckers were classified into age ranges estimated for the Santa Ana sucker population. (SMEA 2003): SL 0 – 80mm : 0+ yrs., SL 81 – 120mm : 1+ yrs, and SL 121mm+ : 2+ yrs.

Due to the length of time between sampling data, the movement and/or growth of fish and changes in habitat conditions could skew results.

Habitat variability was characterized at each point by collecting water quality data and the parameters used on the Riverwalk form. Prior to seining, water temperature, dissolved oxygen (DO), DO%, total dissolved solids (TDS), pH, conductivity and salinity were collected ~1m from the east or south bank (depending on the directional flow of the river) to avoid disturbing the study area. Riverwalk data were taken at the end of each survey to avoid disturbing the fauna in the survey area prior to seining. Surveyors stretched out a meter tape perpendicular to the flow across the river at each center point to measure wetted width (Figure 4). Following along the transect tape, the depth of the rivers deepest point was recorded. Within 2m on either side of the perpendicular transect, substrate was visually estimated as percentages of the following: mud/silt, sand, gravel, cobble and boulder (Figure 2). Boulder is characterized as 300mm+ in diameter, cobble 75mm-300mm in diameter and gravel 4.75mm-75mm in diameter (Bunte 2001). On each bank, the percent of vegetation overhang within a 1m area along the transect tape was recorded, as well as the depth ~4" from each respective bank. In the case of survey points that had more than one channel, the Riverwalk data were taken in each channel and the length of the channel was also noted. More measurements along the transect may have resulted in different findings.

This work was done under USFWS permit TE-114936-1. No native fish were injured or killed during this study.

RESULTS

Distribution of Santa Ana Sucker

In the areas surveyed along the SAR, from the Rialto Channel confluence to the Prado Basin, a total of 301 suckers were captured and processed. Total seine time was 8,268 seconds; this results in a total effort of 0.04 fish/sec. While calculating effort, an adjusted number of captures was used as one sucker was not caught while seining, but caught by a surveyor along the bank with a small 4" dip net. A majority of the suckers were captured in the upper reaches of the study area from the Rialto Channel confluence to just downstream from Mission Inn Avenue (Figure 5). There was a 34.4% occupancy rate among the 32 points surveyed. Of the areas that held sucker, the highest abundance was at points 20, 22 and 24, which are located between Riverside Avenue and Market Street. Sites 101 and 121 downstream of I-15 yielded three fry that were released without processing because they were too small to measure safely. Only 2% of the suckers caught were aged at 1+ or 2+, the other 98% were aged at 0+ (Figures 6, 7, 8).

Habitat Variability

The parameters set to analyze the habitat of the SAR included the substrate found at each site. A mixed substrate habitat was recorded from the Rialto Channel confluence to just downstream of Mission Inn Avenue. With the exception of points near the Hidden Valley Nature Center, the habitat makeup downstream of Mission Inn Avenue turns to predominantly sand and mud/silt composition (Figure 9). The locations where suckers were found in correlation with substrate is shown in Figure 5.

Water Quality Variability

The results of the water quality measurements were not the focus of the study, but results of water quality testing showed parameter: water temperature (18.0-28.3°C), DO (5.3-12 mg/L), DO% (61-91), pH (6.6-8.2), TDS (364-839ppm), conductivity (595-1192), and salinity (345-587ppm). Suckers were captured at sites within the following parameter ranges: water temperature (20.2-28.3°C), DO (5.3-11.2 mg/L), DO% (62-91), TDS (364-651 ppm), pH (6.8-8.2), conductivity (706-958), and salinity (350-507 ppm).

Distribution of Non-native Species

The presence of non-native fauna was not the focus of the study, but their numbers at each site were recorded. A comparison of the distribution of non-native fauna and the distribution of sucker is shown in Figure 10. A majority of the non-natives were found upstream of Mission Inn Avenue, but were found in higher numbers downstream of Mission Inn Avenue than suckers. A total of 4,823 non-native individuals were collected and deceased fish were buried in holes. The four most abundant non-native species caught were Western mosquito fish (*Gambusia affinis*), American bullfrog (*Lithobates catesbeianus*), black bullhead (*Ameiurus melas*), and yellow bullhead (*Ameiurus natalis*).

DISCUSSION

The amount of suckers are compared to substrate in Figures 5. In one location, point 11, where sucker potential appeared high based on habitat condition, no suckers were captured. The anomaly at point 11 that appeared to contain suitable sucker substrate, but where no sucker were collected, might have been due to the speed of the flow which interfered with adequate sampling.

The data in this study makes it important to further investigate a U.S.G.S. survey presented to the Sucker Conservation Team in November 2013 once it is finalized. While the habitat upstream of Mission Inn Ave is currently perceived to be well suited for sucker, it would be beneficial to correlate these data with the potential movement of substrate downstream from the USGS survey area. The data from this current sucker survey also highlight the importance of continuing the Riverwalk data collection annually as a means of indirectly monitoring the abundance and distribution of substrates in the river suitable to sucker occupation.

This distribution of non-native species is an area that requires further study and data collection.

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Appendix 1 – Figures

Figure 1: Riverwalk Points Sampled for SA Sucker in 2013

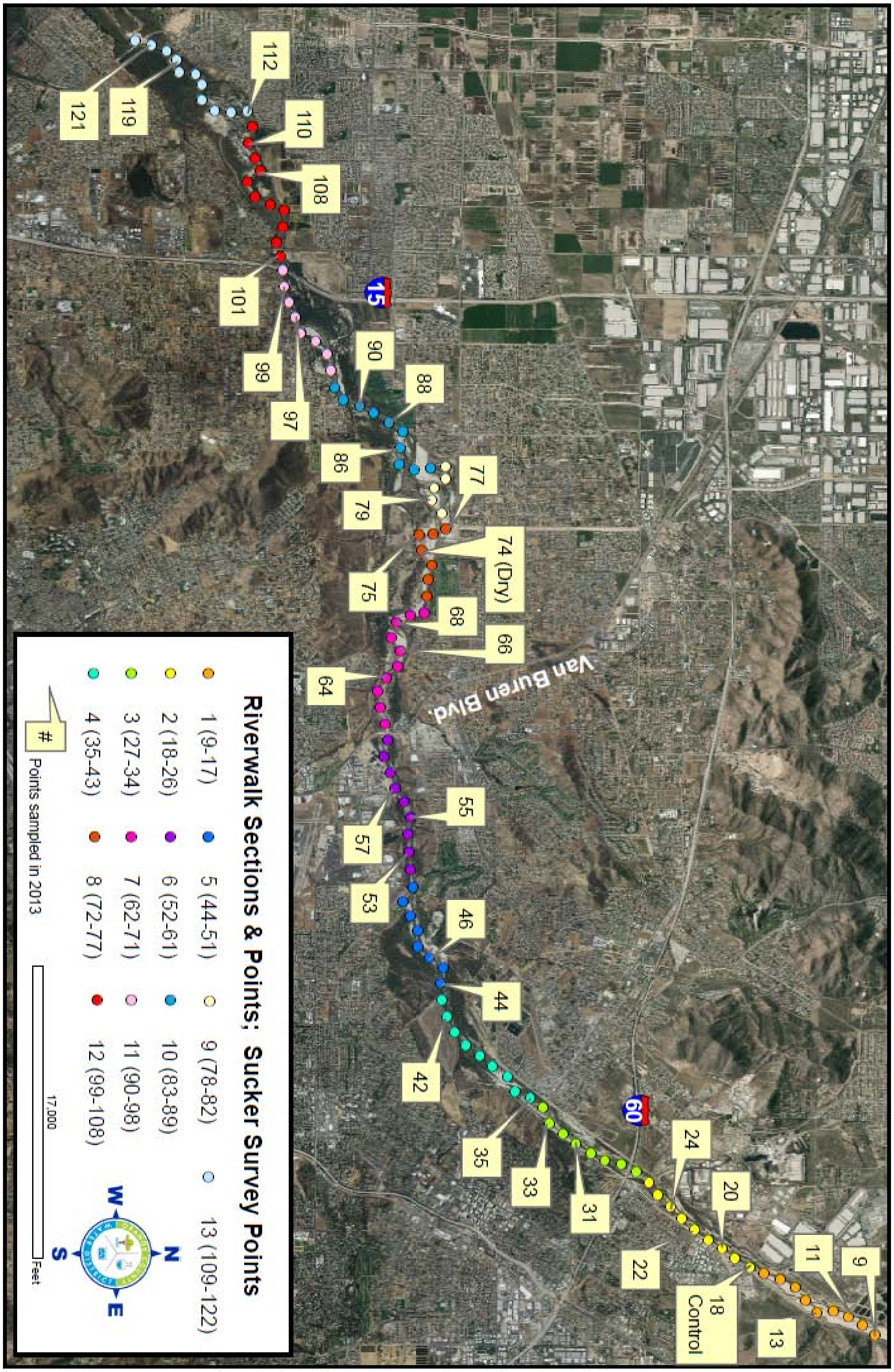

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Figure 1A: Riverwalk GPS points

Point	9	11	13	18	20
GPS	467359	467239	467029	466309	465547
	3767018	3766578	3766064	3764832	3763714

Point	22	24	31	33	35
GPS	465106	464725	464221	463842	463367
	3763349	3762937	3761719	3761369	3760958

Point	42	44	46	53	55
GPS	461984	461399	460943	459084	458464
	3759413	3759293	3759092	3758659	3758740

Point	57	64	66	68	74
GPS	457943	455979	455548	455040	453675
	3758468	3758276	3758635	3758441	3759144

Point	77	79	86	88	90
GPS	453356	452868	451792	451447	451172
	3759209	3759215	3758642	3758283	3757776

Point	97	99	101	108	110
GPS	449606	449059	448511	445945	446511
	3756617	3756424	3756366	3755747	375756

Point	112	119	121
GPS	446941	445023	444828
	3755769	3754302	3754029

Figure 2: Riverwalk Datasheet

SAWA 2014
Santa Ana River Habitat Evaluation

Transect Name: SAS 1 **Date___________**
Target UTM: 469370 3767151
Observers (writer/other)______________________________
General Location ___________________________________

OBSERVATIONS	CHANNEL #1	CHANNEL #2	CHANNEL #3
Actual GPS coordinates in UTM (@ East bank)			
Channel position			
Width of Channel			
Max Depth & location in channel			
Depth Edge East (~4” from edge)			
Depth Edge West (~4” from edge)			
Bank East %Veg Overhang			
Bank West %Veg Overhang			
Substrate % mud/silt			
Substrate % sand			
Substrate % gravel			
Substrate % cobble			
Substrate % boulder			
Photo East Bank (time & #)			
Photo West Bank (time & #)			
Photo upstream (time & #)			
Photo downstream (time & #)			
Photo other (describe)			
Photo other (describe)			
Notes (e.g. Islands, Obstructions)			

Figure 3: Data Sheet

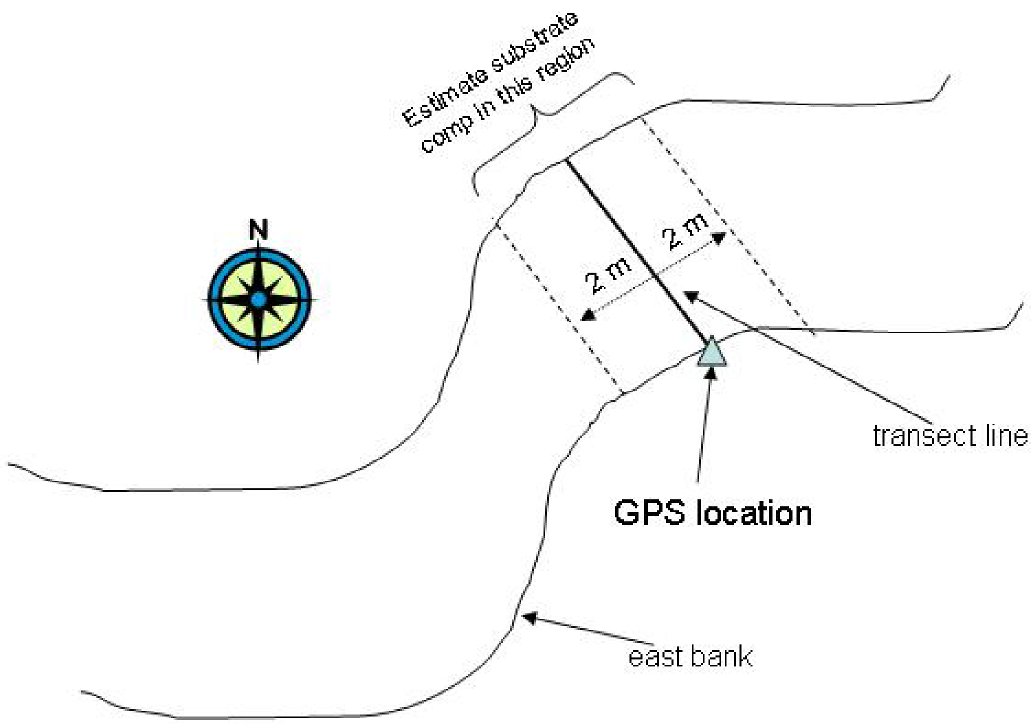
SAWA SAWPA Sucker Project
2013

Date:	Point #:	Section #:	Recorder:
Weather Conditions:		Air Temp:	Seiners:
Water Temp:	DO:	DO%:	
TDS: pH:	Conductivity:	Salinity:	Processors:
Survey Start Time:	Total siene time:		Snorkeling: Yes / No
Survey End Time:			# net pulls: # Passes: 1
Notes:			

Non-Natives:		

Native Fish	Weight (g)	SL (mm)	Breeding Condition	Age	Less than 50 mm

Figure 4: Riverwalk transect protocol diagram



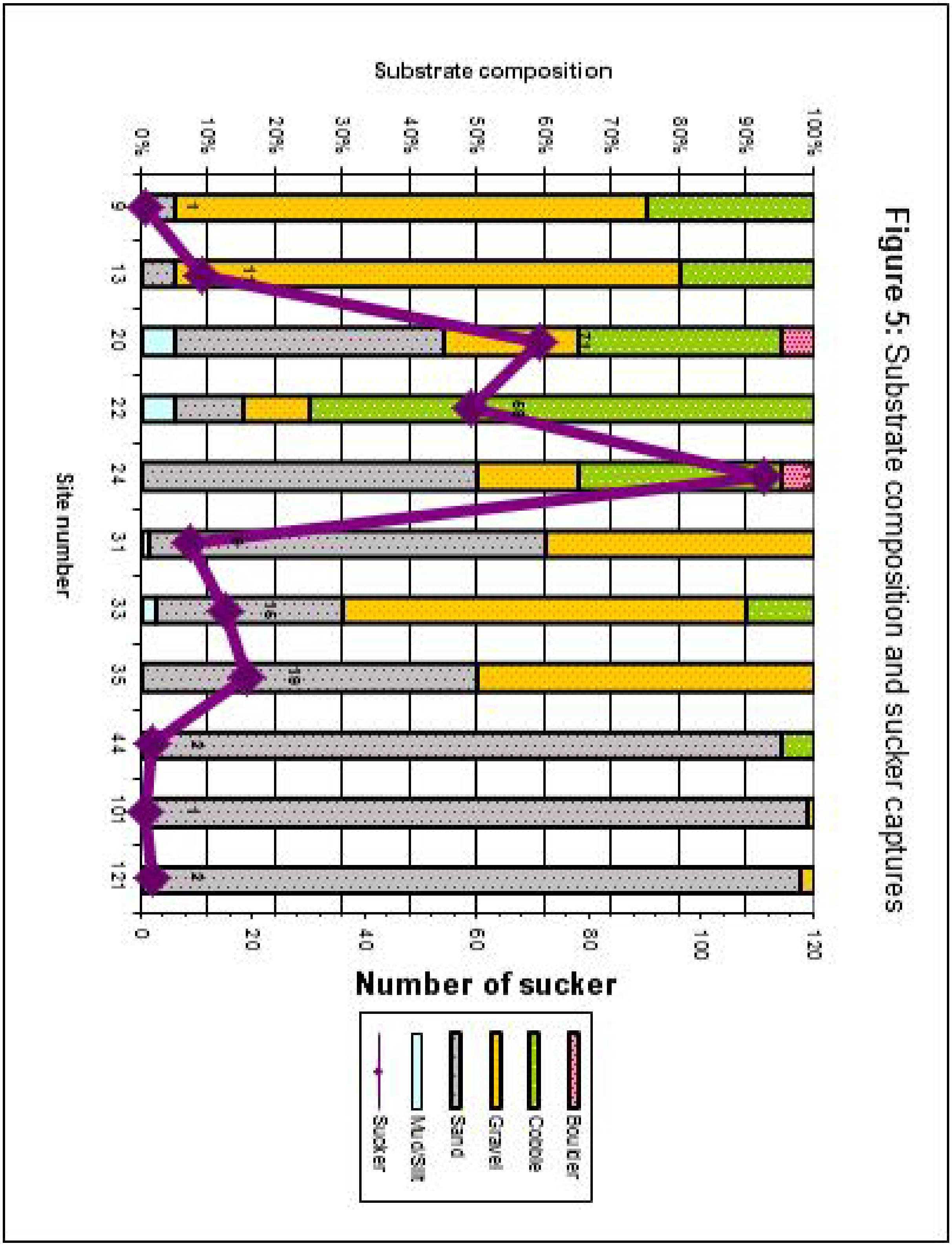


Figure 5: Substrate composition and sucker captures

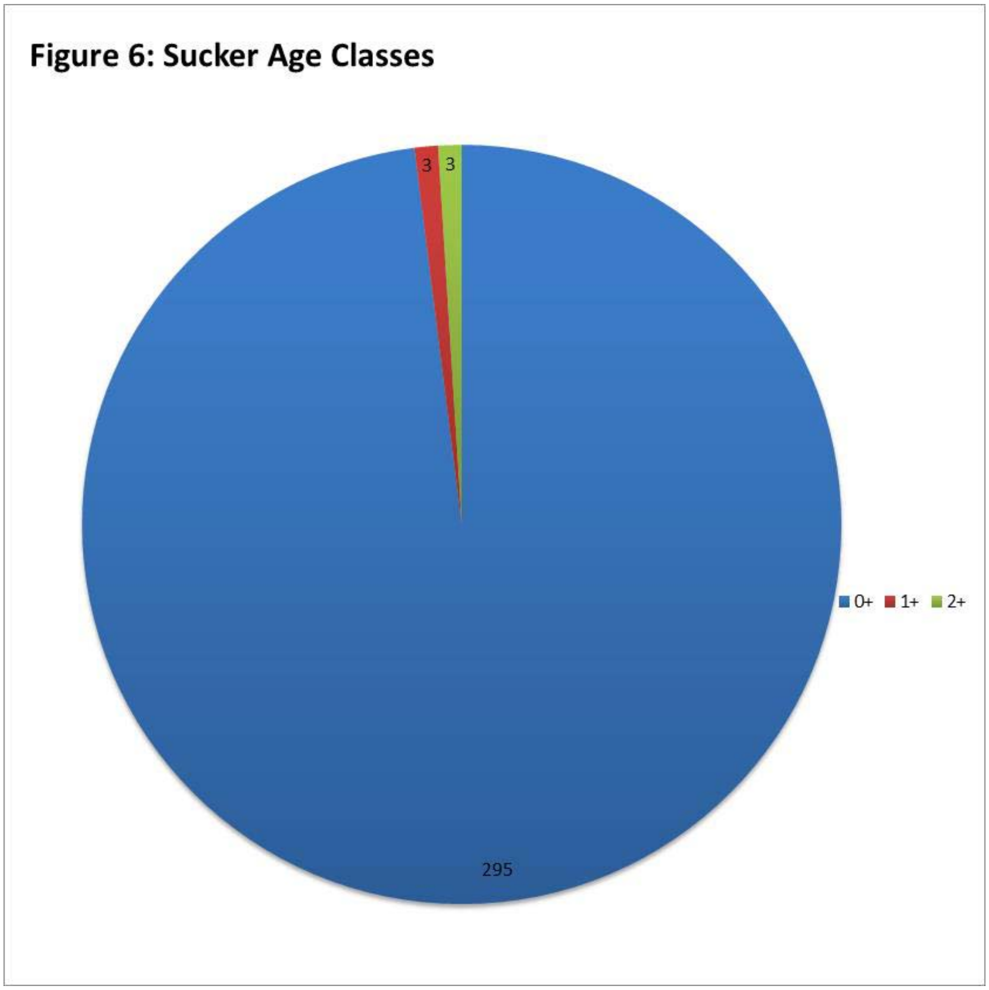


Figure 6: Sucker Age Classes
3
3
295
0+
1+
2+

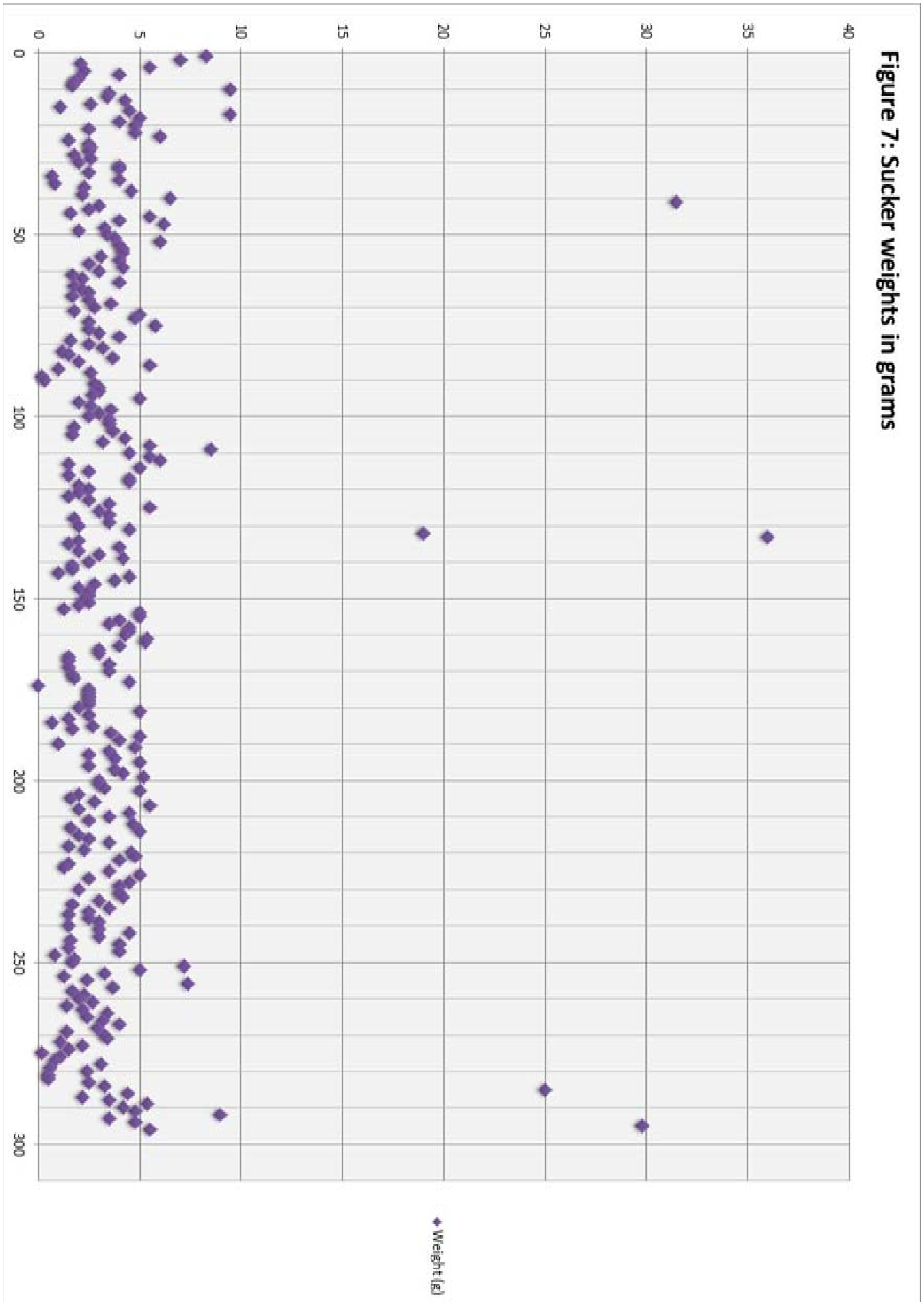


Figure 7: Sucker weights in grams

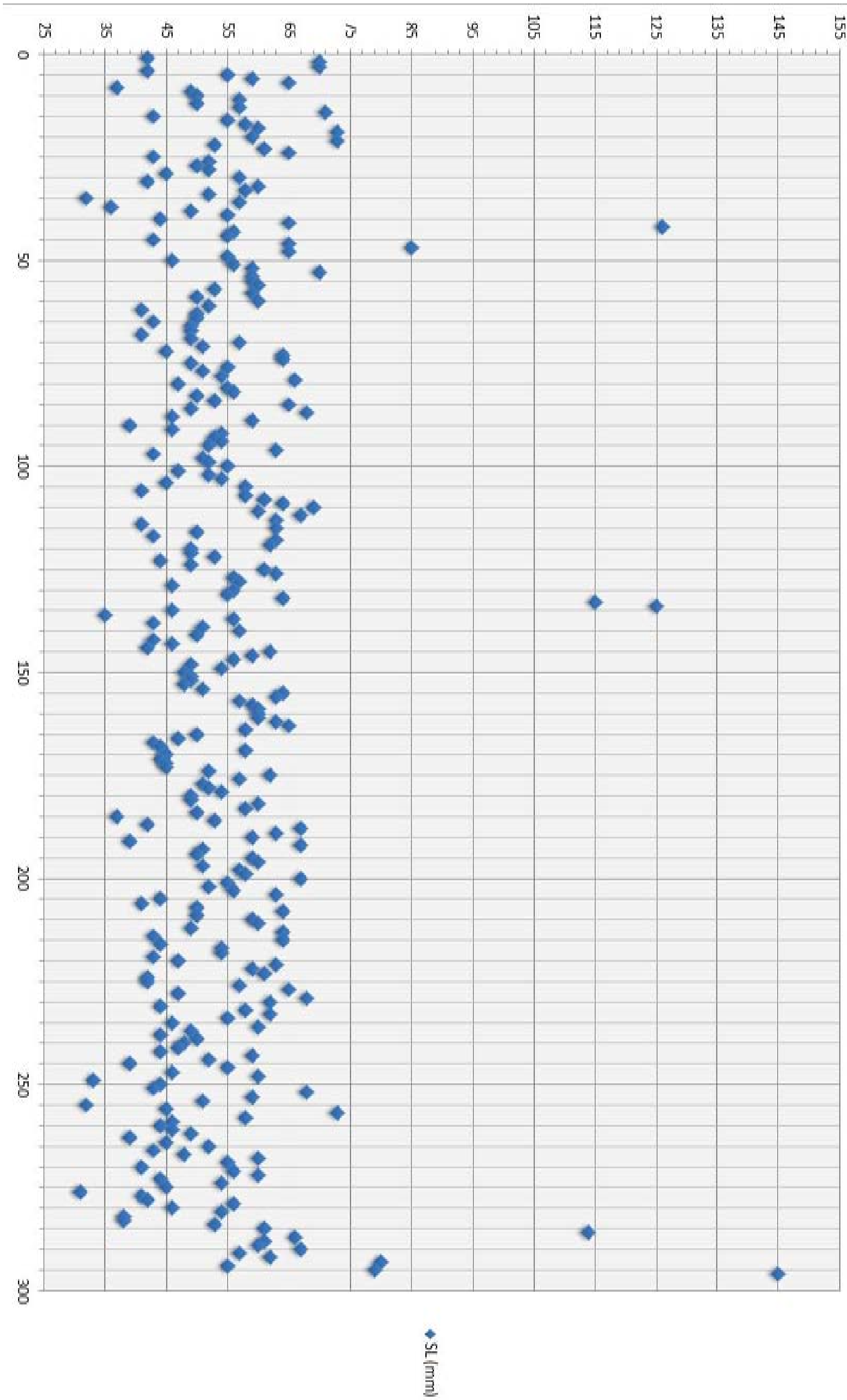


Figure 8: Standard Length (SL) of Suckers in mm

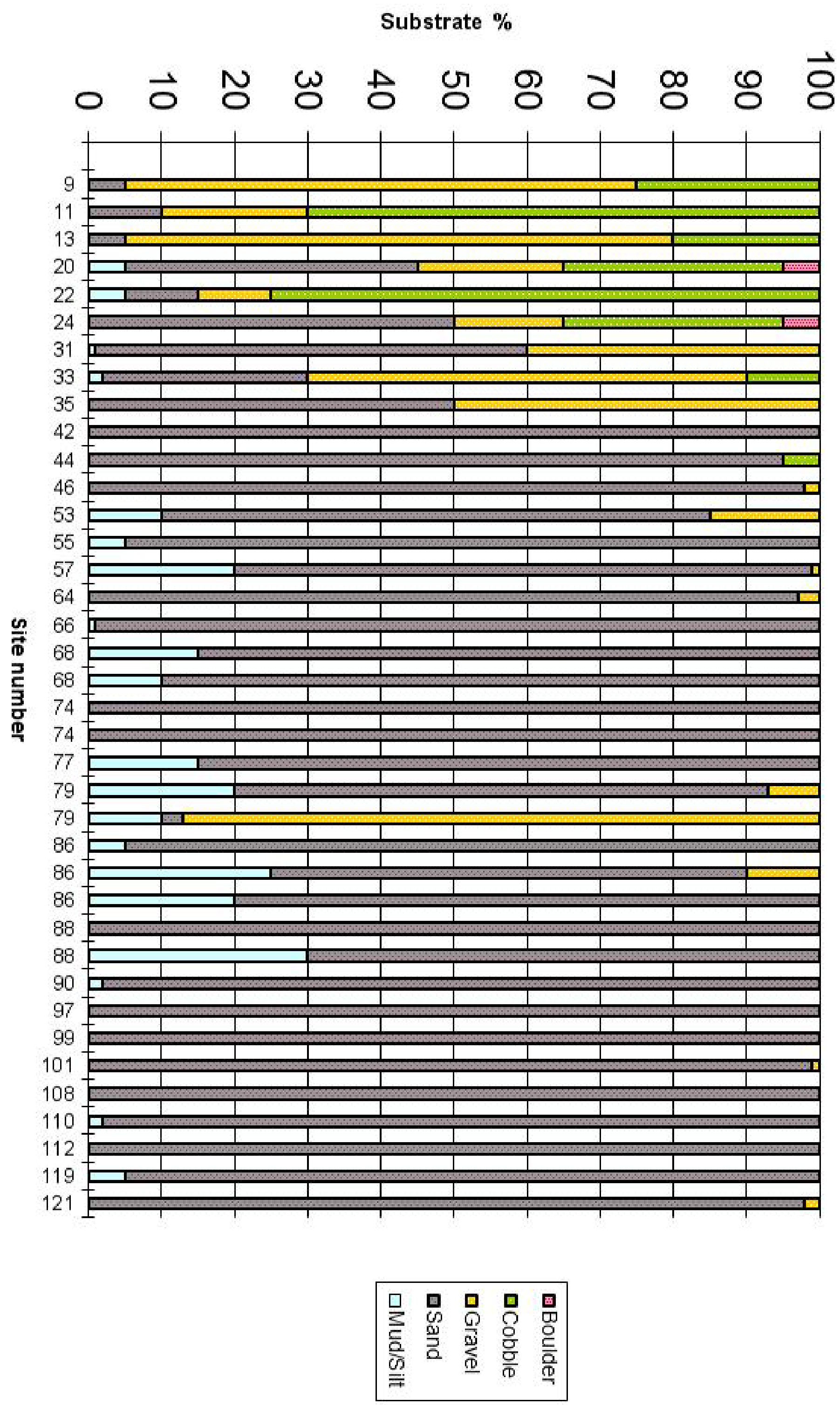
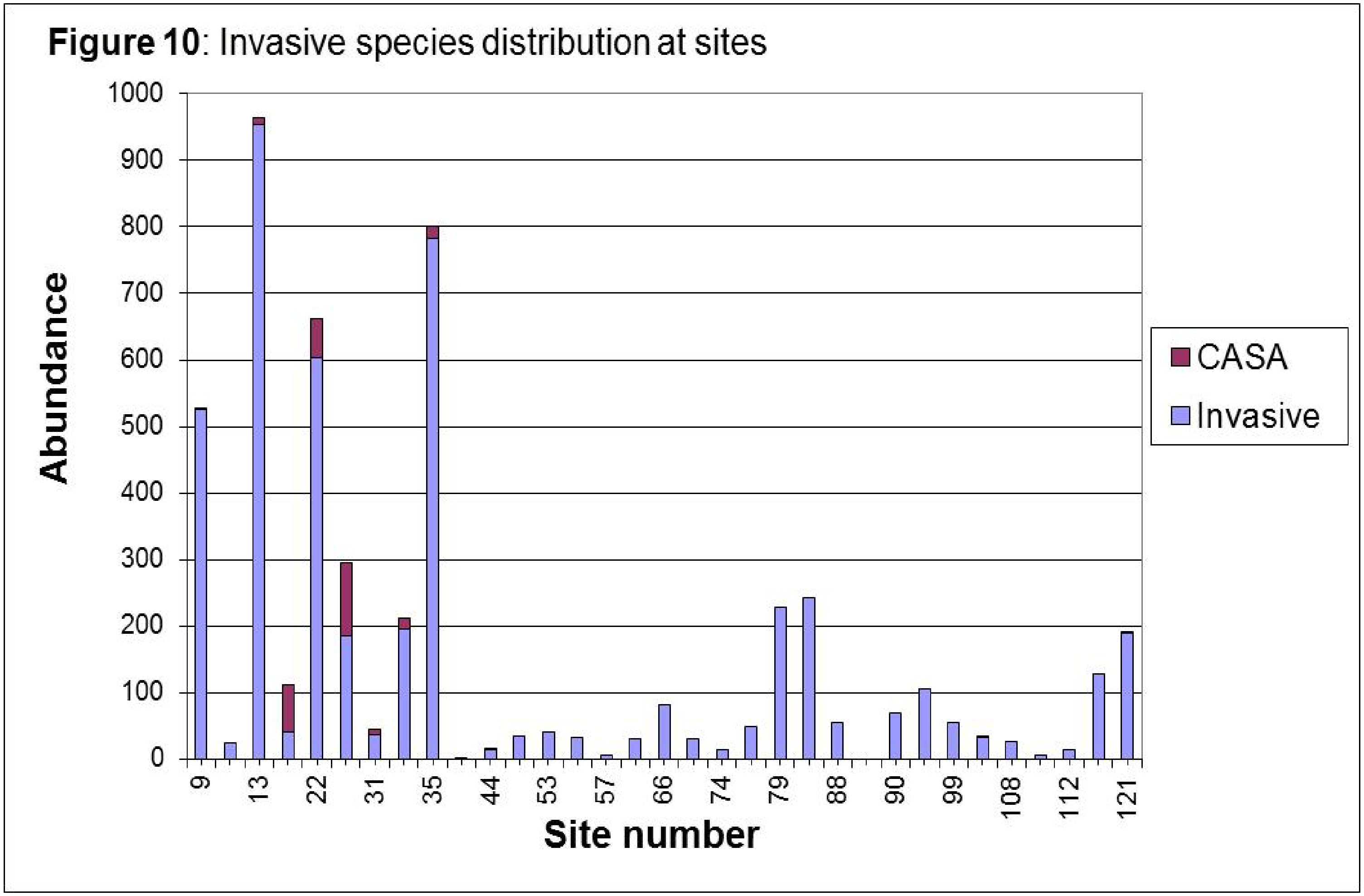


Figure 9: Substrate composition of sites



* CASA = Santa Ana sucker

Appendix 2 - Tables

Table 1 Water quality variables for each site, Dates of survey: May 2013-August 2013

Point	Section	Water Temp (C°)	DO (mg/L)	DO%	TDS (ppm)	pH	Conductivity	Salinity (ppm)
9	1	25.6	11.2	91	604	7.21	808	418
11	1	25	6.3	80	432	6.64	595	345
13	1	25.1	9.6	85	531	6.8	765	385
20	2	23.9	5.7	65	502	7.7	706	350
22	2	26.1	6.6	77	521	7.9	747	372
24	2	28.3	6.6	84	526	7.8	751	376
31	3	23.3	5.3	62	514	7.7	731	367
33	3	24.7	5.8	69	527	7.9	753	377
35	4	26.9	6.5	81	490	8	717	358
42	4	20.1	6.6	78	489	8	689	494
44	5	22.2	6.4	77	364	8.1	730	507
46	5	23.2	7.4	61	530	7.9	763	380
53	7	18	6.6	77	839	7.21	1192	587
55	7	18.5	7	80	781	7.35	1117	548
57	7	19.4	7.5	86	776	7.43	1109	545
64	7	26.2	5.8	69	763	7.13	1094	535
66	7	21.5	6.1	72	777	7.24	1100	542
68	7	24.7	6.7	74	774	7	1112	550
74	8	26.2	5.9	72	750	7.24	1070	523
77	8	23.2	6.2	74	758	7.25	1089	535
79	9	27.1	6.2	73	597	7.31	857	421
86	10	19.9	7.6	83	579	8.1	764	408
88	10	21.4	6.9	81	616	8.2	881	440
90	10	23.7	7.4	88	626	8.2	894	446
97	11	22.7	7.2	85	671	8.2	959	479
99	11	21.2	7.8	91	955	8.1	977	~~42~~
101	12	20.2	7.1	85	~~58~~	8.2	958	473
108	12	19.1	6.4	78	581	8.1	819	418
110	12	21.3	6.9	82	628	8.2	893	444
112	13	21.1	12	89	639	8.2	918	458
119	13	25.7	7	84	628	8.2	895	443
121	13	27.4	6.5	76	651	8.2	933	469

Note: The observations occurred over the course of four months. It may not be exact to compare water quality parameters at different locations to different points in time when the base flow discharges, that supply some of the flow of the Santa Ana River mainstem, can vary daily .

Table 2: Habitat variables for each site

Point	Section	Channel width (m)	Max depth (cm)	Depth edge East (cm)	Depth edge West (cm)	% Veg overhang		Substrate %				
						East bank	West bank	Mud/Silt	Sand	Gravel	Cobble	Boulder
9	1	3.85	16	1	6	70	80	0	5	70	25	0
11	1	9.8	36	3	5	70	85	0	10	20	70	0
13	1	9.3	35	3	5	5	100	0	5	75	20	0
20	2	7.3	32.5	22	5	100	100	5	40	20	30	5
22	2	6.75	37	2	21	10	75	5	10	10	75	0
24	2	7.9	70.5	5.1	3.1	0	10	0	50	15	30	5
31	3	10.6	23	6	6	80	80	1	59	40	0	0
33	3	8.35	25	2	5	50	100	2	28	60	10	0
35	4	6.3	41	9	2	50	0	0	50	50	0	0
42	4	15.3	37	9.2	8	100	100	0	100	0	0	0
44	5	10.6	27	5	6	75	60	0	95	0	5	0
46	5	17.3	25	5	6	100	100	0	98	2	0	0
53	7	41.2	34	6	6	100	100	10	75	15	0	0
55	7	29.5	19	4	4	100	100	5	95	0	0	0
57	7	49.1	19	15	3	100	100	20	79	1	0	0
64	7	34.8	31	11	6	100	100	0	97	3	0	0
66	7	43.4	42	14	14	100	100	1	99	0	0	0
68	7	28.9	41	3	11	100	100	15	85	0	0	0
68	7	6.7	21	13	13	100	100	10	90	0	0	0
74	8	9.6	28	23	11	85	100	0	100	0	0	0
74	8	18.7	31	7	5	85	100	0	100	0	0	0
77	8	30.7	44	9	10	100	100	15	85	0	0	0
79	9	17.4	26	5	15	100	100	20	73	7	0	0
79	9	19.1	33	5	9	100	100	10	3	87	0	0
86	10	31.7	37	18	2.5	100	100	5	95	0	0	0
86	10	6.6	12	10	2	100	40	25	65	10	0	0
86	10	9.9	13	3	1	100	100	20	80	0	0	0
88	10	45	38	4	5	100	100	0	100	0	0	0
88	10	7	11	3	3	100	100	30	70	0	0	0
90	10	61.8	33	7	9	100	100	2	98	0	0	0
97	11	31.8	37	11	7	100	100	0	100	0	0	0
99	11	29.3	35	5	16	100	100	0	100	0	0	0
101	12	33.5	49	7	22	0	70	0	99	<1	0	0
108	12	28.4	59	12.5	7	100	100	0	100	0	0	0
110	12	22.9	42	21	15	100	100	2	98	0	0	0
112	13	30	45	9	5	100	100	0	100	0	0	0
119	13	39.8	37	2	9	20	100	5	95	0	0	0
121	13	53.5	24	7	15	100	100	0	98	2	0	0

Appendix 3 - Comments for Further Consideration

Many comments were received as part of the review process for this habitat survey, and although all were helpful some were outside the scope of the study. The Santa Ana Sucker Conservation Team will use these comments as the Team scopes future possible studies for the Santa Ana River Watershed.

Heather Dyer Water Resources Project Manager	San Bernardino Valley Municipal Water District

Limitations and Future Needs:

1. Although the study was not intended to be a count of sucker in the River, based on several comments it is clear that people are inclined to assume it is, or would like it to be, a count of the current sucker population. Perhaps a true population assessment would be a study valued by the participants of the Conservation Team.
2. If the factor influencing the amount of time between the first sample and the last sample was the number of sites chosen and the ability for one team to do all the sampling then perhaps we should reduce the number of sites to something the team feels they can accomplish in a shorter time span. If the factor was the crew's ability to only spend one day in the field per week then perhaps we should increase the budget in order to secure a dedicated field crew to collect all the data within a 2-3 week period. Either way, since size classes and geographical distribution are aspects of this study, it is important that the data is collected in such a way that minimizes skew from growth and movement of fish.
3. In order to effectively catch all (or near all) of the fish within the area sampled and develop conclusions about their use of habitat types it is essential that the fish captured can be assumed to be the fish present in the sample area. However, without upstream and downstream block nets to eliminate escape from the site, it is difficult to draw conclusions further than presence/absence in a particular habitat type. Additionally, walking up the middle of the stream before sampling likely caused some fish to flee the site before seining was completed. Finally, seines are less effective than other gear types in habitat with uneven banks, bottom debris, and/or riparian vegetation blocking a clean pass of the net. For these reasons, all fish present in each habitat type were probably not accounted for in the data set which makes it difficult to reach conclusions with any degree of certainty.
4. The high percentage of juveniles compared to adults captured suggests that the gear type was ineffective at capturing adult sucker. Perhaps a different and/or additional method of sampling should be considered for future studies in order to collect a more representative sample of the age classes in the sucker population.

Lisa Haney Senior Environmental Specialist	Orange County Sanitation District Environmental Compliance Division

1. It was not clear to me how many suckers there are in the river. Are all the suckers less than 2 years old? If so, why is that? How long do they live?
2. It was not clear to me how many suckers there are in different reaches of the river. Where are they exactly? Can you map their distribution?

3. It was not clear to me what the recovery number is for the sucker and where their population currently stands in that recovery attempt.
4. Over 4,000 non-native species were removed…… how and from where, what reaches of the river where they removed from? Did this help suckers recover in those areas? Mapping that would be helpful. Is there a plan to monitor this for an affect?
5. What are the next steps moving forward? What is the recovery plan for the sucker long-term? What other studies are going on in the area to better understand their ecology and recovery?

Jonathan N. Baskin, PhD. Emeritus Professor, Biological Sciences	California State Polytechnic University Pomona

1) Use the size and weight of the suckers to get a condition index for the population. This could be good baseline data and can be compared to the condition index reported in my SMEA SAWPA reports from earlier years. Especially see the comparison with suckers from the mountain habitat in the San Gabriel River.
2) Look at the distribution of the adults and juveniles to see if there is any pattern as to where they are found, i.e. what part of the river and what habitat conditions, water quality, substrate.
3) Did you see the Habitat Selectivity study that was reported in the SMEA SAWPA reports? Especially see the comparison with suckers from the mountain habitat in the San Gabriel River.