HABITAT CONSERVATION PLAN
BIOLOGICAL MONITORING PROGRAM
San Marcos Springs/River Ecosystem

ANNUAL REPORT

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EXECUTIVE SUMMARY

The Edwards Aquifer Habitat Conservation Plan (HCP) Biological Monitoring program activities conducted in 2015 continued to shed light on the biota of the San Marcos Springs/River ecosystem (San Marcos system). In particular, continued comprehensive monitoring efforts have provided insight into how the aquatic flora and fauna of the San Marcos system, including threatened and endangered species, subsist and change as an extended drought ended. The drought was broken in spectacular fashion with two major flooding events occurring in 2015. Sampling efforts specifically targeting species of concern in the San Marcos system were conducted for the fountain darter (*Etheostoma fonticola*), Texas wild-rice (*Zizania texana*), and the San Marcos salamander (*Eurycea nana*). Additional community level monitoring data was also collected on aquatic vegetation, macroinvertebrate, and fish communities. This annual summary report presents a synopsis of methodologies used and observations made during comprehensive and critical period sampling activities conducted in the San Marcos system during 2015.

While average monthly discharge in the San Marcos began the year below the historic average, both minor and major precipitation events quickly increased discharge resulting in above average total system discharge for the remainder of 2015. The initial flooding event occurred over the Memorial Day weekend timeframe when record precipitation fell over the San Marcos and Blanco rivers basins. Most of the severe flooding affected the Blanco River, but its historic discharge caused the San Marcos River to back up from I-35 all the way to Spring Lake dam. Unfortunately due to the flooding, gages in the river were unable to approximate a maximum discharge at this time. The nature of this flooding (backwater inundation effect) resulted in less disturbance to the biota in the San Marcos river upstream of I-35 than what was originally expected. Aquatic vegetation was mostly unaffected except for some scouring in the I-35 Reach (the most downstream study reach). Vulnerable stands of Texas wild-rice fared better by early summer at all sites except the I-35 Reach where some scouring occurred. Estimates of fountain darters decreased from spring to June, but may be due to increased movement/displacement from the flooding. San Marcos salamander densities fared similarly with a drop-off in numbers from spring to early summer. However, with the exception of the Hotel Site in Spring Lake, these densities were higher than the long-term study averages.

Summers in the San Marcos River are often a busy time, and this recreation pressure is reflected in the fall comprehensive data. The fall sampling event in mid-October began with flows still above the historical average, but on a steady decline from the flooding event in early summer. While water temperatures remained constant, aquatic vegetation surface area decreased at all reaches except for I-35. This is a typical seasonal fluctuation due to increased recreation pressure at the upstream reaches, with pressure usually less in the I-35 Reach. The Spring Lake Dam Reach exhibited the loss of a large area of aquatic vegetation near an access point, but at the same time the designed modification of access points has limited pressure to aquatic vegetation (including Texas wild-rice) in other sections of the river. A similar change is occurring at the City Park Reach with improved access to the river right section in the middle, but restored banks in other areas limiting recreation pressure. A positive result (along with plantings and nonnative removal) has been an increase in Texas wild-rice in this reach.

For the first time since the study began, Texas wild-rice surpassed 7,000 meters squared (m^2) surface area within the San Marcos River. Much of this increase can be attributed to the success of HCP restoration efforts, in particular plantings of the endangered plant and exclusion zones protecting large stands. While success was visceral in the upper San Marcos River, the flooding event in June wiped out nearly all of the Texas wild-rice downstream of I-35. Scouring was intense in the San Marcos River below I-35 as a result of the Blanco River jumping its banks, rushing along the I-35 frontage area, and flushing this downstream section.

Normalized fountain darter population estimates rebounded somewhat between the June flooding and fall, but were still below long-term study averages. Sampling of the overall fish community in the San Marcos River continued to reflect a diverse community of fishes resilient to the varying hydrology. San Marcos salamander densities increased from the high-flow event into fall, with densities at all reaches at or above the long-term study averages. Like the fish community, sampling of the macroinvertebrate community reflected a taxonomically rich and diverse population. The City Park Reach had the highest abundance of fountain darter prey organisms with the I-35 and Spring Lake Dam reaches close behind.

Another more devastating flooding event occurred in the San Marcos River at the end of October. Unlike the Memorial Day weekend flood, this flood occurred mainly as a result of intense precipitation in the Sink and Purgatory creek drainages, as well as the Blanco River watershed. With Sink Creek flowing into Spring Lake, and Purgatory Creek coming in upstream of Rio Vista Park, flooding affects were magnified throughout the system, and more disturbances were observed in the upper reaches compared to the earlier flood. Initial observations show extensive scouring of aquatic vegetation including Texas wild-rice, and large displacement of substrates. Fortunately, the fall comprehensive sampling effort literally concluded the day before the skies opened up. Following the river stabilizing and turbidity subsiding, a complete Critical Period biological monitoring effort was conducted in mid-November through early December. The timing of the sampling and this event should provide an excellent opportunity to examine the direct impacts of this massive flood event on the habitat and biota of the San Marcos River. Results from this assessment will be presented in an addendum to this report in early 2016.

INTRODUCTION

Section 6.3.1 of the Edwards Aquifer Habitat Conservation Plan (HCP) lays out the path for continuation of biological monitoring. Formerly known as the Edwards Aquifer Authority Variable Flow Study, the program initially included comprehensive sampling during "normal," set temporal periods, as well as specific, triggered sampling for low-flow events (i.e., Critical Period sampling) to gather baseline and Critical Period data for use in assessing ecological conditions and filling important data gaps relative to threatened and endangered species and their habitats. The importance of documenting effects of high-flow events was determined early on, and this aspect was added to the Critical Period component. This foundational objective is still valid today, as continued monitoring of system conditions over time and filling in important data gaps where appropriate and practical remain imperative to the success of the HCP. However, the utility of the HCP biological monitoring program has surpassed this original goal and objective, with biological monitoring data collected through this original program (BIO-WEST 2001a–2014a,b) serving as the cornerstone for:

1. Development of the HCP long-term biological goals and objectives (HCP Section 4.1),

2. Development of HCP flow management objectives (flow regimes) embedded within the long-term biological goals (HCP Section 4.1),

3. Determining potential impacts to and incidental take assessment relative to the HCP and Environmental Impact Statement alternatives (HCP Section 4.2), and

4. Establishing core adaptive management activities for triggered monitoring and adaptive management response actions (HCP Sections 6.4.3 [Comal] and 6.4.4 [San Marcos]).

As the HCP progresses, successful execution of the biological monitoring program is mandatory to adequately assess items 1–3 relative to HCP Phase II decisions. Item 4 is essential for the protection of the species should low-flow conditions occur.

Additionally, the HCP biological monitoring program data, in conjunction with other available information, are essential for the following tasks:

5. Assessing the effectiveness and efficiency of HCP mitigation/restoration activities being conducted in both the Comal and San Marcos springs systems.

6. Providing data to inform the ongoing HCP ecological model development either through parameterization and/or validation.

7. Calculating the HCP habitat baseline and net disturbance determination.

8. Calculating the HCP annual "take" estimate.

Items 5 and 6 again relate to providing guidance to assist with HCP Phase II decisions regarding achieving long-term biological goals and the level of protection afforded by the HCP flow-management objectives. Items 7 and 8 focus on addressing annual report requirements for the U.S. Fish and Wildlife Service (USFWS) Incidental Take Permit (ITP).

Needless to say, the current HCP biological monitoring program has expanded to more than monitoring only to assess endangered species and habitat over time. In addition to the comprehensive and Critical Period monitoring already established and ongoing, a new sampling directive entitled "HCP species-specific sampling" was added to the program in 2013. The HCP species-specific sampling is triggered by low-flow conditions (similar to Critical Period sampling) but directly supports HCP adaptive management decisions (HCP Section 6.4.4).

It is important to recognize that many different sampling components are included in the HCP biological monitoring program and several sampling location strategies are employed. The sampling locations selected are designed to cover the entire extent of endangered species habitats in both systems, but they also allow for holistic ecological interpretation while maximizing resources where practical and when applicable. As such, the current design employs five basic sampling location strategies for the San Marcos system as follows, with associated sampling components:

1. System-wide sampling
    - Texas wild-rice full-system mapping—annually
    - Full-system aquatic vegetation mapping—once every 5 years (not conducted in 2015)

2. Select longitudinal locations
    - Temperature monitoring—thermistors
    - Water quality sampling—during low-flow sampling
    - Fixed-station photography

3. Reach Sampling (three reaches)
    - Aquatic vegetation mapping
    - Fountain darter (*Etheostoma fonticola*) drop netting
    - Fountain darter presence/absence dip netting
    - Macroinvertebrate community sampling

4. Springs Sampling
    - San Marcos salamander (*Eurycea nana*) sampling

5. River Section/Segment Sampling
    - Fountain darter timed dip-net surveys
    - Fish community sampling

The following sections provide a description of methods for all 2015 activities, followed by a presentation of observations and results.

METHODS

Study Location

The upper San Marcos River, which is part of the Edwards Aquifer system, extends from its origin as a series of spring upwellings in Spring Lake to the confluence with the Blanco River in Hays County. The upper portion of the river is characterized by near-constant water temperatures and relatively constant flow. This portion of the river also includes several endemic organisms that are federally listed as threatened or endangered, including: Texas wild-rice (*Zizania texana*), San Marcos salamander, San Marcos gambusia (*Gambusia georgei*), Comal Springs riffle beetle (*Heterelmis comalensis*), Texas blind salamander (*Eurycea rathbuni*), and fountain darter. This section of the river is located within an urban area and is subjected to a substantial amount of recreational use. As such, sites were chosen in this section of the river to better understand the interactions between the biota, the surrounding environment, and recreational users of this unique ecosystem (Figure 1).

During 2015 two comprehensive sampling efforts (spring and fall), two high-flow Critical Period efforts, and several annual activities were conducted in the San Marcos River system. The 2015 sampling schedule included the following components:

Aquatic Vegetation
Texas wild-rice full-system survey
Sample reach GPS mapping

Water Quality
Thermistor placement and retrieval
Fixed-station photography
Point water quality measurements
Grab samples (Critical Period only)

San Marcos Salamander Observations
Snorkel/SCUBA surveys

Texas Wild-Rice Physical Observations
Cross-section data
Physical measurements

Fountain Darter Sampling
Drop nets, dip nets
Visual observations

Fish Community Sampling
SCUBA surveys
Seining

Macroinvertebrate Community Sampling

As discussed in last year's annual report, two types of low-flow sampling were incorporated into the HCP biological monitoring program in 2013. The first was the historically conducted Critical Period low-flow sampling, which is for the most part a repetition of sampling components and activities performed for a comprehensive sampling event. The second type of sampling that was incorporated in 2013 is species-specific triggered sampling, which was designed specifically to inform HCP adaptive management decisions.

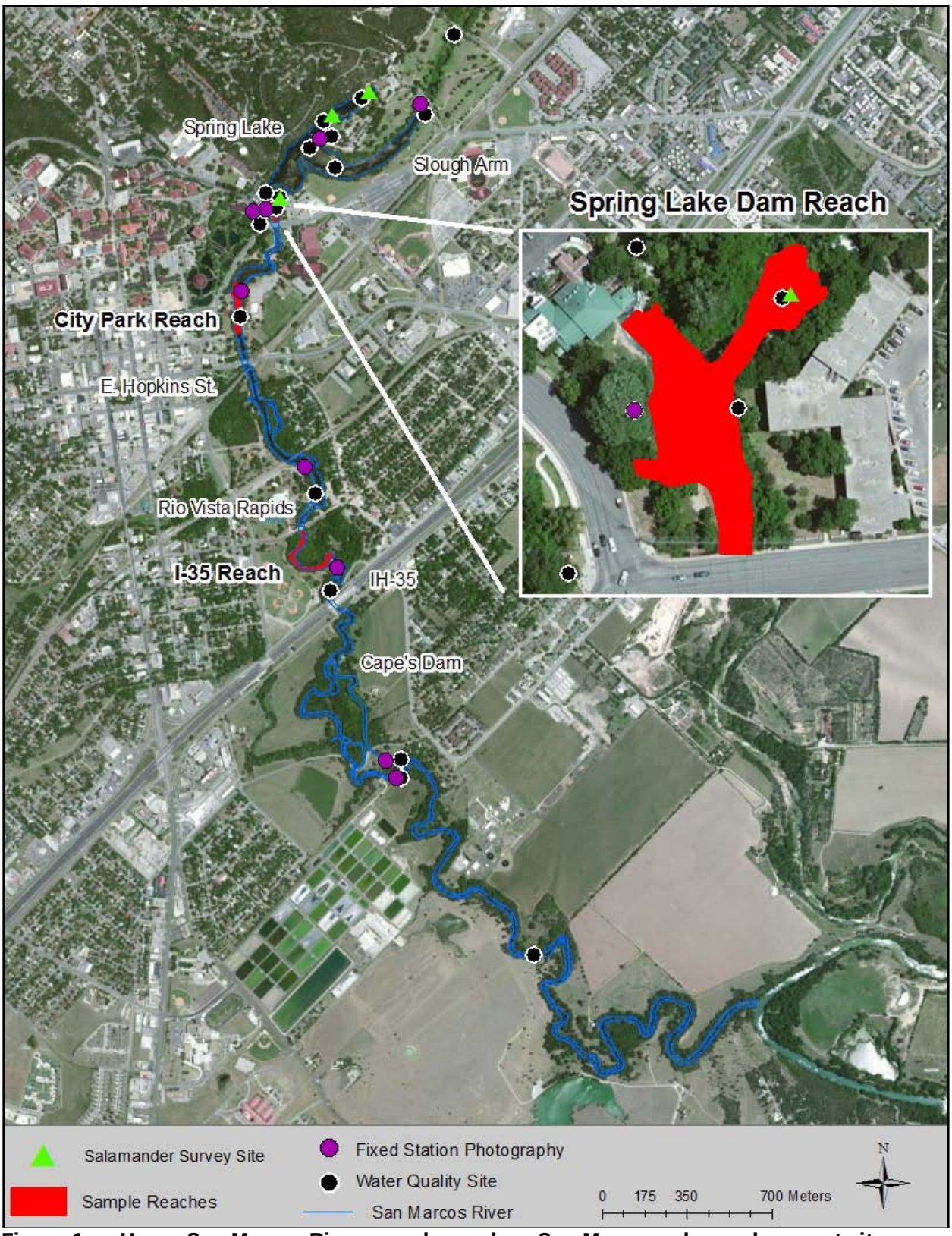

Figure 1. Upper San Marcos River sample reaches, San Marcos salamander count sites, water quality sampling sites, and fixed-station photography sites.

Critical Period Low-flow Sampling

The first trigger for full Critical Period low-flow sampling on the San Marcos system is 100 cubic feet per second (cfs) total system discharge (Appendix A). Total system discharge in the San Marcos River only declined to 116 cfs daily mean average in 2015, thus no Critical Period low-flow sampling was conducted.

A second component of Critical Period low-flow sampling is Texas wild-rice physical measurements in vulnerable areas. This sampling is initiated at 120 cfs and conducted for every subsequent 5 cfs decline to 100 cfs, at which time the HCP species-specific sampling is initiated. In 2015 discharge declined below 120 cfs in January for 4 days, but quickly recovered above this threshold. As a result, it was determined that no additional measurements were needed.

Species-specific Triggered Sampling

As per the HCP, species-specific, low-flow sampling is not triggered in the San Marcos system until 100 cfs (for Texas wild-rice) and 80 cfs (for fountain darter and San Marcos salamander) (Appendix A). As the daily average total system discharge in the San Marcos River remained above 100 cfs throughout the year, no HCP species-specific sampling efforts were conducted in 2015.

High-flow Sampling

There were two high-flow sampling events (June and November) conducted on the San Marcos system in 2015. Full-system high-flow sampling in the San Marcos system is triggered at 385 cfs (daily average total system discharge at the nearest U.S. Geological Survey [USGS] gage) and reliant upon evaluation and approval from Edward's Aquifer Authority personnel. The initial high-flow event occurred during Memorial Day weekend with significant flooding throughout central Texas. While some of the flow came in from the upstream extents of the San Marcos River watershed, significant flooding in the Blanco River caused water to back up into the San Marcos River. In late October another concentrated precipitation event in the San Marcos and Blanco River watersheds resulted in massive flooding throughout the San Marcos River. During this event much of the flow entered the river through Sink and Purgatory Creeks. Unfortunately during both high-flow events the USGS gages were damaged, and no USGS peak flow estimates are available at this time.

San Marcos Springflow

All San Marcos River discharge data were acquired from the USGS water resources division. Some of these data are provisional (as indicated in the disclaimer on the USGS website) and, as such, may be subject to revision at a later date. According to the disclaimer, "recent data provided by the USGS in Texas—including stream discharge, water levels, precipitation, and components from water-quality monitors—are preliminary and have not received final approval" (USGS 2015). The discharge data for the San Marcos River were taken from USGS gage 08170500 at the University Drive Bridge. This site represents the cumulative discharge of the springs that form the San Marcos River system, and also includes local runoff coming from the Sink Creek drainage.

San Marcos Water Quality

The objectives of the water quality analysis are as follows: (1) delineate and track water chemistry throughout the ecosystem; (2) monitor controlling water quality variables (e.g., flow, temperature) with respect to the biology of each ecosystem; (3) monitor alterations in water chemistry that may be attributed to anthropogenic activities; and (4) evaluate consistency with historical water quality information. Due to the consistency in water quality conditions measured over the first 2 years of quarterly sampling, the water quality component of the HCP Biological Monitoring Program was reduced in 2003. One important component for maintenance of long-term baseline data is temperature loggers (thermistors), which are placed throughout the river. In addition, fixed-station photography continues to provide visual proof of changes in the system. Standard physico-chemical parameters, including water temperature, conductivity, pH, dissolved oxygen (DO), water depth at sampling point, and observations of local conditions, were recorded at all drop-net sampling sites and fish community sampling locations using a multiprobe water quality sonde. It is important to note that comprehensive water, sediment and stormwater monitoring is being conducted as part of the HCP with study locations, methods, sampling schedule, and results being presented as stand-alone reports (SWCA 2015, Draft).

Water Temperature Thermistors

Thermistors set to record water temperature every 10 minutes were placed at select water quality stations along the San Marcos River, and they continue to be downloaded at regular intervals to provide continuous monitoring of water temperatures in these areas. To provide a more manageable dataset, 10-minute readings are converted into 4-hour averages for analysis. Thermistors were also placed in two deeper locations within Spring Lake using SCUBA. Thermistor locations will not be described in detail here to minimize the potential for tampering.

Water Quality Grab Samples

During Critical Period sampling events, surface-water grab samples are scheduled to be collected at nine locations in Spring Lake and nine locations along the San Marcos River to evaluate conventional water chemistry parameters (Figure 1). Two high-flow Critical Period sampling events were conducted on the San Marcos River in 2015. This report presents data from the June high-flow event. The data from the October event will be presented in the 2016 addendum. During these events two 500-milliliter (mL) surface-water samples were collected at each site. One of the two samples were left unpreserved for nitrate, soluble reactive phosphorus (SRP), alkalinity and total suspended solid (TSS) analyses, and the other sample was acidified with sulfuric acid for ammonia, total nitrogen, and total phosphorus analyses. Chemical analyses of surface water samples were conducted at an accredited laboratory, where water chemistry parameters were determined utilizing U.S. Environmental Protection Agency standard methods (Table 1).

In addition to the water quality data collection effort, a long-term record of habitat conditions has been maintained with fixed-station photography. Fixed-station photographs allow temporal habitat evaluations. The record includes upstream, cross-stream, and downstream photographs; these were taken in proximity to several water quality sites as noted in Figure 1.

Table 1. Water quality analysis scheduled for Critical Period sampling on surface-water grab samples from nine sites in Spring Lake and nine sites along the San Marcos River, along with the analytical method, technique, and minimum analytical detection levels for each analysis.

PARAMETER	U.S. ENVIRONMENTAL PROTECTION AGENCY METHOD	TECHNIQUE (2013)	MINIMUM ANALYTIC LEVELS (PER LITER)
Total suspended solids	160.2	Gravimetric	appropriate
Alkalinity	310.1	Titration	10 milligrams
Nitrate nitrogen	300.1	Ion chromatography	0.05 microgram
Ammonium	350.2	Spectroscopy	0.01 milligram
Total nitrogen	351.2	Spectroscopy	0.5 milligram
Soluble reactive phosphorous	300.1	Ion chromatography	0.05 milligram
Total phosphorous	365.2	Spectroscopy	0.01 milligram

Aquatic Vegetation Mapping

Aquatic vegetation mapping was conducted using a Trimble Pro-XT GPS and a Trimble Tempest external antenna capable of submeter accuracy. The antenna and GPS unit were attached, with antenna on the bow, to a 10-foot sit-in kayak with a plexiglass window in the bottom. The aquatic vegetation was identified and mapped by gathering coordinates (creating polygons) while maneuvering the kayak around the perimeter of each vegetation type at the water's surface. In 2013 a new protocol assessing all aquatic vegetation species was introduced following discussions with the HCP Science Committee; this protocol was continued in 2015. All vegetation species in mixed stands were assigned a percentage of cover, which was multiplied by the total area of the stand to calculate the surface area of that species. For maps (Appendix B) only the dominant vegetation type is presented for each polygon. Vegetation stands that measured between 0.5 and 1.0 meter (m) in diameter were mapped by recording a single point. Vegetation stands less than 0.5 m in diameter were not mapped.

Kayak-mounted GPS equipment used during aquatic vegetation mapping.

Texas Wild-rice Physical Observations

At the beginning of the initial sampling activities for this project in 2000, Texas wild-rice stands throughout the San Marcos River were assessed and documented as being in "vulnerable" areas if they possessed one or more of the following characteristics: (1) occurred in shallow water (<0.5 feet), (2) revealed extreme root exposure because of substrate scouring, or (3) generally appeared to be in poor condition. Monitoring activities associated with vulnerable stands were designed following discussions with Dr. Robert Doyle, currently with Baylor University, and Ms. Paula Power, formerly with the USFWS San Marcos Aquatic Resource Center. The areal coverage of Texas wild-rice stands in vulnerable locations was determined in 2015 by GPS mapping (described above) in most instances, with some smaller stands measured using maximum length and maximum width. The length measurement was taken at the water surface parallel to streamflow and included the distance between the bases of the roots to the tip of the longest leaf. The width was measured at the widest point perpendicular to the stream current (this usually did not include roots). The length and width measurements were used to calculate the area of each stand according to a method used by the Texas Parks and Wildlife Department (J. Poole, TPWD, pers. comm.) in which percent cover was estimated for the imaginary rectangle created from the maximum length and maximum width measurements.

Qualitative observations were also made on the condition of each vulnerable Texas wild-rice stand. These qualitative measurements included the following categories: the percent of the stand that was emergent (and the percent of that seeding), the percent covered with vegetation mats or algae buildup, any evidence of foliage predation, and a categorical estimation of root exposure.

Flow measurements were taken at the upstream edge of each Texas wild-rice stand and depth was measured at the shallowest point in the stand. Data on velocity, depth, and substrate composition were collected at 1-m intervals along cross sections in the river in each area where Texas wild-rice plants were monitored. To complement all of the measurements taken during each survey, photo sets were made for each of the sampling events in 2015.

Fountain Darter Sampling

Drop-net Sampling

A drop net is a sampling device originally designed by the USFWS to sample fountain darters and other benthic fish species specific to the Comal and San Marcos springs/river ecosystems. The net encloses a known area (2 square meters [m^2]) and allows thorough sampling by preventing escape of fish occupying that area. A large dip net (1 m^2) is used within the drop net and is swept along the length of the river substrate 15 times to ensure complete enumeration of all fish trapped within the net. For sampling during this study, a drop net was placed in randomly selected sites within specific aquatic vegetation types. The vegetation types sampled in each reach were those defined at the beginning of the study as dominant species found in that reach. Sampling sites were randomly selected per dominant vegetation type from a grid overlain on the most recent map (created using GPS-collected data during the previous week) of that reach. Prior to 2013, only the I-35 and City Park reaches in the San Marcos River were sampled using drop nets. However, in 2013, the Spring Lake Dam Reach was added to drop-net sampling efforts.

Top: Fixed-station photo facing upstream (*City Park*).*Center: Fixed-station photo facing across channel* (*City Park*). *Bottom: Fixed-station photo facing downstream* (*City Park*).

At each location, the vegetation type, height, and areal coverage were recorded, along with substrate type, mean column velocity, velocity at 15 centimeters (cm) above the bottom, water temperature, conductivity, pH, and DO. In addition, vegetation type, height, and areal coverage, along with substrate type, were noted for the adjacent area within 3 m of the net. Fountain darters were identified, enumerated, measured for total length, and returned to the river at the point of collection. The same measurements were taken for all other fish species, except for abundant species, in which case only the first 25 individuals were measured. Fish not readily identifiable in the field were preserved for identification in the laboratory. All live giant ramshorn snails (*Marisa cornuarietis*) were counted, measured, and destroyed, while a categorical abundance was recorded (i.e., none, slight, moderate, or heavy) for the exotic Asian snails (*Melanoides tuberculatus* and *Tarebia granifera*) and the Asian clam (*Corbicula* sp.). A total count of crayfish (*Procambarus* sp.) and grass shrimp (*Palaemonetes* sp.) was also recorded for each dip-net sweep.

Drop net sampling.

Dip-net Sampling

In addition to drop-net sampling for fountain darters, a dip net of approximately 40 cm x 40 cm (1.6-millimeter [mm] mesh) was used to conduct three separate types of fountain darter sampling (timed surveys, presence/absence surveys, and fixed-station surveys).

Dip-net Timed Surveys

For timed dip-net surveys, and attempt was made to sample various habitat types within each river section (Figures 2 and 3). Collection was generally performed by personnel moving upstream through a section. Habitats thought to contain fountain darters, such as along or in clumps of certain types of aquatic vegetation, were targeted and received the most effort. Areas deeper than 1.4 m were not sampled. Fountain darters collected by this method were identified, measured, recorded as number per dip-net sweep, and returned to the river at the point of collection. The numbers of native and exotic snails were also quantified and recorded for each dip.

To balance the effort expended across sampling events, a predetermined time constraint was used for each section (Hotel: 0.5 hour, City Park: 1.0 hour, I-35: 1.0 hour, Todd Island: 1.0 hour). The

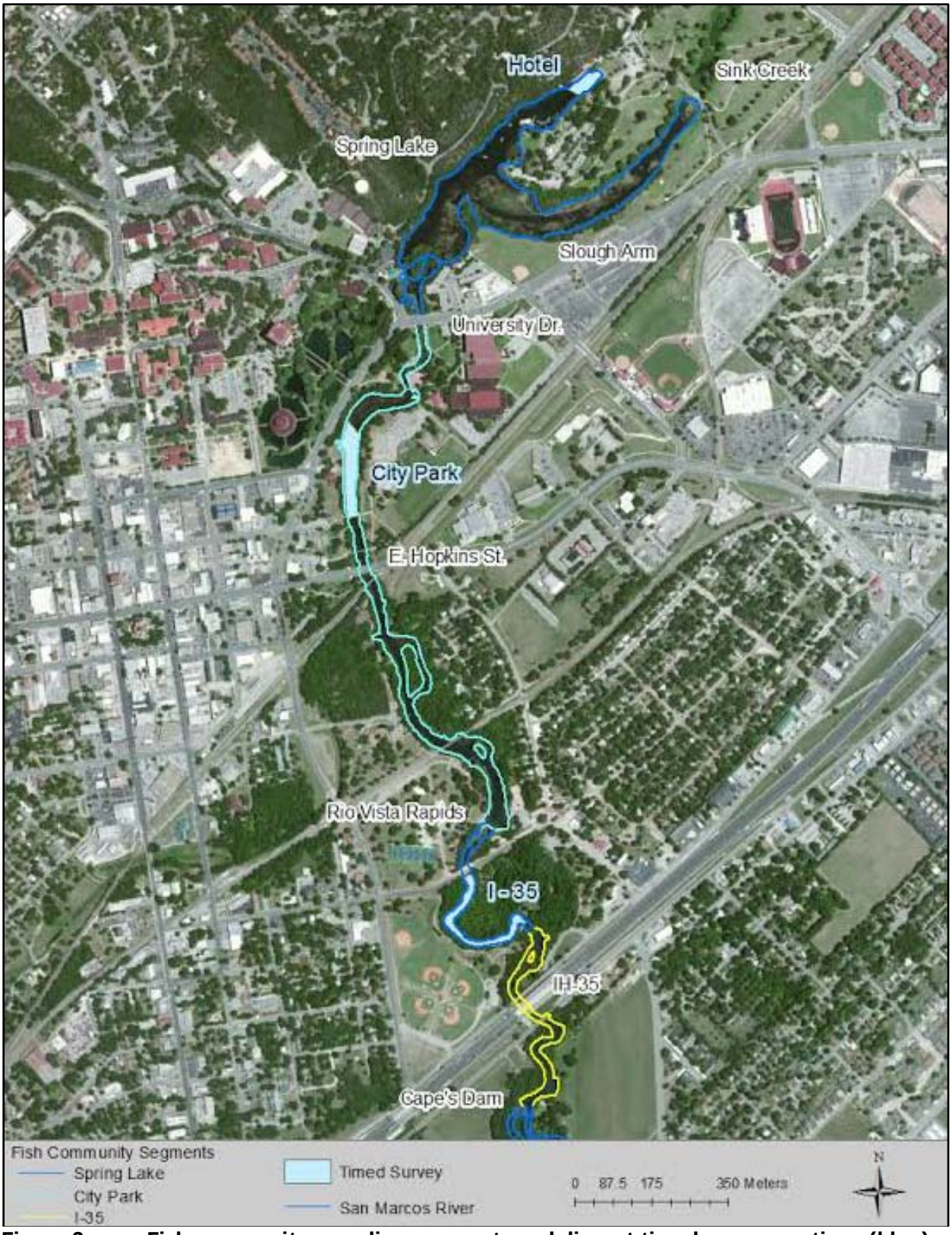

Figure 2. Fish community sampling segments and dip-net timed survey sections (blue) for the upper San Marcos River.

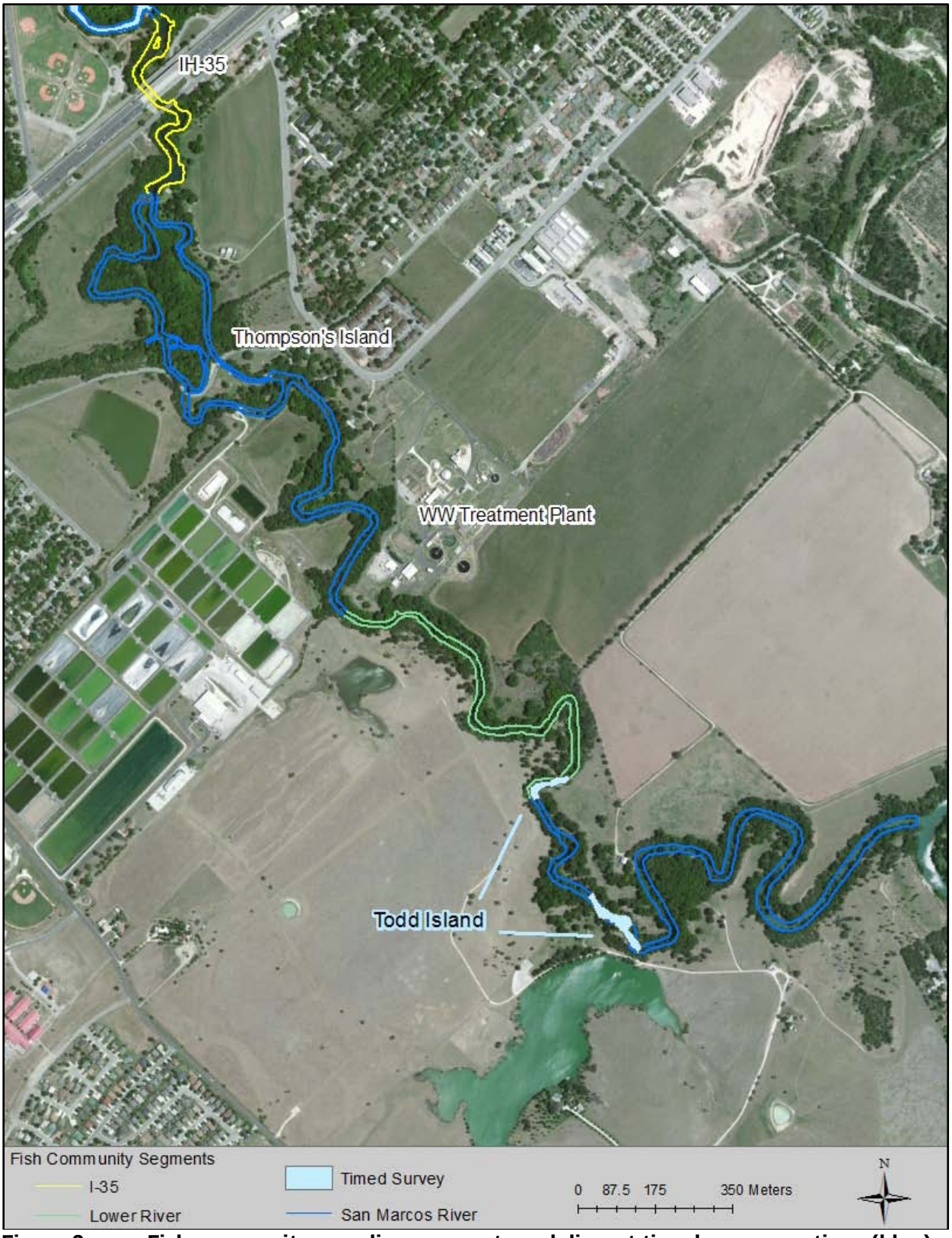

Figure 3. Fish community sampling segments and dip-net timed survey sections (blue) for the San Marcos River.

areas of fountain darter collection were marked on a base map of the section, and these same areas were revisited in subsequent surveys. Though information relating the number of fountain darters by vegetation type was not gathered using this method (as in the drop-net sampling), it did permit a more thorough exploration of various habitats within the reach. Also, spending a comparable length of time sampling the entirety of each reach allowed comparisons to be made between the data gathered during each sampling event. Dip-net data were used to identify periods of fountain darter reproductive activity because this method was efficient for collecting small fountain darters (<15 mm).

Presence/Absence Dip-net Surveys

Presence/absence dip netting was initiated on the San Marcos River during spring 2006. This method is designed to be a quick, efficient, and repetitive means of monitoring the fountain darter population. Also, because it is less destructive than drop netting, it can be conducted during extremely low-flow periods with fewer disturbances to critical habitat.

During each sample, 50 sites were distributed among three sample reaches (Figure 1) based on total area, diversity of vegetation, previous fountain darter abundance estimates, and overall biological importance of each sample reach. Fifteen sites were chosen in the Spring Lake Dam Reach, 20 sites were chosen in the City Park Reach, and 15 sites were chosen in the I-35 Reach. Several sites were chosen in each of the dominant vegetation types in each reach. However, because vegetation coverage changed often, the number of sites within each vegetation type fluctuated slightly between samples. Four dips were conducted at each site for a total 200 dips per sample period. After each dip, presence or absence of fountain darters was recorded. To avoid recapture, fountain darters were placed into a plastic tub filled with river water or moved a sufficient distance away from the dip netter. After all dips were completed at a site, all organisms were released near the site of capture.

Fixed-station Dip Netting

Based on discussions with Dr. Floyd Weckerly (Texas State University and HCP Science Committee member) at the end of 2013, it was determined that a new fountain darter sampling method using fixed-station sites would allow additional and more sophisticated analysis in conjunction with the 8 years of stratified random site data. Many sampling and analysis methods are known to underestimate occupancy, especially in cases where detection of the target species is not perfect (which is common). One solution to this is to use modeling methods specifically designed to account for imperfect detection probability (MacKenzie et al. 2002; MacKenzie et al., 2003), and these methods generally require a fixed-station approach. Therefore, 50 fixed sampling locations for the collection of presence/absence data to be used in occupancy analysis were established in the San Marcos River in 2014 and sampled again in 2015. The overall number of fixed stations remained the same (50) as in the random site sampling scheme, as did their distribution among sample reaches. However, locations were fixed over time. The rationale for continuing both methods is that there is an established baseline for the random approach in place and, if drought conditions continue, there will be a need to confidently evaluate trigger mechanisms designated in the HCP. Additionally, because of the importance associated with this sampling component by the HCP adaptive management decision-making process, 2 years of overlapping data will be collected to observe and test differences between techniques and establish a baseline with the fixed-station approach.

Sampling methods were identical to those described for the presence/absence survey above, although additional data regarding habitat conditions were noted. At each fixed station, four dips were conducted with a 40-cm x 40-cm dip net with 1.6-mm mesh. Presence or absence of fountain darters was noted on each dip. To avoid recapture, fountain darters were placed in a tub or moved a sufficient distance away from the dip netter until sampling was complete. At each location the dominant surficial substrate (clay, silt, sand, gravel, cobble, boulder, bedrock) was categorized based on the modified Wentworth scale (Cummins 1962), and the dominant type of aquatic vegetation was noted (e.g., *Sagittaria*, bryophytes, open). Also, since bryophytes are a key fountain darter habitat component and can grow within or attached to other vegetation types, presence/absence of bryophytes at each site was also noted. After all four dips were completed and all necessary data were recorded, all organisms were released near the site of capture.

Fish Community Sampling

A multifaceted sampling methodology was again employed in 2015 to efficiently monitor fish community composition and abundance by using seines in shallower areas as well as conducting visual underwater surveys in deeper habitats. This methodology was originally developed by Dr. Timothy H. Bonner and his students at Texas State University during previous fish community work on the San Marcos River (Behen 2013).

Seining in the San Marcos River.

For fish community monitoring, the San Marcos system was split into the following four segments: Spring Lake, City Park, I-35, and Lower River (Figures 2 and 3). Within the deeper parts of each segment, at least three visual transect surveys were conducted by SCUBA and/or Hookah divers during each sampling event. At each transect, two divers swam across the river perpendicular to the flow at approximately midcolumn depth. Divers identified and enumerated all fish observed and relayed the information to a third biologist at the surface, who recorded the data. After the divers completed this initial transect, four 5-meter-long PVC pipe segments (micro-transect pipes) were equally spaced along the stream bottom along the original transect and oriented parallel to the river's current. The two divers then swam to the bottom and surveyed each of the micro-transect pipes. Divers started at the downstream end and swam up the pipe with one diver on each side searching through the vegetation (if present) and substrate within approximately 1 meter of the pipe to dislodge small benthic-oriented fishes such as darters. Again, all fish observed were identified, counted, and relayed to the data recorder on the surface. Notes on the percent coverage of various substrate and vegetation types were also recorded. After fish surveys were complete, depth and velocity data were collected near the middle of each micro-transect pipe using a Marsh McBirney Model 2000 portable flowmeter and adjustable wading rod. At each micro-transect pipe, velocity measurements were taken 15 cm from the

bottom, midcolumn, and near the surface. Standard water quality parameters were also recorded once at each transect using a HydroTech water quality sonde.

In addition to visual surveys, seining was used to sample the fish community in shallow areas. At least three seining transects were conducted within each segment (except Spring Lake, which was too deep for seining) during each sampling event. At each transect, multiple seine hauls were pulled until the entire wadeable area at that transect had been covered. For example, seines were pulled along the bank on one side of the river and then the biologists moved closer to midchannel, taking caution not to sample the same area. They continued to move toward the opposite bank with subsequent seine hauls until the other bank was reached or water became too deep to seine effectively. Randomly selecting seining transects within the wadeable portion of each reach and using the protocol above ensured that habitats were sampled in similar proportions to their availability. After each seine haul, fish were identified, measured to the nearest millimeter total length, enumerated, and placed in a bucket containing river water to prevent recapture in subsequent seine hauls. At each seine haul location, notes on percent coverage of substrate, vegetation, and other cover types were recorded, and water depth and velocity were measured with a portable flowmeter and adjustable wading rod. Velocity measurements were taken at 15 cm, midcolumn, and near the surface. After completion of seine hauls at each transect, fish were released from holding buckets.

Data from underwater observations were combined with seine hauls to examine overall fish community composition during each event. Densities were calculated by dividing number of fishes or species caught by area sampled (m^2). Individual densities were averaged across each site per season to determine average densities of each species. Data were also collected to allow calculation of catch-per-unit-effort (CPUE) by gear type and taxa. Initial analysis focused on elucidating spatial and temporal trends in fish community structure.

San Marcos Salamander Visual Observations

San Marcos salamander sampling in Spring Lake.

In 2015 visual salamander surveys were conducted at three sites within Spring Lake and the San Marcos River for each sampling effort. Visual observations were made in areas previously described as habitat for San Marcos salamanders (Nelson 1993) (Figure 1). Two of the sites—the Hotel and Riverbed sites—were located within Spring Lake: the Hotel Site was adjacent to the old hotel and was identified as Site 2 in Nelson (1993), and the Riverbed Site was located across from the former Aquarena Springs boat dock and was identified as Site 14 in Nelson (1993). The third survey area, called the Spring Lake Dam Site, was not located in Spring Lake but was instead in the main river channel immediately downstream of Spring

Lake Dam in the eastern spillway. This was identified as Site 21 in Nelson (1993). The Spring Lake Dam Site was subdivided into three smaller areas to allow greater coverage of suitable salamander habitat; calculated salamander densities from these three subdivisions were averaged together as one.

SCUBA gear was used to sample habitats in Spring Lake, while a mask and snorkel were used in the site below Spring Lake Dam. For each sample, an area of macrophyte-free rock was outlined using flagging tape, and three timed surveys (5 minutes each) were conducted by overturning rocks >5 cm wide and noting the number of San Marcos salamanders observed underneath. Following each timed search, the total number of rocks surveyed was noted to estimate the number of San Marcos salamanders per rock in the area searched. The three surveys were averaged to yield the number of San Marcos salamanders per rock. The density of suitably sized rocks at each sampling site was determined by using a square frame constructed out of steel rod to take random samples within the area. Three random samples were taken in each area by blindly throwing the 0.25-m^2 frame into the sampling area and counting the number of appropriately sized rocks. The three samples were then averaged to yield a density estimate of the rocks in the sampling area. The area of each site was determined by physically measuring each sampling area with a tape measure.

An important note about these San Marcos salamander density estimates is that extrapolating beyond the area sampled into surrounding habitats would not necessarily yield accurate values, particularly in the Hotel Site. This is because the area sampled was selected based on the presence of silt-free rocks and relatively low algal coverage (compared to adjacent areas) during each survey. Much of the habitat surrounding the sampling areas is usually densely covered with aquatic macrophytes and algae, and provides a three-dimensional habitat structure that supports different densities of San Marcos salamanders. The estimates created from this work are valuable for comparing between trips, but any estimates of a total population size derived from this work should be viewed with caution.

Macroinvertebrate Community Sampling

In 2015, BIO-WEST conducted macroinvertebrate community sampling to determine species composition, relative number, and vegetation associations of macroinvertebrates in the City Park, I-35, and Spring Lake Dam reaches within the San Marcos system (Figure 1). As part of twice-annual comprehensive sampling efforts, macroinvertebrate community samples were collected from dominant vegetation types at each of the three reaches in the San Marcos system during spring (April

Macroinvertebrate sampling using the Custom-built Triple-H sampler.

16, 2015) and fall (October 6, 2015) (Table 2).

Table 2. Sampling efforts and dominant vegetation types by reach during spring and fall 2015 macroinvertebrate sampling efforts in the San Marcos system.

VEGETATION	CITY PARK REACH	I-35 REACH	SPRING LAKE DAM REACH
Cabomba	not sampled [a]	spring and fall	not sampled [a]
Hydrilla	spring and fall	spring and fall	spring and fall
Hygrophila	spring and fall	spring and fall	spring and fall
Potamogeton	spring and fall	not sampled [a]	spring and fall
Sagittaria	spring and fall	not sampled [a]	spring and fall
Ludwigia	not sampled [a]	spring and fall	not sampled [a]
Vallisneria	not sampled [a]	not sampled [a]	spring

[a] not sampled = Vegetation type not dominant at reach; reach not sampled for this vegetation type.

For each dominant vegetation type at each site, crews made three grab samples in areas with 100% cover of that vegetation type. Vegetation types sampled at each reach depended on the types of vegetation present at each site at the time of the sampling event. Samples were collected using a custom-built Triple-H sampler (pictured above), which allows collection of consistent volumes of sediment and vegetation at different sites and is similar to an Ekman sampler in function. Each grab sample contained both above- and below-ground vegetation, roots, and sediment. Crews recorded the GPS location of each grab sample taken. Upon collection, the three grab samples taken per vegetation type were composited in a 541 micrometer (µm) sieve bucket, washed, and picked through to remove large objects and debris (e.g., sticks, rocks, and vegetation). Washed samples were placed into plastic containers, preserved in 95% ethanol, and transported to the laboratory, where the collected macroinvertebrates were picked out and placed into sample vials containing 95% ethanol. These samples were sent to a taxonomist who identified organisms to the lowest level practical, results of which are presented in Appendix C. Please note that in 2015 analyses of macroinvertebrate abundance and taxonomic richness were restricted to those taxa that were identified to at least family or, in the case of chironomids, subclass. For this reason, Cladocera, Euhirundea, Gastropoda, Oligochaeta, and Ostracoda were excluded from the analyses presented in this report unless otherwise stated in the text. However, unaltered count data for all taxa collected in 2015 are presented in Appendix C.

OBSERVATIONS

In 2015 the project team conducted sampling on the dates shown in Table 3.

Table 3. Study components and dates of sampling events in 2015.

SEASON	EVENT	DATES
Spring	Vegetation mapping	April 13–16
	Texas wild-rice physical observations	April 22
	Fountain darter sampling	April 20–22
	Fish community sampling	April 20-30
	San Marcos salamander observations	April 22
	Macroinvertebrate sampling	April 16
Critical Period 1 High-Flow 1	Vegetation mapping	June 4–9
	Texas wild-rice physical observations	June 18
	Full-system Texas wild-rice mapping	June 5–29
	Fountain darter sampling	June 4–11
	Fish community sampling	June 7-12
	San Marcos salamander observations	June 5
	Water quality grab samples	June 8
Summer	Fountain darter dip netting	August 14, 19
	Full-system Texas wild-rice mapping	Aug. 11–Sep. 1
Fall	Vegetation mapping	October 12–14
	Texas wild-rice physical observations	October 29
	Fountain darter sampling	October 15–19
	Fish community sampling	n/a
	San Marcos salamander observations	October 28
	Macroinvertebrate sampling	October 6
Critical Period 2 High Flow 2	Vegetation mapping	November 11–19
	Texas wild-rice physical observations	December
	Full-system Texas wild-rice mapping	November–December
	Fountain darter sampling	Nov. 11–Dec. 3
	Fish community sampling	November 16-December 10
	San Marcos salamander observations	December 15
	Water quality grab samples	November 17

San Marcos Springflow

Total system discharge in the San Marcos River during 2015 was dominated by two major precipitation events in late May and late October. Unfortunately, peak discharge during each of those events is unknown at this time due to USGS gage malfunction. Average monthly discharge in the San Marcos River was above the historical average for much of 2015 (Figure 4). A minimum average daily flow of 116 cfs occurred from January 4 to 8, with no average daily flows dropping below 115 cfs in 2015 (Table 4). The 2015 minimum was the highest minimum since 2010.

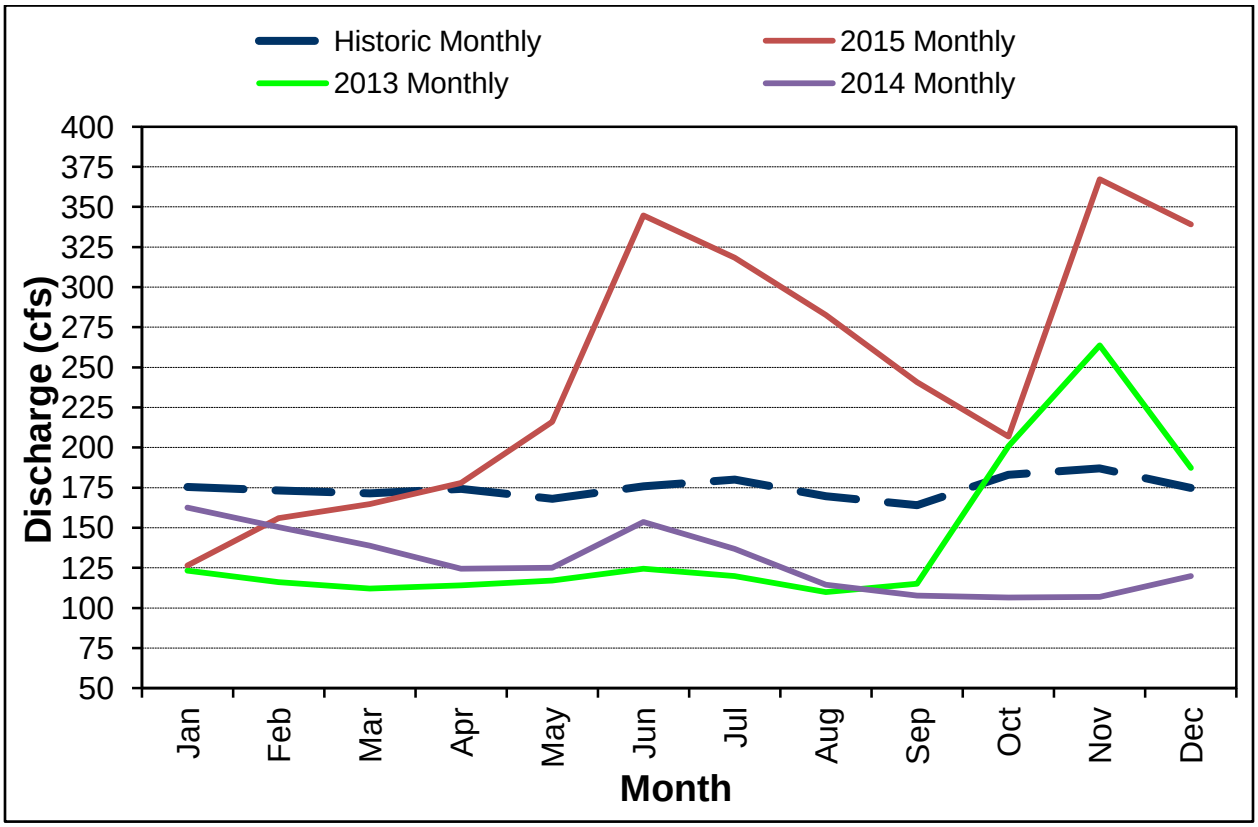

Figure 4. **Mean monthly discharge (cubic feet per second) in the San Marcos River during recent years and the 1956–2015 period of record.**

Table 4. Minimum and maximum daily average discharge (cubic feet per second) in the San Marcos River since the beginning of the study in 2000.

YEAR	MINIMUM DISCHARGE	MAXIMUM DISCHARGE
2000	108	397
2001	167	1,019
2002	157	668
2003	156	332
2004	146	1,280
2005	136	361
2006	90	145
2007	101	971
2008	97	217
2009	83	206
2010	163	273
2011	88	173
2012	100	241
2013	99	2,600
2014	104	176
2015	116	550[a]

[a] Flows for the May/June and October events have not been estimated by USGS.

The shifting weather pattern in central Texas resulted in record rainfall in several places and led to two major high-flow events in the San Marcos River. The late-May flood occurred when heavy rainfall fell in the Blanco River basin in Hays and Blanco Counties. This precipitation event resulted in flooding in the Blanco River. A large volume of water moved downstream in the Blanco River, which backed up into the San Marcos River. The upper portions of the San Marcos River (Spring Lake to Rio Vista Park) were relatively unaffected because the tributaries in this section provided little floodwater runoff into the river channel. The portion of San Marcos River below the I-35 Reach received a large volume of runoff as the Blanco River overflowed its banks. This large volume of water heavily impacted the San Marcos River below I-35. After this heavy rain event, discharge from the Edwards Aquifer increased significantly boosting spring flow into the San Marcos above historical levels. The second flood event occurred on October 30 and impacted all of the San Marcos River. Heavy precipitation, estimated at 16 to 20 inches, fell just north and west of San Marcos directly in the San Marcos River watershed. All major tributaries of the San Marcos River, including Sink Creek, Sessoms Creek, and Purgatory Creek, received heavy floodwaters, which were then concentrated into the upper San Marcos River. During this event the level of Spring Lake rose up to 5 feet, and the San Marcos River crested above 6 feet. Flood waters flowed over the Aquarena Springs Drive Bridge and flooded most of the parkland and neighborhoods along the river. After this flood event, river discharge returned to historical average flows and remained at average flows for the rest of the year.

Figure 5 reflects how much wetter 2015 was compared to previous years in the San Marcos River. This year looks most similar to 2004 on the hydrograph, a year when several precipitation events contributed to higher daily flows.

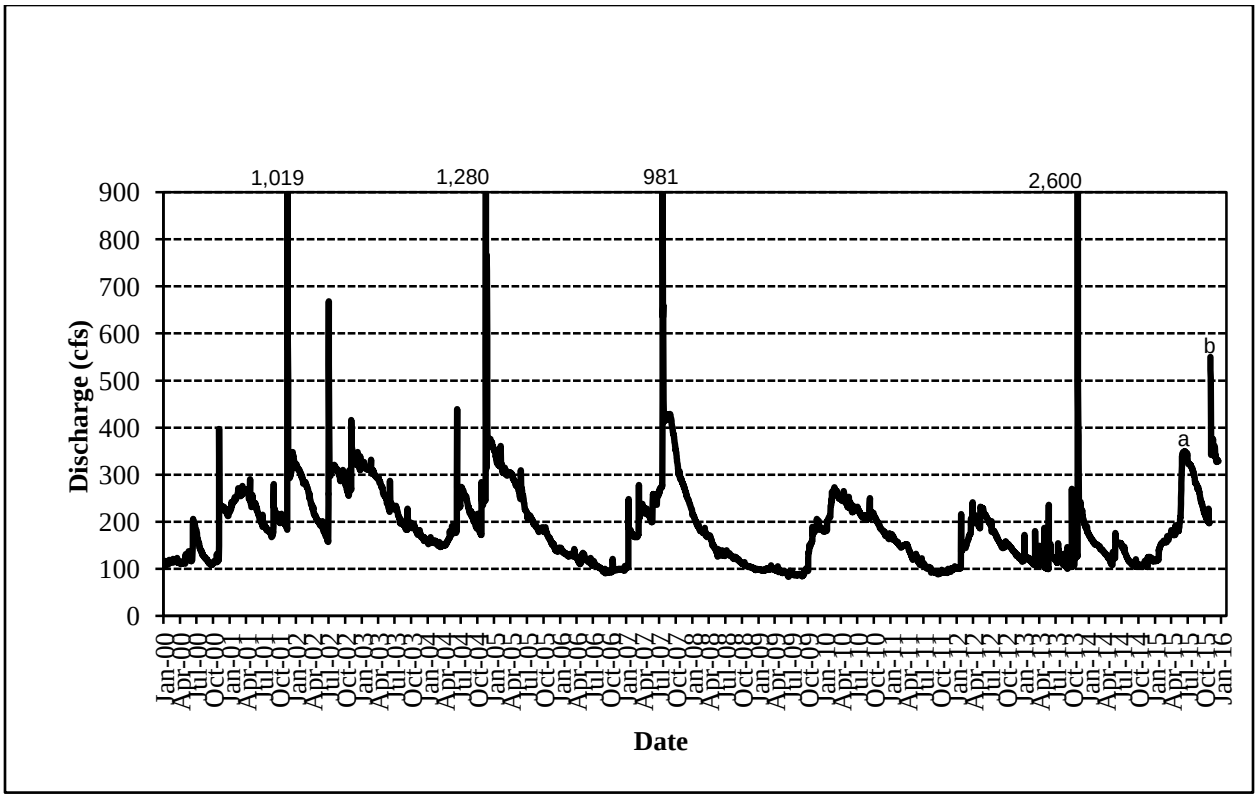

Figure 5. Daily average discharge (cubic feet per second) for the San Marcos River since the beginning of monitoring in 2000. [a] Memorial Day weekend flood 2015, USGS estimate not accurate. [b] Late-October flood 2015, USGS estimate not available.

Water Quality Results

Water Temperature Thermistors

The continuously sampled water temperature data provide information regarding fluctuations due to atmospheric conditions and springflow influences in the San Marcos River from 2000 to 2015. Water temperature data for the City Park and I-35 reaches are presented in Figure 6, and additional graphs for all reaches can be found in Appendix C. Thermistors collect data every 10 minutes; however, to condense this into a more manageable dataset, graphs and analysis in this report are based on 4-hour averages of these data. Occasional data gaps are a result of lost, stolen, or malfunctioning thermistors. As expected, thermistors closest to spring inputs (farthest upstream) display relatively constant water temperatures. Further downstream, ambient conditions exert a greater influence on water temperature due to increased exposure time and runoff from rain events. Figure 6 displays this relationship; higher temperature fluctuations occur at the downstream thermistor (I-35) compared to the thermistor that is closer to spring inputs (City Park). It is interesting to note that although the I-35 thermistor is well downstream of spring inputs, water temperatures there still exhibited minimal variation compared to other rivers in the region. No thermistors collected readings that exceeded the Texas Commission on Environmental Quality's (TCEQ) water quality standard of 26.67 ºC for the San Marcos river in 2015 (Appendix C).

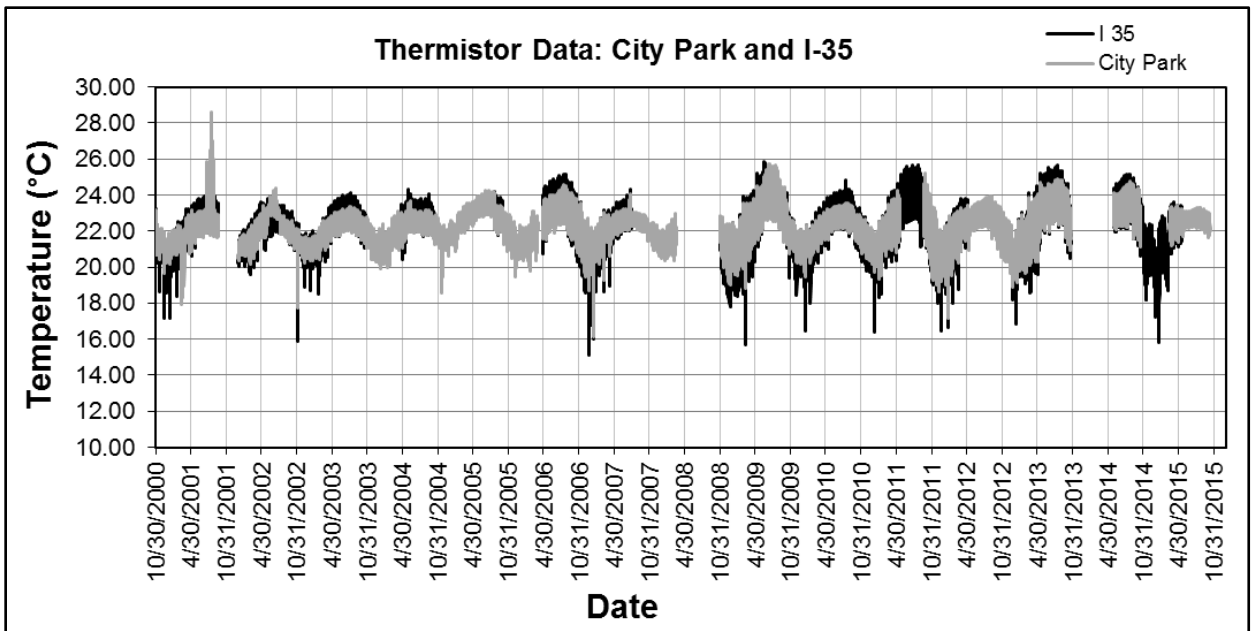

Figure 6. Thermistor data from the City Park and I-35 reaches.

Edwards Aquifer Authority Manta 2 Sonde Data

In 2012 the Edwards Aquifer Authority (EAA) installed Eureka Manta 2 multiprobes at two locations in the San Marcos River (Rio Vista Park and University Drive). The multiprobes monitor standard parameters (temperature, pH, conductivity, DO, and turbidity) every 15 minutes, and the data from 2015 are summarized below. These data were taken directly from the EAA Environet web-based water quality data service (Edwards Aquifer Authority 2013).

Much like the temperature thermistor data collected in City Park as part of the HCP biological monitoring program, the sonde data showed very little variation throughout the year. Data for University Drive and Rio Vista Park are shown in Figure 7. The precipitous drop in water temperature in early November reflects the flooding event at the end of October. In 2015 neither site had temperatures that exceeded the 26.7 ºC TCEQ water quality standard. These stable temperatures are a mirror of water temperatures collected in the course of HCP biological monitoring at City Park (Figure 6) and Rio Vista Dam (Appendix C).

Dissolved oxygen (DO) at Rio Vista Park varied from 6.72 mg/L to 10.33 mg/L in 2015, while DO at University Drive varied from 5.22 mg/l to 10.26 mg/l (Figure 8). The difference between these two sites is likely a result of their relative distance from spring inputs and specific habitat conditions at each site. Since University Drive is just downstream of Spring Lake, there is more mixing of water from the pour-off of the dam, and therefore DO varied little. There is less mixing at Rio Vista Park where the river is deeper and less turbulent and DO concentrations are more driven by photosynthetic activities, which contribute to more variable DO conditions. Dissolved oxygen readings decreased in variability at both sites during the fall flooding event.

Conductivity showed very little long-term variation throughout the year (Figure 9). The observed erratic, short-term fluctuations in conductivity during the year are likely due to rainfall events, which result in a dilution effect, or data-quality events, such as probe cleaning/maintenance.

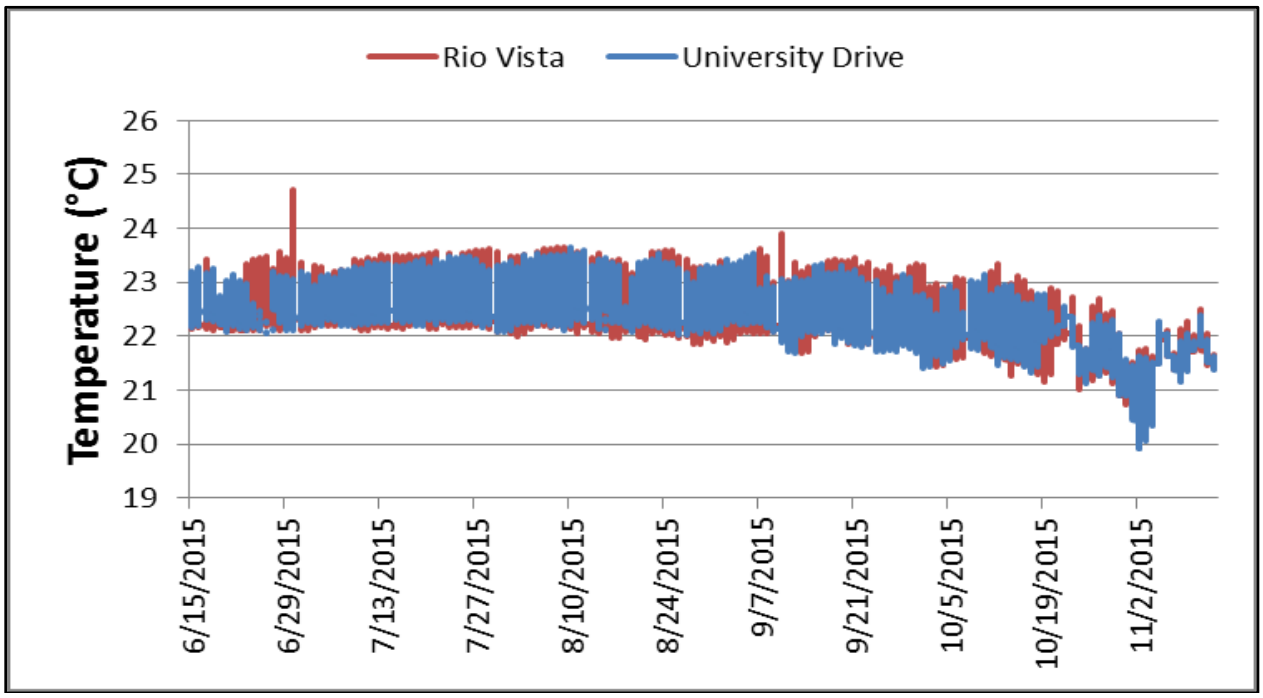

Figure 7. **Edwards Aquifer Authority Manta 2 multiprobe temperature data from Rio Vista Park and University Drive.**

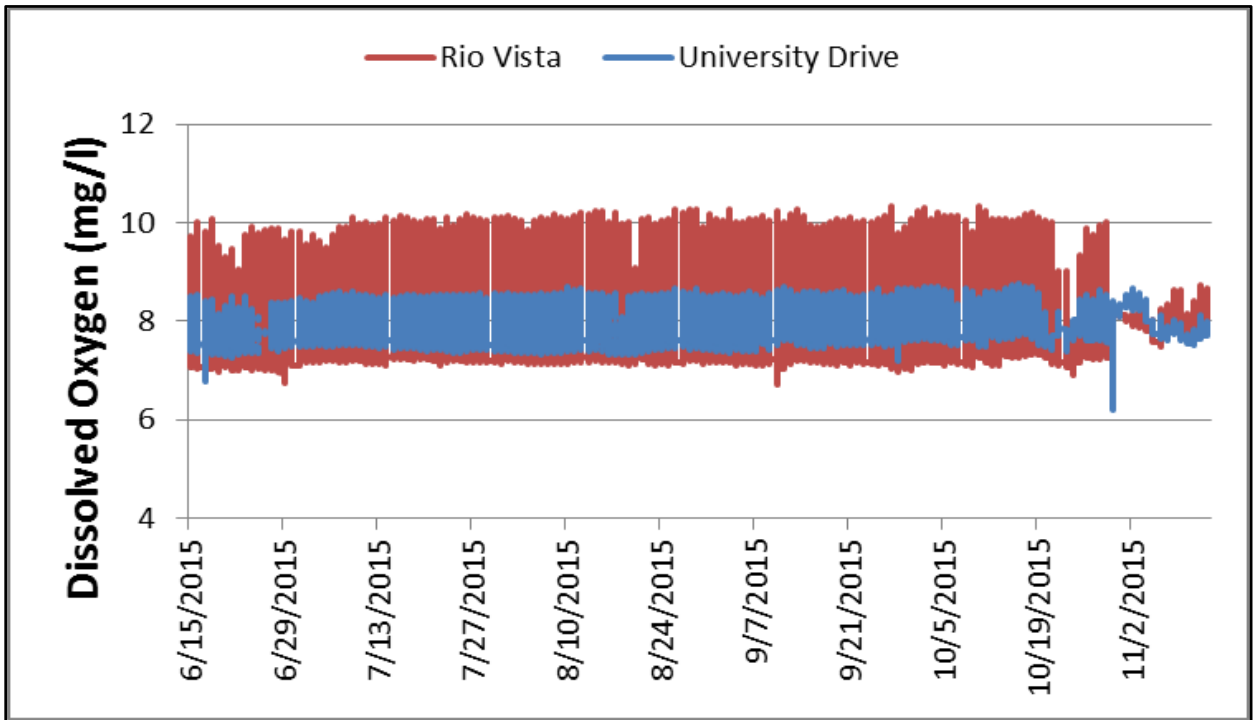

Figure 8. **Edwards Aquifer Authority Manta 2 multiprobe dissolved oxygen (DO) data from Rio Vista Park and University Drive.**

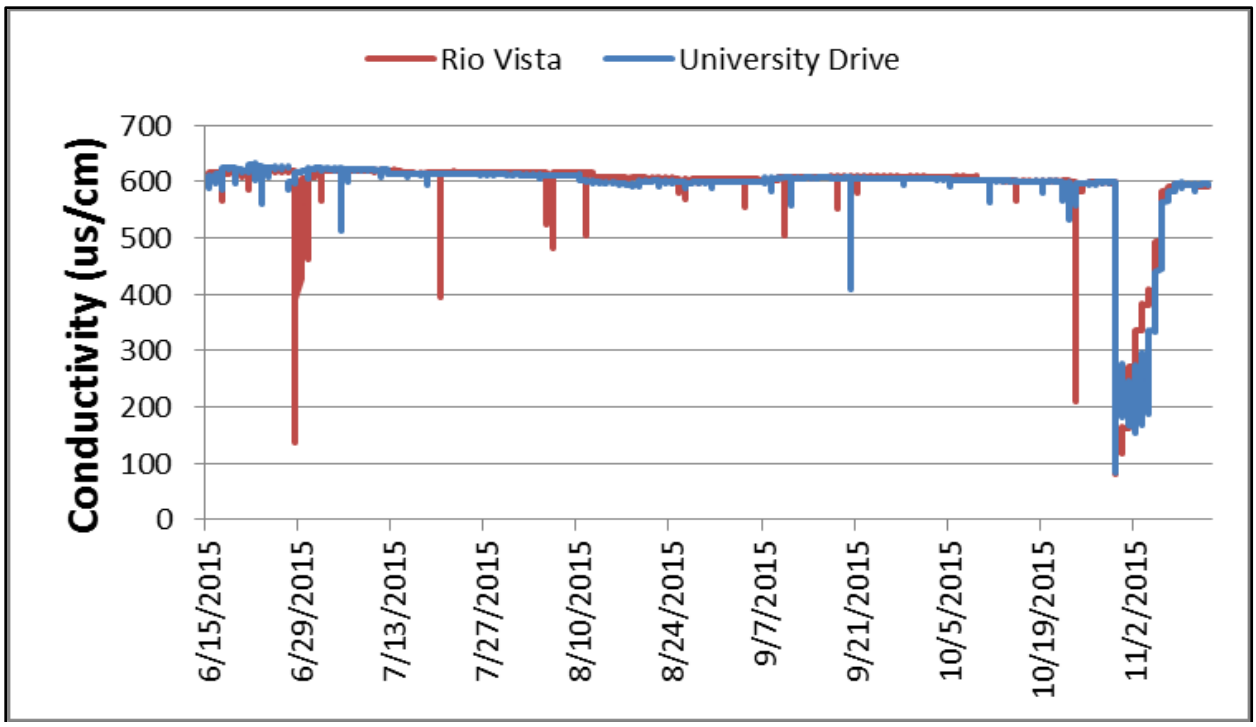

Figure 9. Edwards Aquifer Authority Manta 2 multiprobe conductivity data from Rio Vista Park and University Drive.

Conductivity decreased dramatically at the end of October due to large amounts of water entering the system, which diluted the conductivity in the large volume of water coursing through the San Marcos River. pH remained between 7 and 8 for both sites during 2015, but exhibited a large spike during the fall flooding event (Figure 10).

Water Quality Grab Samples

A summary of water quality data for the June 2015 water quality sampling effort is presented in Tables 5 and 6. Water quality sites in the San Marcos River can be seen in Figure 1. Data from the November high-flow effort will be presented in the 2016 addendum. Values remained fairly constant throughout the system and fluctuated minimally from site to site. Temperatures varied minimally between all sites during the water quality sampling event (Table 5). Dissolved oxygen concentrations varied from 3.10 mg/l to 9.71 mg/l. All 6 sites in Spring Lake and the Sink Creek site were below the TCEQ "High" water quality standard of 5.0 milligrams per liter (mg/L) during this event but above the minimum of 3.0 mg/l.

The TSS values were very low at most of the sites (below 3 mg/L), reflecting the clear waters of this spring system following the river stabilizing, but measurements at the lowest three sites were higher due to the higher runoff flows associated with the June flooding event. Alkalinity was consistent between sites (Table 6), with values similar to those measured in 2009 (BIO-WEST 2009). All of the SRP concentrations and most of the Total P concentrations were below laboratory detection limits (<0.05 mg/L and <0.02 mg/L, respectively), which are also well below the TCEQ's screening values of 0.1 mg/L and 0.2 mg/L, respectively (Table 6).

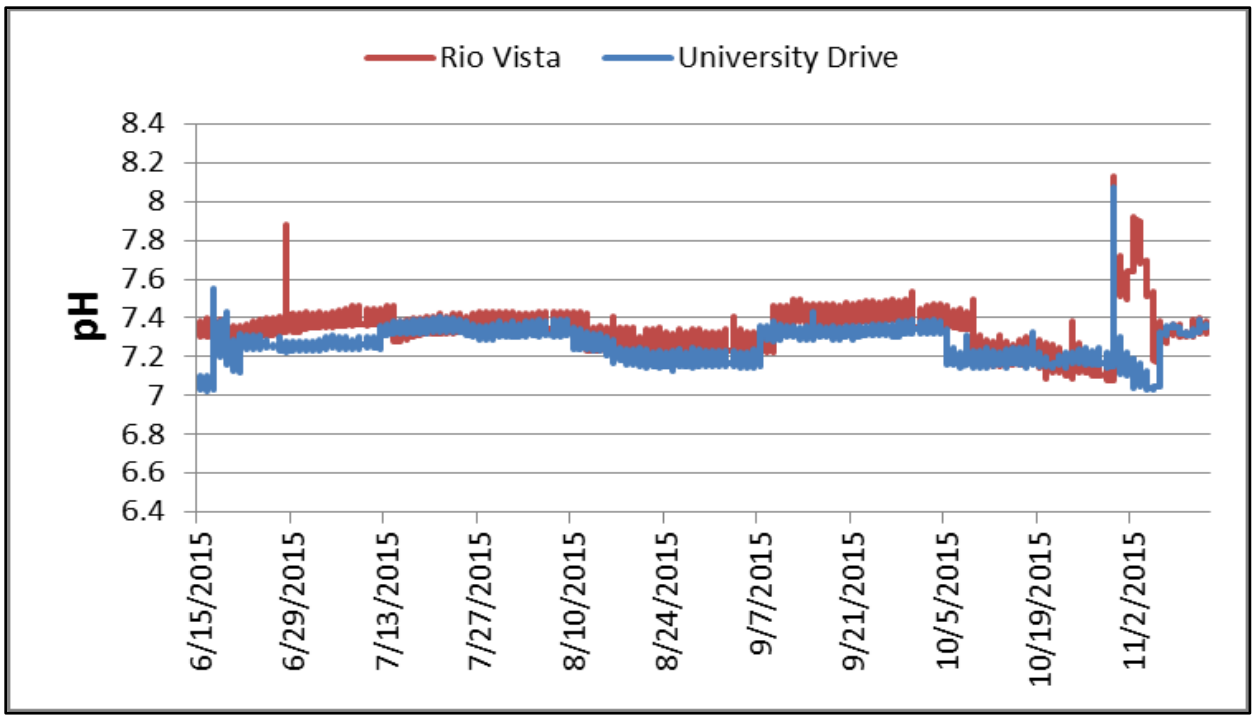

Figure 10. **Edwards Aquifer Authority Manta 2 multiprobe pH data from Rio Vista Park and University Drive.**

Table 5. **Summary of San Marcos system physical water quality measurements from the June high-flow sampling effort.**

SITE	LOCATION	TIME	DEPTH (FEET)	TEMP (°C)	DO (MG/L)	PH	COND (µS/CM)
SMA	Hotel	9:50	9.0	21.55	4.60	7.40	700
SMB	Submarine	10:10	4.5	21.82	3.52	7.07	627
SMC	Downstream of Boat Dock	10:25	1.0	22.38	3.67	7.05	629
SMD	Above Chute	11:25	2.0	23.03	6.86	7.08	621
SME	Upstream of Dam	11:00	0.5	22.62	6.02	7.13	631
SMF	Landing Dock	10:15	1.8	22.00	3.10	7.01	659
SMG	Boardwalk	10:30	2.0	24.01	3.82	6.95	685
SMH	Downstream of Road	9:40	2.5	21.55	3.62	7.30	694
SMS	Sink Creek	9:30	1.7	21.55	4.60	7.40	700
SM1	Below Chute	11:20	1.0	23.18	8.02	7.37	636
SM2	Below Dam	11:05	1.5	22.62	7.98	7.30	629
SM3	Sessom's Creek	11:15	1.0	22.94	6.38	7.28	643
SM4	City Park	11:45	5.0	22.62	8.55	7.27	620
SM5	Rio Vista Park	12:00	4.5	22.90	9.71	7.34	620
SM6	I-35 Crossing	12:25	1.5	22.96	9.06	7.43	620
SM7	Thompson Island Artificial	12:40	4.0	22.96	8.50	7.44	619
SM8	Thompson Island Natural	12:45	2.5	23.02	8.96	7.52	621
SM9	Animal Shelter	13:00	4.0	23.05	8.71	7.52	622

Table 6. Summary of San Marcos system water quality analytical results from the June high-flow sampling effort.

SITE	LOCATION	TSS	ALKALINITY (MG/L)	AMMONIA (MG/L)	NITRATE (MG/L)	TOTAL N (MG/L)	SRP (MG/L)	TOTAL P (MG/L)
SMA	Hotel	<1.43	160	0.011	1.2	1.32	<.05	0.0238
SMB	Submarine	<1.43	170	<.01	1.2	1.36	<.05	<.02
SMC	Downstream of Boat Dock	<1.43	170	0.013	1.13	2.02	<.05	<0.02
SMD	Above Chute	<1.43	290	<.01	1.44	1.62	<.05	0.0272
SME	Upstream of Dam	<1.43	170	0.018	1.24	1.36	<.05	<.02
SMF	Landing Dock	3.4	180	0.013	1.17	1.37	<.05	<.02
SMG	Boardwalk	2.9	180	0.055	0.518	1.33	<.05	0.0578
SMH	Downstream of Road	2.0	290	0.044	0.792	1.04	<.05	0.0238
SMS	Sink Creek	<1.43	290	0.058	0.818	1.2	<.05	0.0238
SM1	Below Chute	<1.43	300	<.01	1.68	1.73	<.05	<.02
SM2	Below Dam	<1.43	180	<.01	1.27	1.38	<.05	<.02
SM3	Sessom's Creek	3.3	180	<.01	1.72	1.99	<.05	0.0204
SM4	City Park	1.5	270	<.01	1.46	1.52	<.05	<.02
SM5	Rio Vista Park	3.9	260	<.01	1.44	1.64	<.05	<.02
SM6	I-35 Crossing	4.4	260	0.011	1.42	1.67	<.05	<.02
SM7	Thompson Island Artificial	6.1	270	0.015	1.4	1.54	<.05	<.02
SM8	Thompson Island Natural	11.0	260	<.01	1.42	1.84	<.05	<.02
SM9	Animal Shelter	15.0	260	0.025	1.42	1.7	<.05	<.02

Nitrate values varied from 0.5 mg/l in the slough arm of Spring Lake to 1.68 mg/l in the main river channel, whereas ammonium values were well below 0.5 mg/L (Table 6). These lower nitrate concentrations may be due to uptake of nitrate by the abundant plants and algae in the Slough Arm and Sink Creek areas of Spring Lake. The median concentration of nitrate in the Edward's Aquifer ranges from 1.4 to 1.7 mg/L (Bush et al. 1998), which is consistent with the values measured during this event. The Total N values for the San Marcos River are influenced by the high nitrate concentrations. These high values are likely not the result of anthropogenic inputs to the immediate surface waters. Spring flow is the most likely source of high nitrate values found at all sites in the San Marcos system.

A more in-depth look at water and sediment quality can be found in the 2015 EAA HCP Expanded Water Quality Report (SWCA 2015, Draft). A review of the water quality results provided thus far for 2015 show very few incidences where pollutants were detected, and conventional parameters (nutrients, etc.) were generally within the ranges historically reported in the San Marcos River.

Aquatic Vegetation Mapping

Spring Lake Dam Reach

The Spring Lake Dam Reach is the most upstream reach of the San Marcos River in this study. Although it is difficult to make broad generalizations about seasonal and other trip-to-trip characteristics because most changes occur in such fine detail, some of the more interesting observations are described below. Aquatic vegetation maps for each reach can be found in Appendix B.

Total surface area of aquatic vegetation in the Spring Lake Dam Reach is highly variable due to heavy recreation pressure in the area. Proximity to a restaurant and recreational use by college students exacts a heavy toll on the biota of this reach. Nevertheless, total surface area in spring 2015 (1,272.0 m^2) was not far below the long-term study average, and within one standard deviation (Figure 11). The high-flow event at the end of May 2015 led to scouring throughout the San Marcos River, but the aquatic vegetation was relatively unaffected following the high-flow event (1,062.9 m^2), and was not vastly different from the spring mapping effort. This was the first high-flow event since aquatic vegetation was mapped at this reach (2002), so there is not another event to compare it to, but the slight decrease was negligible compared to that observed during the late October 2015 flood. By fall 2015 total surface area had decreased to 805.7 m^2, the second lowest total since mapping began in this reach. This total was well below the fall long-term study average, and lower than one standard deviation. This is almost certainly a result of the heavy recreation pressure sustained here during the summer coupled with the higher than average sustained discharge and accompanying swift velocities being imposed on plants in this reach. Much of the vegetation that was lost was closest to the new stairs that were constructed in 2014 (see photo below).

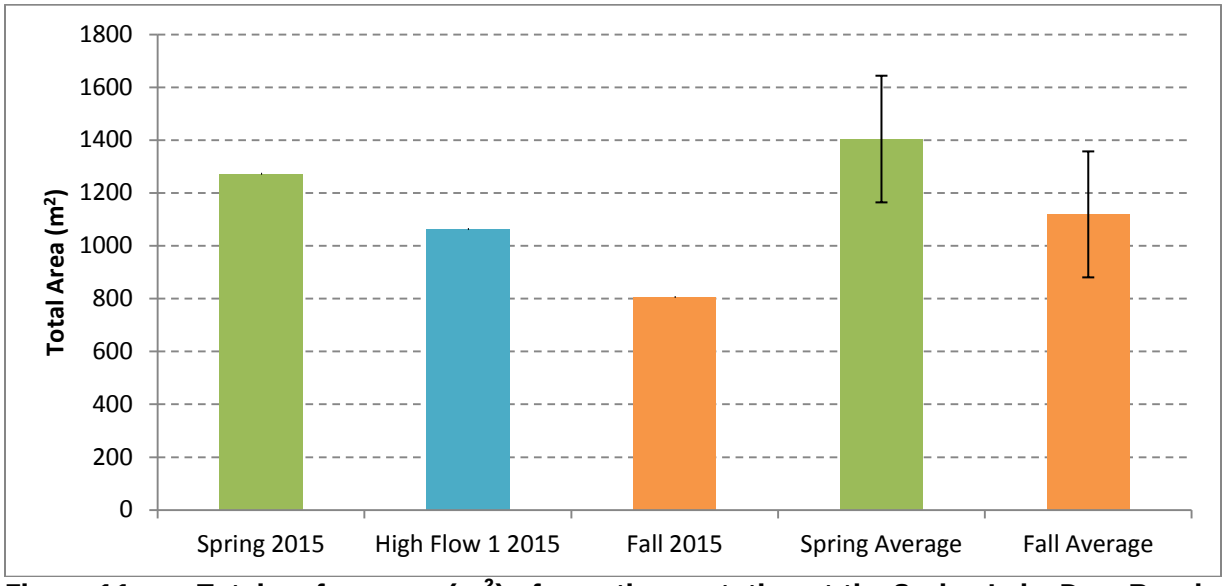

Figure 11. Total surface area (m^2) of aquatic vegetation at the Spring Lake Dam Reach. Long-term study averages are provided with error bars representing one standard deviation from the mean.

New stairs, a part of bank stabilization and recreation access efforts resulting from the Habitat Conservation Plan (HCP) within the Spring Lake Dam Reach.

City Park Reach

Although total surface area of aquatic vegetation increased from fall 2014 (2,663.3 m^2) to spring 2015 (3,387.4 m^2), it was still below the long-term study average and well below one standard deviation (Figure 12). In recent years it appears that recreation pressure has exacted a larger toll on the vegetation, especially in the middle part of the reach. Aquatic vegetation decreased further following the high-flow event in late May (2,790.9 m^2) but only slightly (Figure 12). Some areas were scoured out, but recreation may be a contributing factor here, too. This decrease of almost 600 m^2 was much greater than the decrease (188.4 m^2) following a high-flow event in 2001; however, it is presented here only for comparison as two data points cannot be considered indicative of a trend. Total surface area of aquatic vegetation decreased further by fall 2015 (2,702 m^2) at the City Park Reach. This is much lower than the fall long-term study average, and again below one standard deviation from the mean. As in the Spring Lake Dam Reach, this decrease is likely a combination of scouring from the high-flow event and heavy recreation pressure during the summer months. In addition, after-effects from the bank stabilization construction on river right may have had a lasting effect on the vegetation. The construction of the new stairs may also have increased recreation pressure as a result of the increased ease of access. Further study of recreation numbers is needed to understand what factors are affecting aquatic vegetation coverage directly in this heavily used reach.

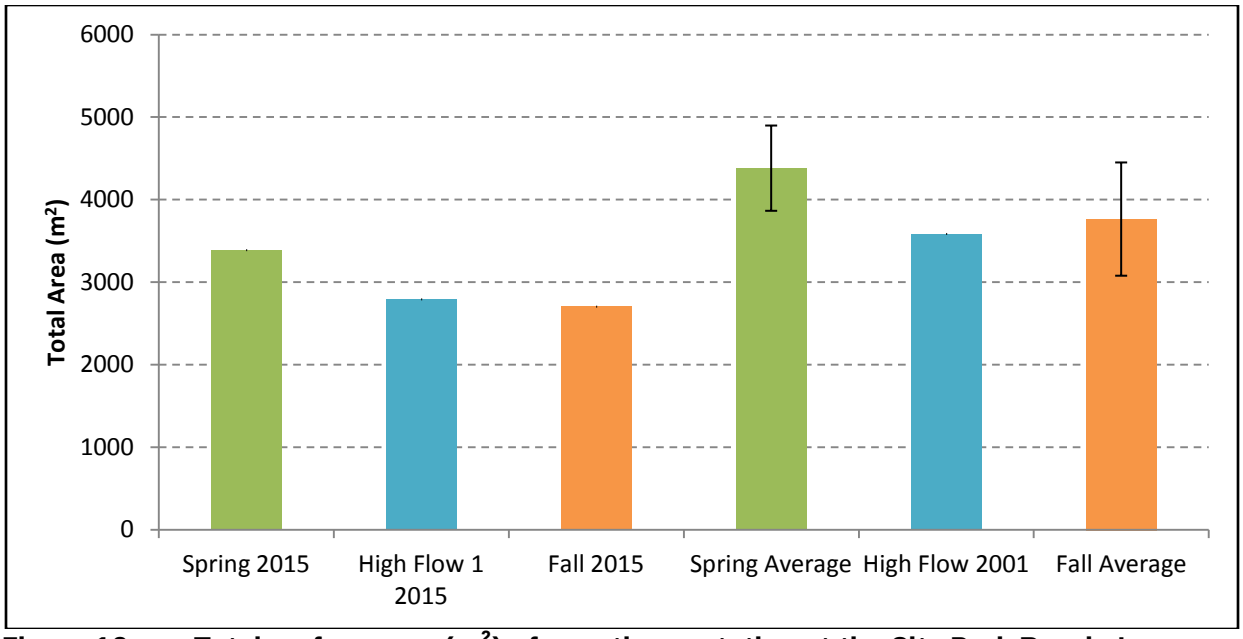

Figure 12. Total surface area (m^2) of aquatic vegetation at the City Park Reach. Long-term study averages are provided with error bars representing one standard deviation from the mean.

I-35 Reach

Since the reconstruction of Rio Vista Dam in 2006, aquatic vegetation has been severely impacted in the I-35 Reach, likely due to increased sedimentation, which results in shallower water and increased velocities, and subsequent loss of aquatic vegetation as documented in previous annual reports (BIO-WEST 2013b). In 2014, the I-35 Reach was expanded to include the San Marcos River from Cheatham Street downstream to the I-35 Highway Bridge (Figure 13). This increased the reach area by 54% and, more importantly, it included large stands of *Hygrophila*, *Sagittaria*, *Cabomba*, and *Hydrilla* that are habitat for fountain darter populations. In addition, this allowed us to continue monitoring fountain darter populations using drop nets. Figure 14 displays the total aquatic vegetation from 2015 and the study averages. However, it must be noted that these averages include all years prior to the expansion of the reach, and this must be considered when making comparisons. As a result, total areas during all 2015 events are well above the respective study averages, but some comparisons can still be made.

Total aquatic vegetation coverage increased from fall 2014 (1,518.5 m^2) to spring 2015 (2,116.7 m^2), which was the highest coverage since the reach expansion (Figure 14). As expected, following the high-flow event of late May 2015, total coverage decreased (1,584.4 m^2), but rebounded some by fall (1,767.7 m^2). Unlike the upstream reaches, the I-35 Reach was turbid for a much longer time period following the late-May flood. Historic flooding in the adjacent Blanco River basin backed up into the San Marcos River from the confluence. With the I-35 Reach being the most downstream reach, it was expected that more damage would have occurred here, but the aquatic vegetation fared relatively well. The high-flow event in October was very different in that much of the flow came from the Sink Creek and Purgatory Creek watersheds resulting in much worse scouring of aquatic vegetation. These data will be presented in the 2016 addendum.

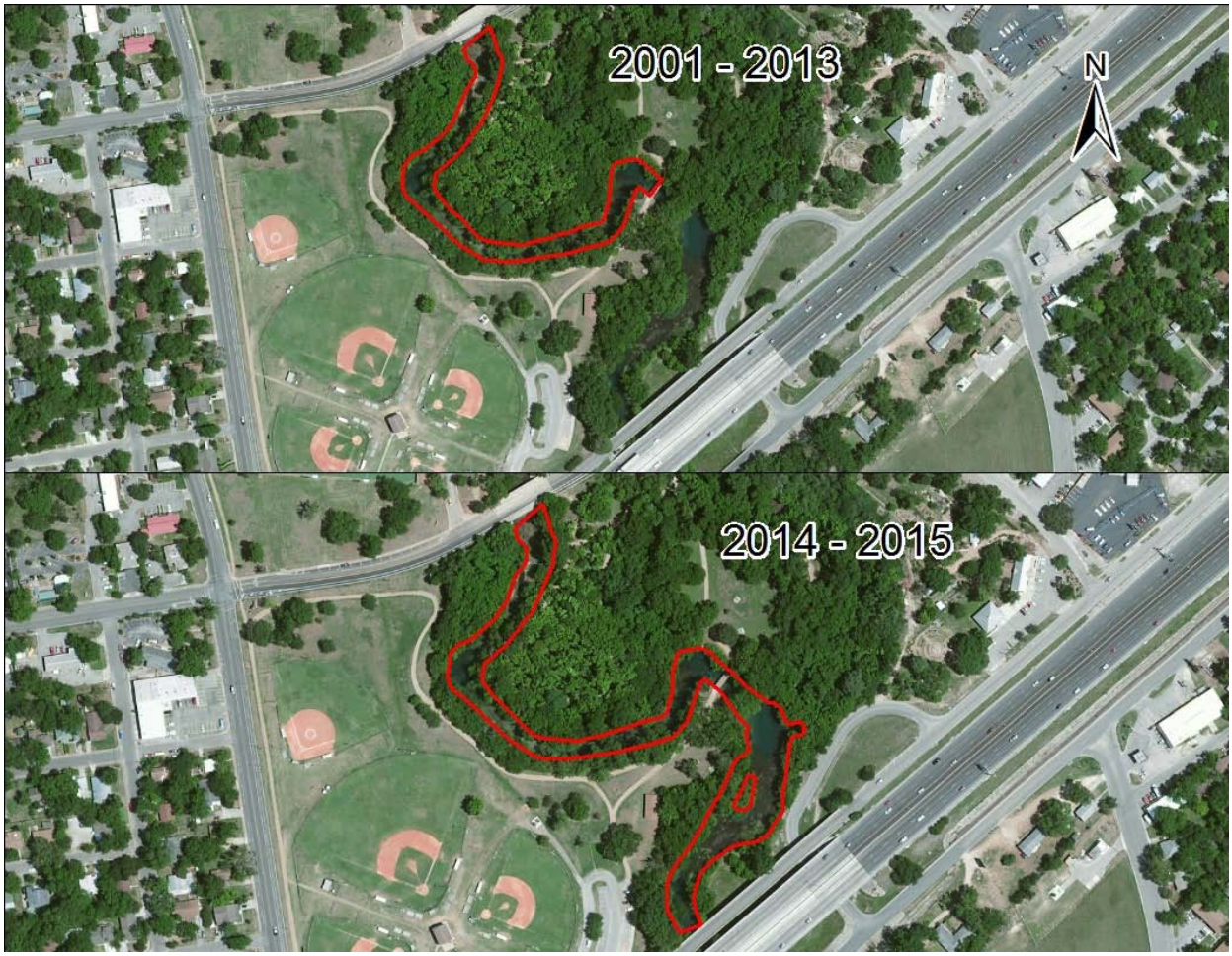

Figure 13. I-35 Reach expansion in 2014 (bottom) and continued in 2015 due to relative scarcity of aquatic vegetation in the original reach (top).

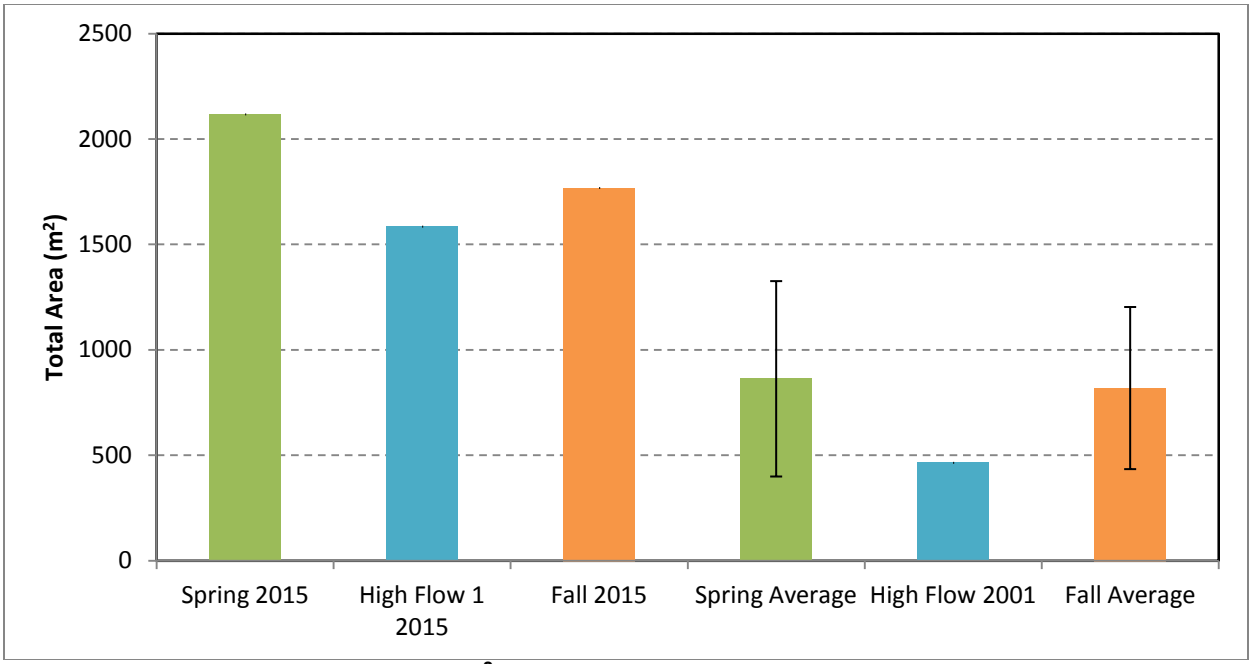

Figure 14. Total surface area (m^2) of aquatic vegetation at the I-35 Reach. Long-term study averages are provided with error bars representing one standard deviation from the mean. Note that the reach was expanded in 2014 resulting in greater surface area of aquatic vegetation.

Texas Wild-rice Annual Mapping

Texas wild-rice maps for the entire San Marcos River broken out by river segment can be found in Appendix B. In early 2015, river flows in the San Marcos remained below the historic average until February, when early spring rains increased flows to the historical average. Precipitation events in April and May increased flows above the historical average, and these flows were maintained for the rest of 2015. As previously mentioned, two flooding events occurred in the San Marcos system in 2015. The two flooding events triggered Critical Period Texas wild-rice mapping for a total of three San Marcos River full mapping events. The first high-flow event occurred in June to record changes in wild-rice distribution after the late-May flood. The yearly Texas wild-rice mapping event occurred in August as planned, and, finally, a third mapping event occurred in November and December to document changes in Texas wild-rice from the October 30 flood. The data from that final event will be presented in the 2016 addendum. Critical Period mapping of Texas wild-rice was conducted between June 5 and 29, 2015. The yearly mapping event occurred between August 11 and September 1, 2015.

In the June high-flow event, Texas wild-rice covered 7,489 m² in the San Marcos River, an increase of 1,286 m² from summer 2014. Although this is an overall increase, the Memorial Day flood caused significant disturbance to Texas wild-rice stands below I-35. Mapping in 2014 showed an estimated 121 m² of Texas wild-rice below the I-35 Highway Bridge whereas mapping in June demonstrated a total surface area of only 19 m². Not only did Texas wild-rice coverage decrease, but entire Texas wild-rice stands were removed by the flooding event. Historically, several large stands of Texas wild-rice have been present below Cape's Dam, but the post-flood survey showed that this area and several others were even devoid of Texas wild-rice roots. These areas were noted to be significantly deeper, indicating that scouring effects had

removed large amounts of streambed sediment. As a result, only two small plants were noted to exist below Cape's Dam, and no Texas wild-rice was observed below Thompson's Island. This is a significant alteration in distribution of Texas wild-rice.

August mapping showed a slight decrease from the June high-flow event with Texas wild-rice coverage at 7,352 m². August mapping confirmed little recovery of Texas wild-rice below I-35 with cover in this area reaching 28 m². Again only a few small plants were located below Cape's Dam, and no Texas wild-rice was observed below Thompson's Island. Upstream of the I-35 Highway Bridge, Texas wild-rice remained relatively stable. Texas wild-rice stands in Sewell Park, City Park, and other areas remained mostly intact despite recreation pressure. This was most likely due to deeper and faster-moving water, which prevents human disturbance of the streambed. In Sewell Park, from the University Drive bridge to the second pedestrian bridge, Texas wild-rice total surface area increased from 1,258 m^2 in August 2014, to 1,504 m^2 in June 2015, and decreased slightly to 1,480 m^2 by August 2015. In June 2015 Texas wild-rice occupied areas where it had been absent through 2014, specifically, along University Drive bridge and in the upper portions of Sewell Park. By August some additional Texas wild-rice had colonized this area as well. Between Hopkins Street bridge and the Purgatory Creek confluence, Texas wild-rice total surface area increased as well from 332 m^2 in August 2014 to 427 m^2 in August 2015. Again, post-flood mapping in June showed no decrease in coverage here as Texas wild-rice in June covered 423 m^2. Texas wild-rice cover located in HCP exclusion zones along both of these stretches is being maintained, and in several locations Texas wild-rice has expanded outside of these protected areas as well. Texas wild-rice restoration in late June and August significantly increased coverage below Purgatory Creek from 476 m^2 in June to 660 m^2 by August 2015.

Two areas of concern for Texas wild-rice after the high-flow event in May 2015 were the Spring Lake Dam and City Park reaches. In the Spring Lake Dam Reach, Texas wild-rice exclosures have been installed to maintain Texas wild-rice cover, and in City Park Texas wild-rice has been planted extensively. Both measures were carried out as part of the HCP. The May 2015 high-flow event did not seem to immediately impact Texas wild-rice in either of these areas. Between August 2014 and June 2015 Texas wild-rice increased from 591 m^2 to 763 m^2 with rice expanding outside of the exclosures in the Spring Lake Dam Reach. However, by August, Texas wild-rice cover in this reach decreased to 456 m^2. Recreation pressure in the Spring Lake Dam Reach over the summer of 2015 was extreme and seemed to contribute heavily to Texas wild-rice loss.

In City Park, below the Lions Club tube put-in, Texas wild-rice was extensively planted throughout 2015, and these efforts resulted in an increase in cover of Texas wild-rice in this location by more than 50% from August 2014 to August 2015. In June over 1,100 m^2 of Texas wild-rice was present and further increased to over 1,300 m^2 by August. The late-May flood caused little damage to the plants here. Overall, the flood event minimally impacted Texas wild-rice upstream of Rio Vista Park. Much of the restored Texas wild-rice remained in place after the flood, while summer recreation impacted the plants extensively in some locations.

In summary, coverage of Texas wild-rice continues to increase (Figure 15) and has surpassed 7,000 m^2 for the first time since the comprehensive monitoring study began. A total of 463 Texas wild-rice polygons were mapped along with 38 Texas wild-rice points (plants too small to map accurately) in June 2015. In August 2015 499 Texas wild-rice stands were mapped along with 120 points (Appendix B). However, as of August 2015, distribution of Texas wild-rice stretches from Spring Lake to just downstream of Cape's Dam. This represents a historically significant reduction in Texas wild-rice longitudinal distribution, with the lower extent previously immediately downstream of the outflow from the San Marcos Waste Water Treatment Plant.

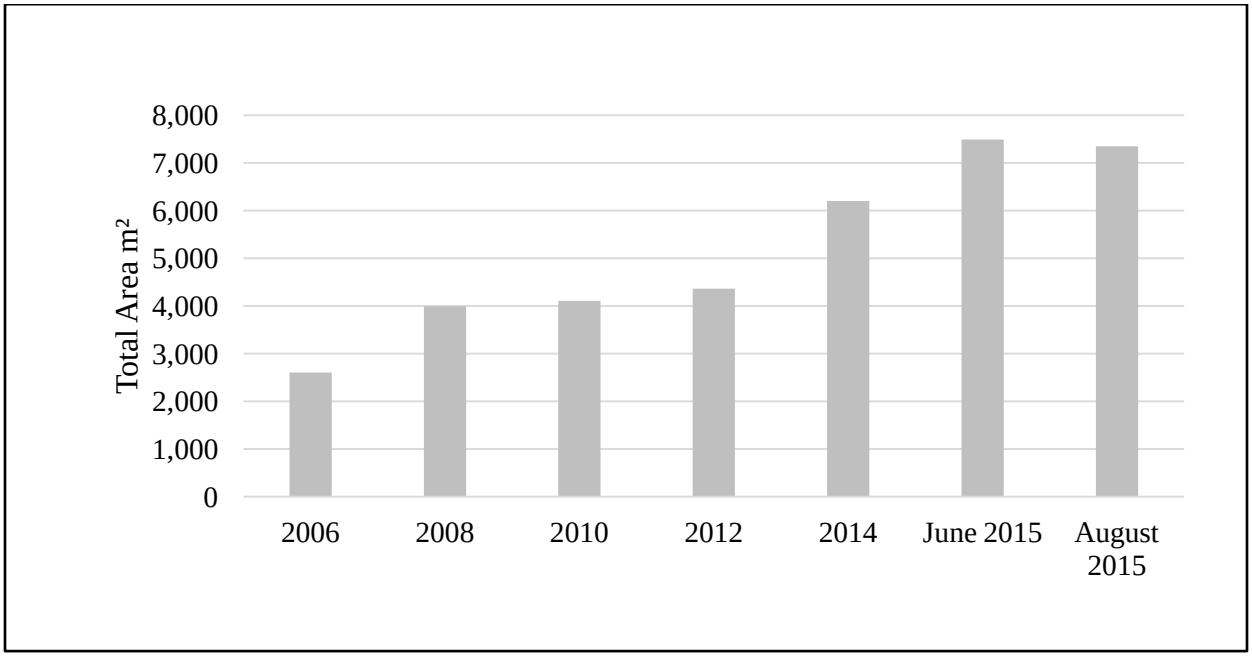

Figure 15. Total surface area of Texas wild-rice stands across selected years in the San Marcos River.

Of the 499 Texas wild-rice stands mapped in August 2015, 359 of them were found to be in water deeper than 3 feet, while 140 stands were found to be in water less than 3 feet in depth (Table 7). Unlike in 2014, when 55 stands were found in water depth of 1 foot or less, in 2015 no stands were found in less than 1 foot of water depth (Table 7), a reflection of the above-average flows of 2015. More than half of Texas wild-rice stands (270) were found to be associated with another species of aquatic plant. *Hydrilla* was the species most often found growing with Texas wild-rice, followed by *Hygrophila* and *Potamogeton* (Table 8). In 2013 and 2014, Texas wild-rice displayed extensive blooming events, which have not been common in the recent past. During the August 2015 survey, only nine Texas wild-rice stands were found to be blooming in 80% or more of mapped plants.

Table 7. Distribution of Texas wild-rice based on water depth (N=499) in the San Marcos River.

DEPTH (FEET)	NUMBER OF TEXAS WILD-RICE STANDS	FREQUENCY (%)
0 to 1	0	0
1–2	26	5
2–3	114	23
3 +	359	72

Table 8. Associated species found with Texas wild-rice (N=270) in the San Marcos River.

SPECIES	NUMBER OF TEXAS WILD-RICE STANDS	FREQUENCY (%)
Hydrilla	137	51
Hygrophila	59	22
Potamogeton	39	14
Sagittaria	26	9
Hydrocotyle	5	1
Ludwigia	3	.01
Cabomba	1	.003

Texas Wild-rice Physical Observations

Observations for vulnerable stands of Texas wild-rice were conducted four times during 2015 (Table 9). Two observations were made during comprehensive sampling events (spring and fall) and two more observations were conducted as high-flow events in June and December. Physical observations were made for vulnerable Texas wild-rice stands within two study reaches, the Sewell Park Reach and the I-35 Reach. Methods for physical observations were revised in 2015. To help better assess the coverage of designated vulnerable Texas wild-rice stands, rectangular plots encompassing each stand were mapped in GIS to provide a reference area (Figures 16 and 17). Stand cover measured within the plot was then used to better document the expansion and retraction of Texas wild-rice. Whereas previously when a vulnerable stand fragmented it was difficult to tell which smaller clumps were once part of the original larger stand and typically only one of the smaller clumps was measured for areal cover while the areal cover of the surrounding clumps was not taken into consideration. With a designated plot all rice within the plot is now mapped providing a more accurate areal cover estimate. Two additional stands were added in the Sewell Park Reach, and three new stands were added to the I-35 Reach. All other stands were relocated from previous years. The coverage of each vulnerable stand in the San Marcos River is presented below (Table 10). Qualitative data and observations were made on each vulnerable stand for a variety of factors such as root exposure, water velocity, minimum depth, percent cover, percent of stand flowering and seeding, percent covered by floating vegetation mats, stand depth, herbivory, and emergence. Detailed graphs showing the total surface area of Texas wild-rice in these two reaches as well as maps of vulnerable stands during each monitoring effort are found in Appendix C.

Table 9. The dates of Texas wild-rice observations conducted in 2015 with corresponding average daily discharge in the San Marcos River.

TEXAS WILD-RICE OBSERVATION	SAMPLING PERIOD	DATE	AVERAGE DAILY DISCHARGE (CFS)
1	Spring	April 22	172
2	High-flow 1	June 18	345
3	Fall	October 29	N/A[a]
4	High-flow 2	N/A	N/A

[a] Approved data not currently available from USGS.

Table 10. Total surface area (m^2) of vulnerable Texas wild-rice stands in the San Marcos River in 2015.

STAND NUMBER	SPRING	HIGH-FLOW 1	FALL
Sewell Park 1	41.52	59.21	47.11
Sewell Park 2	2.47	3.62	1.92
Sewell Park 3	1.85	2.36	Gone
Sewell Park 4/5	50.52	53.79	48.51
Sewell Park 6	1.81	1.88	2.14
Sewell Park 7	53.63	84.12	61.90
Sewell Park 8	5.46	3.38	1.2
I-35-1	4.23	3.08	1.2
I-35-2	0.7	0.51	Gone
I-35-3	1.47	1.49	0.89
I-35-4	59.21	39.04	58.97
I-35-5	3.04	1.90	0.97
I-35-6	1.8	2.93	Gone
I-35-7	11.27	13.05	13.94
I-35-8	15.95	18.15	12.7
I-35-9	11.85	10.88	15.81
I-35-10	19.55	21.42	21.47

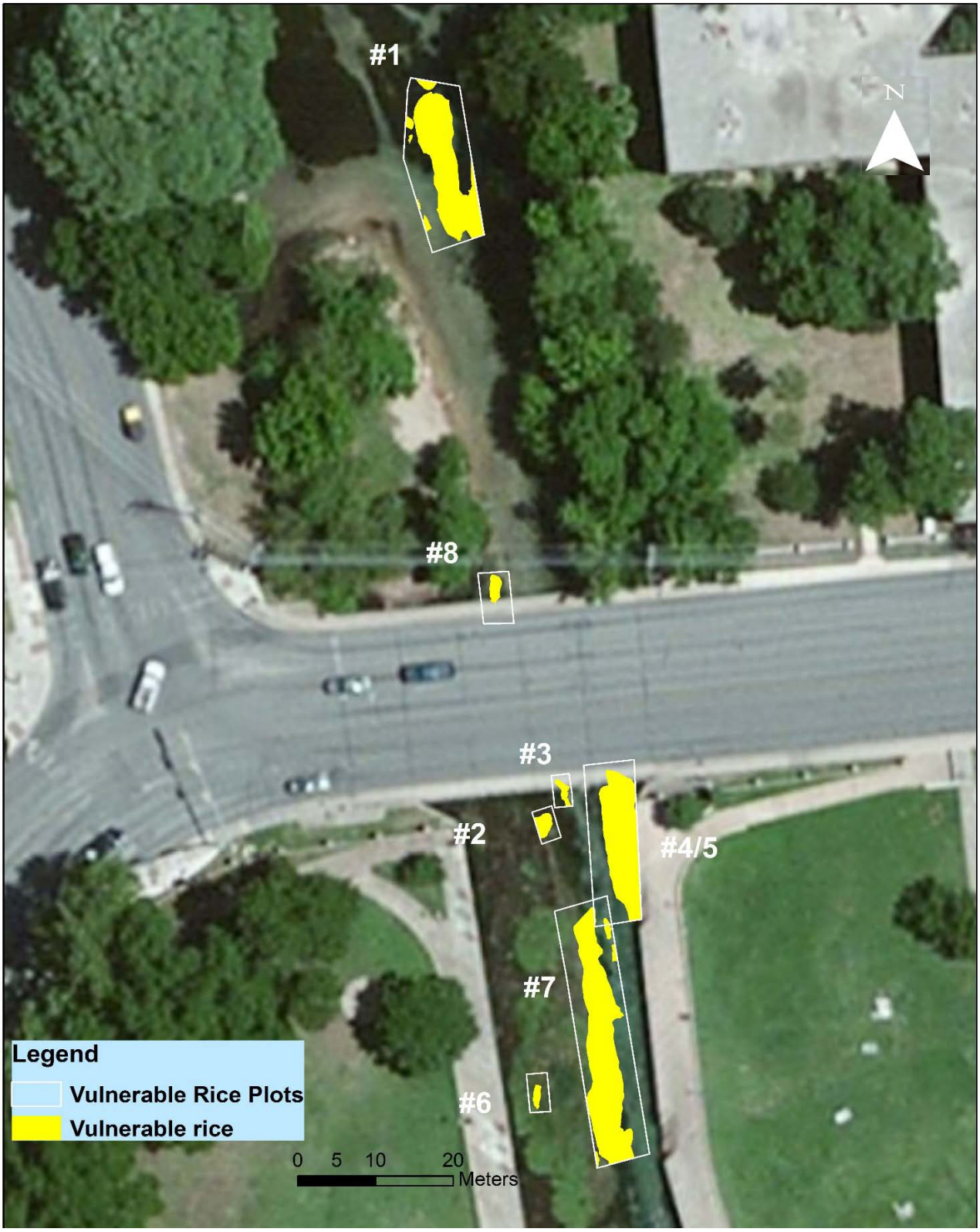

Figure 16. Texas wild-rice vulnerable stands in the Sewell Park Reach.

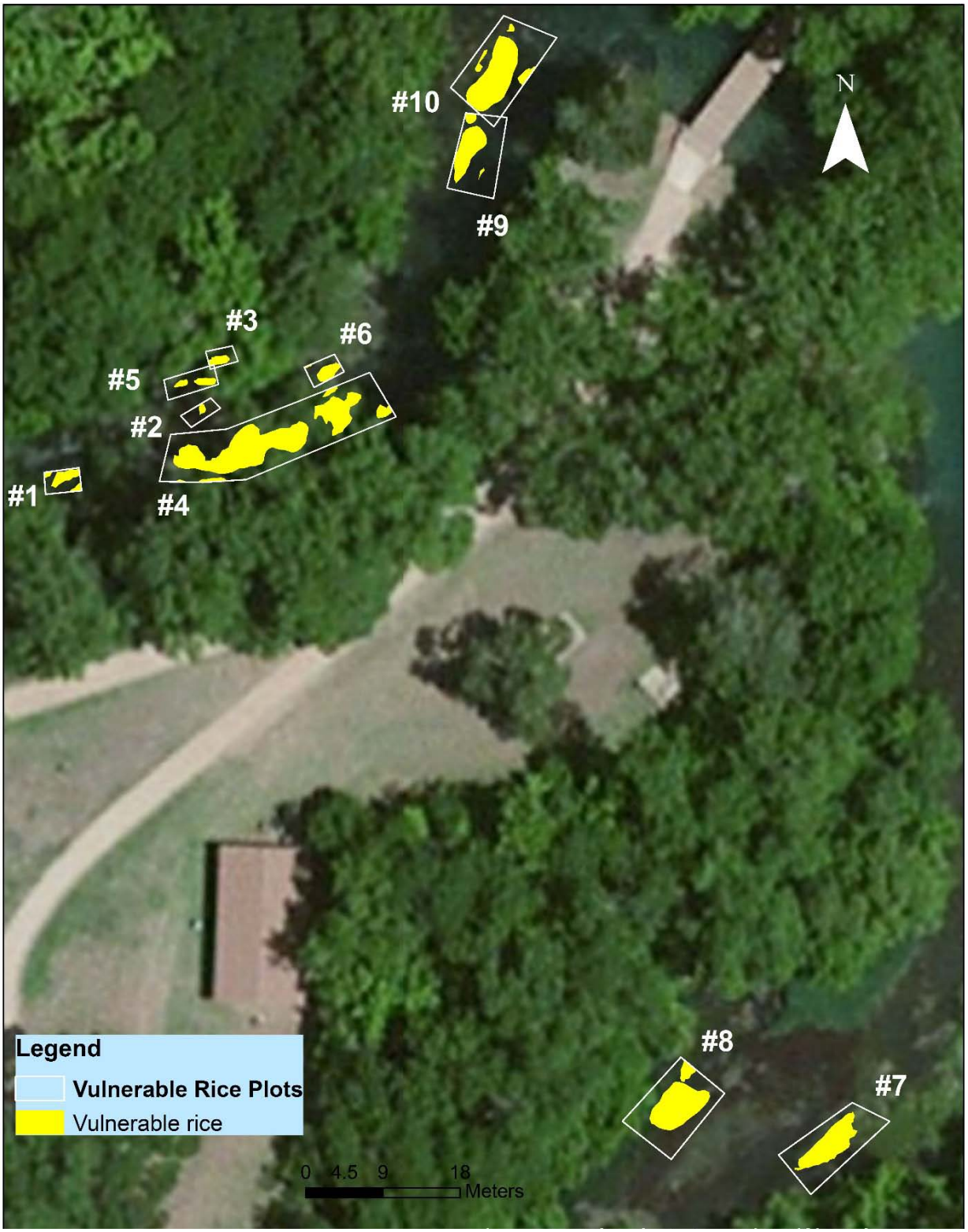

Figure 17. Texas wild-rice vulnerable stands in the I-35 Reach.

Sewell Park

While Texas wild-rice in Sewell Park has remained vigorous over the last few years, this area has seen a loss or reduction in size of vulnerable stands below the University Drive bridge, due in part to low flows (which enable vegetation mats to build up) and recreational disturbance in shallow waters. In 2015 eight stands were monitored in this reach, and two new stands were added (stands 1 and 8). These stands are upstream of the University Drive bridge and provide additional observations to monitor Texas wild-rice in this highly recreated area besides general mapping. Over all three monitoring periods, the mean stand flows were high, well above the historical average over the duration of monitoring program. The June high-flow event showed average stand velocities of 2.65 ft/s, the highest average stand velocity ever measured during Texas wild-rice physical monitoring. Water depths occupied by Texas wild-rice stands were much deeper than previous years, and ranged from 2 feet to over 3 feet and did not recede much through the summer. In fact, Texas wild-rice stands were never exposed to water depths less than 1 foot from April onward. In April, Texas wild-rice stands were noted to be healthy and robust with multiple stands 50 to 60% emergent and some stands in a blooming stage of 30% to 40% (Figure 18). Little root exposure from scouring or damage from herbivory was noted.

Figure 18. Emergent plant #4/5 in April of 2015 in the Sewell Park Reach.

The combined cover for vulnerable rice stands in Sewell Park in April was 157 m^2. After the June high-flow event, vulnerable Texas wild-rice stands in this reach were subjected to increased flows from improved spring discharge. The mean water velocity reached 2.65 ft/s with water velocity at individual stands ranging from 1.66 to 4.29 ft/s. These velocities subjected Texas wild-rice stands to a staggering amount of force. As expected, no stands were emergent or blooming because the increased velocities either shredded top growth away or forced it below the water's surface (Figure 19). Despite the increased flow, root exposure remained "low" with only one plant (#4) having any notable damage to roots. Yet sediment accretion was noted around multiple plants burying the lower parts of stems. Despite increased velocities, all Texas wild-rice stands maintained their size or expanded—total surface area increased to 208 m^2. By October, all but one Texas wild-rice stand decreased in cover and one stand (#3) was not located. As a result, surface area was reduced to 162 m^2. Water velocities remained fast (1.8 to 3.5 ft/s) at individual stands and root exposure was noted as "severe" in plants 1, 2 and 7, with 5 inches or more of exposed root ball on the upstream end. Despite high velocities, a very thick vegetation mat had formed on plant #7.

Figure 19. A Texas wild-rice plant exhibiting emergent growth and flower structure (circled) which have been submerged due to increased flows and depths.

Texas wild-rice in the Sewell Park Reach is increasingly under pressure from recreation, as this year has shown (Figure 20), and has been subjected to water velocities much higher than in the recent past. It has been observed that recreation can have severe impacts on Texas wild-rice biomass, especially when water depths are lower. This increases the amount of wadeable area, which results in stream bed disturbances. Increased flows can protect Texas wild-rice from recreation by increasing water depths and thereby limiting areas where people swim and wade. However, Texas wild-rice, although quite adapted to lotic conditions, can be negatively impacted by continuous high flows, too. Sustained turbulence from water velocities scour areas around the root ball and rip apart growth structures.

Figure 20. Heavy recreation in area of Texas wild-rice vulnerable stands upstream of University Drive. The location of stand #1 is circled.

I-35 Reach

In 2013, 10 vulnerable Texas wild-rice stands were located in the I-35 Reach with three new stands added in 2015 (Figure 17). Overall, stands here had a reduction in total surface area over the course of 2015. Stand flows were higher-than-average and depths considerably deeper when compared to 2014.

In April, mean stand flow was 1.4 ft/s, well above the study average, with velocities at individual stands ranging from 1.0 to 2.7 ft/s, and depths ranging from 2 to 3.5 feet. Percent emergence was minimal, as was blooming. Root exposure was "severe" in one stand (#1) while in all other stands root exposure was minimal. Total cover for vulnerable Texas wild-rice stands in this reach in spring was 129 m^2. Following the late-May flooding event, mean stand velocity increased to 1.9 ft/s with velocities at stands ranging from 1.1 to 2.8 ft/s. Depths increased as well, ranging from 2 to 4 feet. Root exposure was noted as "severe" in several stands, notably #1, #5, and #8, with 5 inches or more of the root ball exposed at the upstream edge of the stand. Total surface area of Texas wild-rice was reduced to 112 m^2. For the fall monitoring effort, velocities were 1.5

ft/s, and most stands reduced in biomass and size with two stands disappearing completely (#2 and #6). However some stands, notably #4 and #9, increased in cover from June to fall resulting in an overall increase to 125 m^2. In fall stand #7 was in 100% bloom and very robust. Vegetation mats did not accumulate on Texas wild-rice stands in this reach as they seldom occur here. In 2015 this stretch received little recreation pressure because it was closed to tubing from June onward, and high water velocities may have discouraged other forms of recreation. Yet this area also received the highest degree of flooding as storm waters from the late May flood entered into the San Marcos River near this location. Multiple downed trees and collapsed banks have slightly altered the river currents. This area has also seen a steady loss or fragmentation of Texas wild-rice vulnerable stands over the duration of the comprehensive monitoring study.

Fountain Darter Sampling Results

Drop-net Sampling

In 2015, drop netting was conducted on the San Marcos River during the spring (April), high-flow (June), fall (October), and high flow (November) sampling efforts. The number of drop-net sites and vegetation types sampled in each sample reach per event is presented in Table 11, with all data from the November high-flow event to be presented in the 2016 addendum. Although the City Park and I-35 reaches have been sampled continuously since the beginning of the study, the Spring Lake Dam Reach was added to the HCP biological monitoring program in 2013. In addition, two *Sagittaria* sites were added to each of the City Park and I-35 reaches in 2013, and two open sites were added to each of the three reaches in fall 2014.

Table 11. Drop-net sites and vegetation types sampled in each reach in the San Marcos River in 2015.

VEGETATION TYPE	SPRING (APRIL 20–21)			HIGH-FLOW (JUNE 10–11)			FALL (OCTOBER 19–20)			TOTAL
	Spring Lake Dam	City Park	I-35	Spring Lake Dam	City Park	I-35	Spring Lake Dam	City Park	I-35	
Potamogeton	2			2			2			6
Hydrilla	2	2	2	2	2	2	2	2	2	18
Hygrophila	2	2	2	2	2	2	2	2	2	18
Potamogeton/ Hygrophila		2			2			2		6 0
Vallisneria	2			2						4
Sagittaria		2	2		2	2		2	2	12
Cabomba			2			2			2	6
Ludwigia										0
Open	2	2	2	2	2	2	2	2	2	18
TOTAL	**10**	**10**	**10**	**10**	**10**	**10**	**8**[a]	**10**	**10**	**88**

[a] *Vallisneria* no longer present in sufficient coverage in the reach, therefore it was not sampled.

Using drop nets, biologists captured 776 fountain darters in the San Marcos River in 2015, with 307 captured during spring 2015, 267 captured during the high-flow event, and 202 captured in fall 2015. Due to the changes in sampling design described above, increased effort in recent years resulted in a corresponding increase in the total number of fountain darters captured compared to previous years.

Submerged aquatic vegetation is a critical component of fountain darter habitat in the San Marcos River, as demonstrated by the density of fountain darters in open habitats ($0.05/m^2$) versus vegetated habitats ($2.3–11.3/m^2$) (Figure 21). However, fountain darter density varies considerably both within and between various vegetation types. While *Vallisneria* (a nonnative plant in the San Marcos River) showed some potential for harboring higher densities of fountain darters, this vegetation is relatively rare. *Potamogeton* ($8.1/m^2$) and *Cabomba* ($8.0 /m^2$) exhibited the highest densities of fountain darters of native vegetation types sampled in the San Marcos River. While these densities are very similar, these native plants are different in both structure and habitat preference. *Cabomba* has a more complex leaf structure, and is typically found in low-velocity backwaters. This study has also shown that it harbors the most fountain darter prey items (amphipods, true flies, mayflies, caddisflies) at both the City Park and I-35 reaches (this plant is not found at the Spring Lake Dam Reach). As a result, we would expect higher densities of fountain darters in this native species. *Potamogeton* has a relatively simple leaf structures, and is found in many habitats, but is most common in higher-velocity sections of the river. It holds relatively few prey items in comparison to other vegetation at all reaches. Further study is needed to assess why fountain darter densities are relatively high in *Potamogeton*.

Fountain darter densities are generally lower in the San Marcos system than in the Comal system, in which certain vegetation types, such as filamentous algae and bryophytes, exhibit higher mean densities (22–28 fountain darters/m^2) and an overall greater number of fountain darters (BIO-WEST 2015a). Filamentous algae and bryophytes provide dense cover at the substrate level and also harbor large numbers of invertebrates on which fountain darters commonly feed. In the San Marcos system, filamentous algae and bryophytes are found in large amounts only in Spring Lake. Although Spring Lake is not sampled by drop netting, dip-net data confirm a high abundance of fountain darters in these vegetation types within the lake.

The length-frequency distributions for fountain darters collected by drop nets in the San Marcos system during spring and fall sampling events are presented in Figures 22 and 23. Laboratory studies have shown that fountain darters of 16 mm total length are approximately 63 days old (Brandt et al. 1993). Therefore, the presence of fountain darters this size and smaller suggests recent reproduction. Recent studies of fountain darter reproduction found that reproductive effort peaks in late winter/early spring and declines throughout the summer before beginning to increase in the fall (BIO-WEST 2014c). Indeed, spring collections from all reaches show a larger proportion of small fountain darters, confirming a peak in reproduction in late winter/early spring (Figure 22). In contrast, fall samples are usually dominated by larger individuals due to less recent reproductive activity (Figure 23).

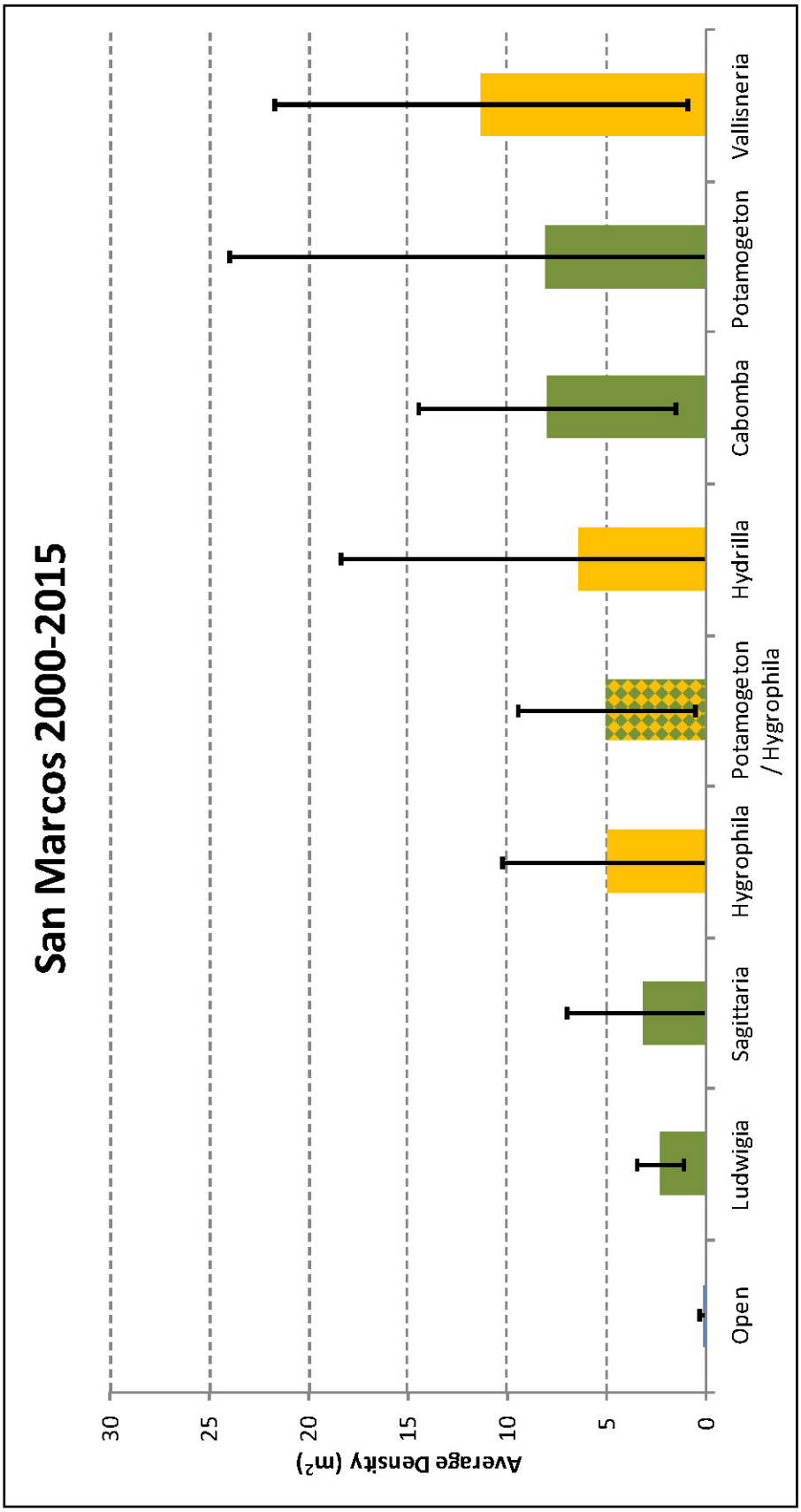

Figure 21. Average fountain darter density for each sampled vegetation type in the San Marcos River from 2000–2015. Green represents native vegetation, while yellow reflect nonnative types.

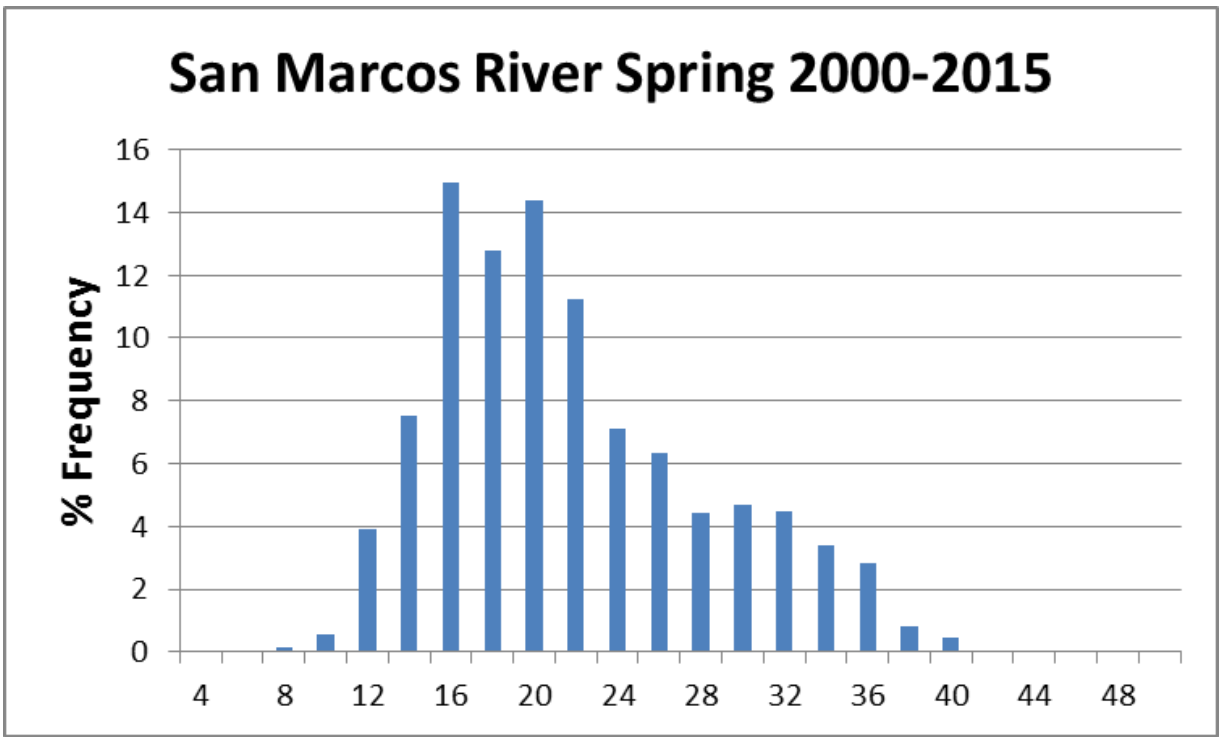

Figure 22. **Length frequency distribution of fountain darters collected from the San Marcos system during all spring events (2000–2015).**

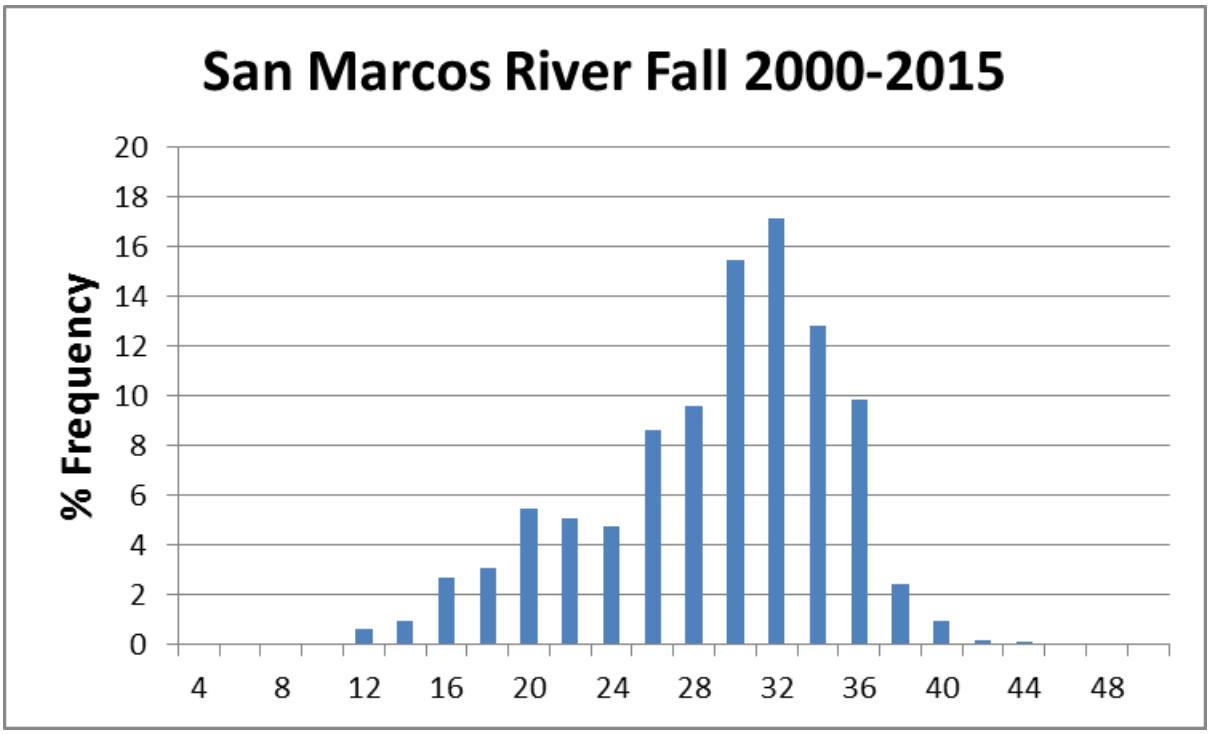

Figure 23. **Length frequency distribution of fountain darters collected from the San Marcos system during all fall events (2000–2015).**

Estimates of fountain darter population abundance (Figure 24) were made according to vegetation coverage within the study reaches and average density of fountain darters found in each vegetation type, as described in the Methods section. Trends in the San Marcos and Comal systems are similar. The spring 2015 population estimate was slightly lower than the long-term average, but within one standard deviation. Similarly, data from the June high-flow event displayed a lower population estimate than all study averages, and was comparable to the only other high-flow event in 2001. These high-flow events typically scour vegetation, which leads to lower estimates, whereas low-flow events don't usually disturb vegetation as extensively (at least over the short term). It does stand out that the fall 2015 fountain darter normalized population estimate was lower than all other averages, and outside one standard deviation. This is a result of decreased aquatic vegetation coverage in fall 2015, particularly in the Spring Lake Dam and City Park reaches. Further scouring resulting from the October high-flow event should indicate if this trend continues.

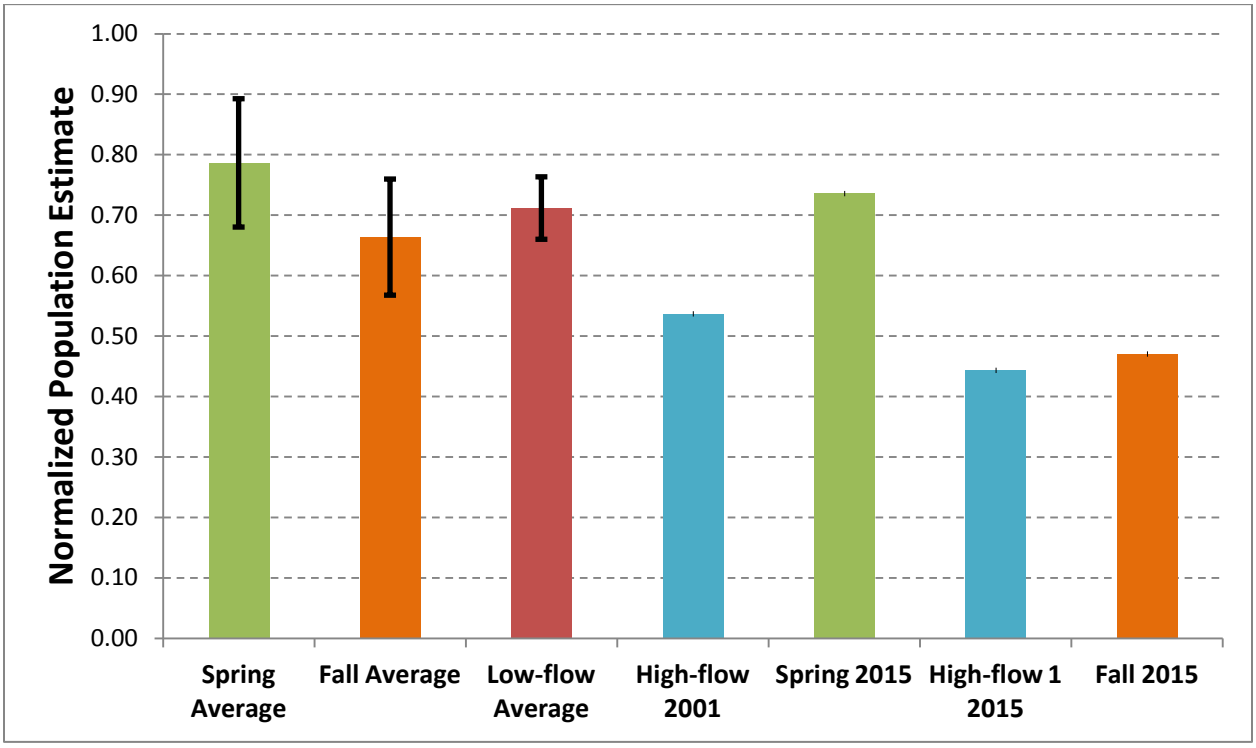

Figure 24. Normalized population estimate for all events 2000–2015. Long-term study averages are provided with error bars representing one standard deviation from the mean.

In addition to fountain darters, 48,477 fishes representing 26 other taxa have been collected by drop netting since 2000 (Table 12). Commonly captured exotic or introduced species include the rock bass (*Ambloplites rupestris*), Rio Grande cichlid (*Herichthys cyanoguttatus*), redbreast sunfish (*Lepomis auritus*), and the sailfin molly (*Poecilia latipinna*). Although these species are not native to the system, most have been established for decades and negative impacts to the fountain darter have not been noted. However, one exotic fish of particular concern is the armadillo del rio (*Hypostomus* spp.). These fish are not commonly captured in drop nets, but they are abundant in the system based on observations made during fish community sampling. This detritivorous species (Pound et al. 2011) feeds by scraping algae and detritus from the river substrate and, therefore, has the potential to alter the food chain and impact fountain darter habitat and food supplies. Five of these fish were captured in 2015 (Table 12) up from two captured in 2014. Hence, continued monitoring and management of the armadillo del rio population in the San Marcos River is important.

Dip-net Timed Surveys

Timed dip-net collections were conducted five times in the San Marcos River during 2015: April (spring), June (high-flow 1), August (summer), October (fall), and November (high-flow 2). Each section where dip-net collections were conducted is depicted in Figures 2 and 3. Section numbers are included in data figures to be consistent with the USFWS classification system for the San Marcos River. Data gathered from all reaches are graphically represented in Appendix C.

Although only half the sampling effort was exerted in the Hotel Section (Spring Lake) compared with other sections, the overall number of fountain darters collected by dip netting there was typically greater than found in the other three sections. Filamentous algae and bryophytes present in this area provided the highest-quality habitat found in the San Marcos system.

Almost all samples collected from the Hotel Section during the study period contained individuals in the smallest size class (5–15 mm, Appendix C). The presence of this size class suggests some reproduction is occurring during all seasons. However, fountain darters within this size class are more sporadically observed in the section within the San Marcos River and are often found only in spring collections. This may suggest lower recruitment in these downstream sections, which highlights the importance of habitats in Spring Lake to the overall health of the population.

Within the City Park Section, abundances observed during timed dip-net surveys were rather dynamic (31–69, Appendix C). The spring 2015 sampling effort had the second highest abundance recorded at this reach (69), but abundances documented in summer and fall were closer to average. Due to the decrease in available habitat in the I-35 Section after modification of Rio Vista Dam in spring 2006, the reach was extended to the I-35 Highway Bridge in 2014. Although more fountain darters were observed in the I-35 Section in 2015 than in 2013 and 2014, the overall total is consistent with past years, and the recent reach expansion makes it premature to use these data for sweeping long-term year-to-year comparisons at this time. Abundance of fountain darters was lower and more variable in the lower portion of the river near Todd Island (Appendix C). Habitat (sparse patches of submerged *Hygrophila* and filamentous

Table 12. All fish collected in drop nets from 2000 to 2015.

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	NUMBER COLLECTED	
				2015	2000-2015
Lepisosteidae	*Lepisosteus oculatus*	Spotted gar	Native		1
Cyprinidae	*Cyprinella venusta*	Blacktail shiner	Native		6
	Dionda nigrotaeniata	Guadalupe roundnose minnow	Native	2	54
	Notropis amabilis	Texas shiner	Native	7	81
	Notropis chalybaeus	Ironcolor shiner	Native		131
	Notropis sp.	Unknown shiner	Native		4
Catostomidae	*Moxostoma congestum*	Gray redhorse	Native		2
Characidae	*Astyanax mexicanus*	Mexican tetra	Introduced	4	55
Ictaluridae	*Ameiurus melas*	Black bullhead	Native		1
	Ameiurus natalis	Yellow bullhead	Native	6	150
	Noturus gyrinus	Tadpole madtom	Native		4
Loricariidae	*Hypostomus plecostomus*	Armadillo del rio	Introduced	5	53
Poeciliidae	*Gambusia* sp.	Mosquitofish	Native	1,640	44,990
	Poecilia latipinna	Sailfin molly	Introduced		158
Centrarchidae	*Ambloplites rupestris*	Rock bass	Introduced	48	694
	Lepomis auritus	Redbreast sunfish	Introduced	15	85
	Lepomis cyanellus	Green sunfish	Native		9
	Lepomis gulosus	Warmouth	Native	6	46
	Lepomis macrochirus	Bluegill	Native		78
	Lepomis megalotis	Longear sunfish	Native		19
	Lepomis microlophus	Redear sunfish	Native		2
	Lepomis miniatus	Redspotted sunfish	Native	125	1,333
	Lepomis sp.	Sunfish	Native/Intr.	25	270
	Micropterus salmoides	Largemouth bass	Native	11	72
Percidae	*Etheostoma fonticola*	Fountain darter	Native	776	6,781
	Percina apristis	Guadalupe darter	Native	3	22
	Percina carbonaria	Texas logperch	Native		1
Cichlidae	*Herichthys cyanoguttatus*	Rio Grande cichlid	Introduced	20	140
	Oreochromis aureus	Blue tilapia	Introduced		16
Total				2,693	55,258

algae) within this reach fluctuates drastically based on flow conditions and land use in the area. High flows result in excessive scouring, whereas low flows often result in portions of the sampling area being trampled by cattle entering the river for water. As mentioned throughout this report, the late-May flooding event affected the lower reaches of the San Marcos River more, and likely contributed to the low abundance of fountain darters observed at Todd Island. As a result of such extraneous local factors, a larger dataset is needed to understand flow-dependent relationships with fountain darter abundance in this section of river.

Presence/Absence Dip-net Surveys

Presence/absence dip netting was conducted on the San Marcos River during the spring (April), high-flow (June), summer (August), and fall (October) sampling events in 2015. Fountain darters were present at 68% of sites in spring (Figure 25). This number decreased slightly to 66% during the June high-flow event, and decreased further to 60% in the summer. The occupancy increased to 74% for the fall sampling effort. This increase in occupancy is different than what is normally observed during the fall effort. Patterns in reproduction and analysis of length-frequency data from drop-net sampling show intense reproductive activity in early spring that results in an abundance of small fountain darters, while fountain darters captured in fall samples are often fewer and larger in size. This increase in the fall 2015 sampling effort could be due to the loss of vegetation in reaches such as the Spring Lake Dam Reach that resulted in fountain darters clumping in remaining vegetation.

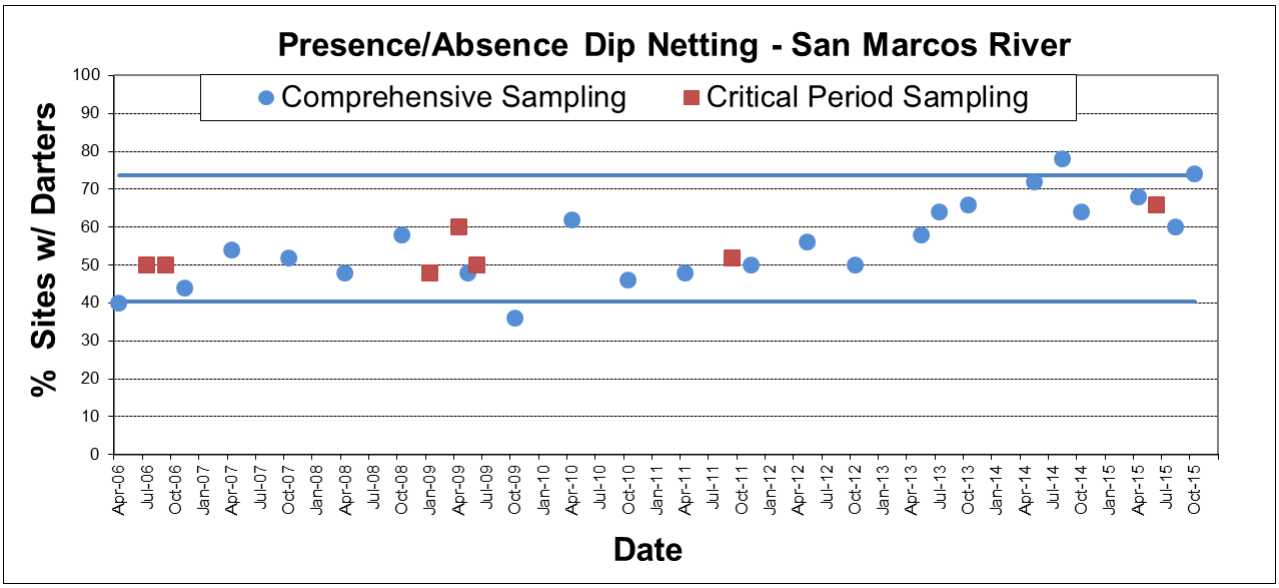

Figure 25. Percentage of sites (n=50) in which fountain darters were present. Solid blue lines mark 5th and 95th percentiles of comprehensive sampling data.

Figure 25 shows the variation observed in this metric since 2006. The average percent of sites occupied by fountain darters during comprehensive sampling is 56%, and the blue lines show the 5th and 95th percentiles of the comprehensive sampling data. It is interesting to note that only two samples have occurred outside this range. For the 2006–2014 time period, percent occupancy was lowest in fall 2009 (36%), after flows increased following a period of sustained low flows in summer 2009, and was highest in summer 2014 (78%), during a period of sustained lower-than-average flows. The mechanisms behind such fluctuations are unclear at this time.

However, additional data—along with conducting occupancy modeling with fixed-station presence/absence data—will help clarify the flow-dependent mechanisms influencing this dataset.

Fixed-station Dip Netting

In 2015, three seasonal presence/absence samples (May, August, and October) were collected in the San Marcos River. Fixed-station fountain darter presence/absence data were analyzed using the single-season occupancy model methods (MacKenzie et al. 2002) implemented in PRESENCE v7.6 (Hines 2006). The primary assumption of these single-season models is that occupancy of a site does not change permanently over the "season," an assumption likely to be met by our data because: (1) fountain darters are unlikely to move appreciably, even given drastic changes in habitat conditions; and (2) fountain darters live in a spring ecosystem, hence conditions are stable under most circumstances and typical (within year) "seasonal" movement patterns observed for some organisms (migration, etc.) have not been observed for fountain darters. However, as additional data are collected over the coming years, we will be able to apply multiple-season models and allow for estimated changes in occupancy such as colonization and local extinction. All reasonable candidate models for the San Marcos system were compared using Akaike information criterion (AIC) (Akaike 1974) and AIC weight following established best practices (Burnham and Anderson, 1998).

The "best" candidate models were selected based on lowest AIC and highest AIC weight (which is often interpreted as the probability of that model being the best of those tested). These models provide estimates of probability of occupancy (ψ, psi) and detection probability (p) for the sites sampled. Probability of occupancy may be modeled as a function of site covariates or factors that are descriptive of sites that do not change over the study period. Unfortunately, due to the dynamic nature of the morphology of the San Marcos system, as well as the unavoidable heterogeneity consequent of recreation impacts, covariates recorded and intended to be used in modeling of ψ in this fashion (vegetation type and substrate) did not meet this criteria (they varied in many cases over the study period), so ψ was modeled as static ψ (.)). On the other hand, p was modeled as static (p (.)), varying by survey (p (survey)), as well as dynamic or affected by covariates (vegetation type [veg], substrate [sub], vegetated vs. unvegetated [open]) (Table 13). Model fit of the best model selected from each analysis was evaluated using the methodology of MacKenzie and Bailey (2004) to ensure that the model was appropriate for the data.

The best model for the San Marcos River fixed-site occupancy data (model with the lowest AIC and highest AIC weight) was ψ (.), p (survey + veg) or static probability of occupancy with detection probabilities that vary by survey and vegetation type. The naïve occupancy estimate for these data was 0.92 (92%), while the derived estimate from this model was 1.0. ψ conditional, or the probability of a site being occupied based on its detection history was 1 for all sites under this model. In contrast, occupancy of the San Marcos River was estimated from the alternate sampling method (random sites) to be only 69.4%. Estimated individual detection probabilities for each site/each sample under this model ranged from 0.0 to1.0 with a mean of 0.6, SE 0.02. Model fit assessment from parametric bootstrap resampling (1,000 repetitions) and Pearson's chi-square (MacKenzie and Bailey, 2004) resulted in a test statistic of 0.914 and p value of 0.927, indicating reasonable fit of the model. Though it was not selected as the highest-ranked model, when the model ψ (.), p (survey) is used as a comparison (as it is more parsimonious),

Table 13. San Marcos River 2015 occupancy modeling results. All candidate models are listed, along with the parameterization of occupancy probability (ψ) and detection probability (p), ranked by Akaike information criterion (AIC) and AIC weight. Delta AIC is the difference in AIC between a model and the highest-ranked model, and shows the degree of difference in support.

MODEL	AIC	DELTA AIC	AIC WEIGHT
ψ (.), p(survey+veg)	171.45	0	0.9774
ψ (.), p(.+veg)	178.98	7.53	0.0226
ψ (.), p(survey)	200.84	29.39	0
ψ (.+open), p(survey)	202.76	31.31	0
ψ (.), p(survey+open)	202.81	31.36	0
ψ (.), p(survey+sub)	202.96	31.51	0
ψ (sub), p(survey)	206.02	34.57	0
ψ (.), p(.)	208.53	37.08	0
ψ(.), p(.+sub)	208.84	37.39	0
ψ (.), p(.+silt+grav)	209.26	37.81	0
ψ (.), p(.+open)	210.52	39.07	0

detection probabilities are estimated as 0.77, 0.66, and 0.44 for the 1st, 2nd, and 3rd samples, respectively. Estimates of occupancy were slightly lower than for the higher-scoring model, ψ = 0.96 and ψ conditional = 1 for all but four sites where fountain darters were not detected during any sampling event, resulting in a ψ conditional of 0.52 for these sites. In other words, these sites were given a 52% chance of being occupied by fountain darters even though fountain darters were not detected there during sampling, in contrast to the previous model that predicted that those four sites were definitely occupied even though there were no individuals detected during the first three samples taken.

The comparison of these results illustrates the importance of accounting for heterogeneity in detection probability to avoid underestimating occupancy. The addition of more data as the study progresses will refine and clarify these estimates. Fixed-station sample sites showed high rates of fountain darter occupancy under all models. In fact, even naïve estimates were very high, and both naïve and derived-occupancy estimates were higher than estimates from the random site's data (92% vs. 69%), supporting the expectation that occupancy will be underestimated using the random-site sampling scheme. Detection probabilities were also generally high, especially for an endangered species. They do, however, show a good bit of variation by survey period and other covariates under the occupancy models selected. This variation likely caused the lower estimates generated from the random sites method (where such variation in detection was not accounted for). The very high occupancy rates observed for the fixed stations suggest that monitoring sampling design may be so well geared to sampling where fountain darter occupancy is certain that we are not collecting data that encompass the total variation in the system, thereby limiting the ability to make meaningful inference from monitoring data. Thus, some modification of this sampling design may be necessary to provide inferences more directly applicable to species management. Potential modifications are currently being investigated to this end.

At this time, it appears that the fixed-station dip netting methodology will provide a more accurate estimate of occupancy to inform HCP adaptive management decisions regarding the fountain darter. However, one additional year of data collection via both presence/absence dip-netting methods will be performed to confirm this preliminary observation.

Fish Community Sampling

Twenty-six species of fishes and 3,488 individuals were identified and enumerated among four locations in the San Marcos River observed in two sampling periods (spring and summer/high-flow critical period) in 2015 (Table 14). While the overall number may seem low, this total includes only two sampling efforts. Unfortunately, the flooding event of late October interrupted fish community sampling, so it is in the process of being resampled, and the resulting data will be included in the 2016 addendum. The channel catfish (*Ictalurus punctatus*) was the only species captured in 2015 that was not reported in 2014. However, the common carp (*Cyprinus carpio*), mimic shiner (*Notropis volucellus*), sailfin molly (*Poecilia latipinna*), and warmouth (*Lepomis gulosus*) were captured in 2014 and not thus far in 2015.

Fountain darter densities increased in Spring Lake and City Park reaches and decreased at the I-35 Reach between spring (0.450 fish per m^2) and summer (0.050 fish per m^2) 2015. Fountain darters are rare in the Lower River Reach, and none were collected in either sampling period in 2015. The I-35 and Lower River reaches were more affected by scouring flood waters than Spring Lake and City Park during the late-May high-flow event. Among fishes from the I-35 and Lower River reaches, densities were less in summer than in spring, with the exception of Texas logperch (*Percina carbonaria*) and orangethroat darter (*Etheostoma spectabile*). This is likely a result of scouring and loss of aquatic vegetation in this reaches as they were most affected by the high-flow event. Among all sites, fountain darter densities were greater at the Spring Lake and City Park reaches than the I-35 and Lower River reaches before and after the late-May flooding.

San Marcos Salamander Visual Observations

As in previous years, observed San Marcos salamander densities were variable across sites in 2015. At the Hotel Site (Site 2), densities in spring 2015 were the highest (18.03 salamanders/m^2) since 2013 (Figure 26). While this was above the long-term study average, it was within one standard deviation for spring at this site. As expected, densities decreased following the first high-flow event in late May/early June (see addendum for observations on the November 2015 high-flow event 2), and was below both the fall and spring study averages. It is unclear if this is an effect of salamander movement or difficulty in searching ability following the flooding. By fall densities increased (13.17), but were still below the long-term average (Figure 26). A similar trend was observed at the Riverbed Site (Site 14) with both the spring and fall densities within one standard deviation of the study averages (Figure 27). Densities decreased slightly in spring 2015 (10.06) compared to fall 2014 (12.87). They further decreased following the high-flow event in spring to 8.99 salamanders/m^2, which was the lowest density since 2011. Densities recovered somewhat by fall (11.82), which was similar to the density during fall of 2014.

Table 14. Total number (N) of individuals and species, gear type of efficient catch-per-unit-effort (CPUE), number of individuals for gear type specified, and CPUE (number of individuals per m^2) quantified during spring and summer 2015 from four locations on the San Marcos River.

				Spring Lake		City Park		I-35		Lower River	
	Total N	Gear Type	N for gear type	Spring	Summer	Spring	Summer	Spring	Summer	Spring	Summer
Lepisosteus oculatus	3	Meso	3	<0.001	0.001	0	0	0	0	0	0
Cyprinella venusta	40	Seine	40			0	0	0	0	0.081	0.055
Dionda nigrotaeniata	1,102	Meso	1,091	0.073	0.273	0	0	0	0	0	0
Notropis amabilis	15	Seine	13			0.005	0	0	0	0.024	0
Notropis chalybaeus	8	Seine	8			0.003	0	0.020	0	0	0
Macrhybopsis marconis	1	Seine	1			0	0	0	0	0.002	0
Moxostoma congestum	2	Meso	2	<0.001	0	0.001	0	0	0	0	0
Astyanax mexicanus	817	Meso	766	0.057	0.114	0	0	0	0	0	0
Ameiurus natalis	1	Seine	1			0.002	0	0	0	0	0
Ictalurus punctatus	2	Seine	0			0	0	0	0	0	0
Hypostomus plecostomus	93	Meso	62	0.007	0	0.001	0	0	0	0.025	0.012
Gambusia affinis	5	Seine	5			0.008	0	0	0	0	0
Gambusia geiseri	148	Seine	148			0.218	0.050	0	0.010	0.002	0
Gambusia	99	Meso	95	0	0.033	0	0.014	0	0	0	0
Ambloplites rupestris	4	Meso	2	<0.001	0	0.001	0	0	0	0	0
Lepomis auritus	242	Meso	221	0.016	0.026	0.030	0.015	0	0	0	0
Lepomis macrochirus	167	Meso	157	0.015	0.027	0.001	0.003	0	0	0	0
Lepomis megalotis	18	Meso	15	0.000	0.007	0	0.001	0	0	0	0
Lepomis microlophus	86	Meso	85	0.004	0.025	0	0	0	0	0	0
Lepomis miniatus	8	Seine	4			0.005	0.003	0	0	0	0
Lepomis	181	Meso	170	0.016	0.003	0.011	0.015	0.005	0	0.008	0.005
Micropterus salmoides	140	Meso	129	0.009	0.021	0.006	0.003	0	0.002	0.004	0.001
Etheostoma fonticola	217	Micro	196	0.133	0.975	0.188	0.344	0.450	0.050	0	0
Etheostoma spectabile	8	Seine	8			0	0	0	0	0.010	0.038
Percina apristis	35	Seine	31			0.002	0.020	0.027	0.01	0.029	0.007
Percina carbonaria	28	Seine	21			0	0	0	0	0.026	0.083
Percina	1	Micro	1	0	0	0	0	0	0	0.006	0
Herichthys cyanoguttatus	15	Meso	14	0.001	0	0.002	0.001	0	0.004	0	0
Oreochromis aureus	2	Meso	2	<0.001	0	0.001	0	0	0	0	0
Total N	3,488										
Procambarus	52	Micro	40	0.017	0.108	0.025	0.006	0.350	0	0.025	0.050

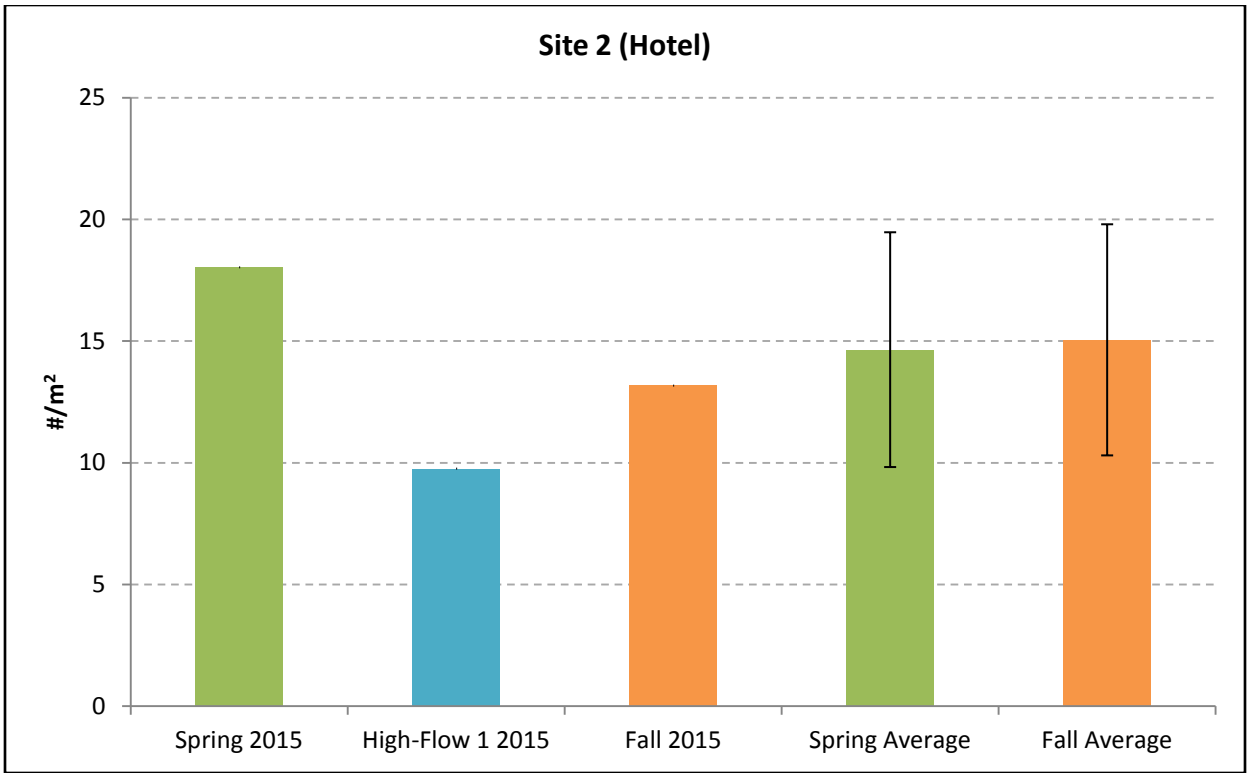

Figure 26. **San Marcos salamander densities at Site 2 (Hotel Site) in 2015. Long-term study averages are provided with error bars representing one standard deviation from the mean.**

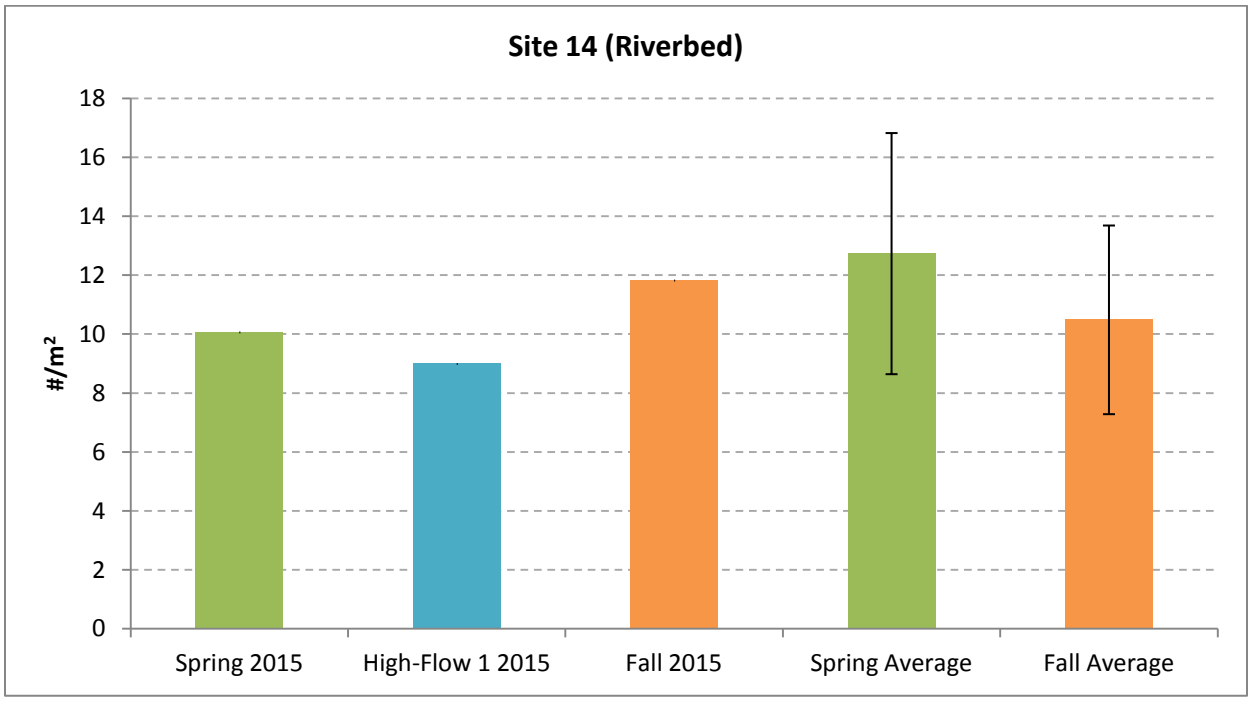

Figure 27. **San Marcos salamander densities at Site 14 (Riverbed Site) in 2015. Long-term study averages are provided with error bars representing one standard deviation from the mean.**

San Marcos salamander densities at the Spring Lake Dam Site (Site 21) were more robust in 2015 compared to the Spring Lake sites (Figure 28). Of the three sampling areas surveyed for salamanders, this site is the only one located within the San Marcos River. This site is heavily recreated, so rocks and other salamander cover objects are often disturbed by visitors. This disturbance is thought to be the underlying cause behind the lower overall salamander counts at the site compared to Spring Lake. However, salamander densities were higher than the long-term averages in both spring and fall (Figure 28). The density in spring 2015 (8.73) was lower than in fall 2014 (10.84), but still higher than one standard deviation of the long-term spring average, and may reflect changes from the higher flows in 2015. Like the other sites, the density decreased (6.18) following the spring high-flow event, but recovered by fall (8.73). The fall density at the Spring Lake Dam Site was higher than at the long-term average, but within one standard deviation. The higher densities observed at this site in 2014–2015 may be a result of perceived lower recreation pressure in this reach due to the removal of the apartment complex, and excluding eastern access points that were present since the start of the study. Although rocks are clearly still being moved around, it does not appear that it is occurring as frequently, but an in-depth analysis of recreation pressure at this site is needed to further explore its effects.

San Marcos salamander survey at the Spring Lake Dam Site in 2015.

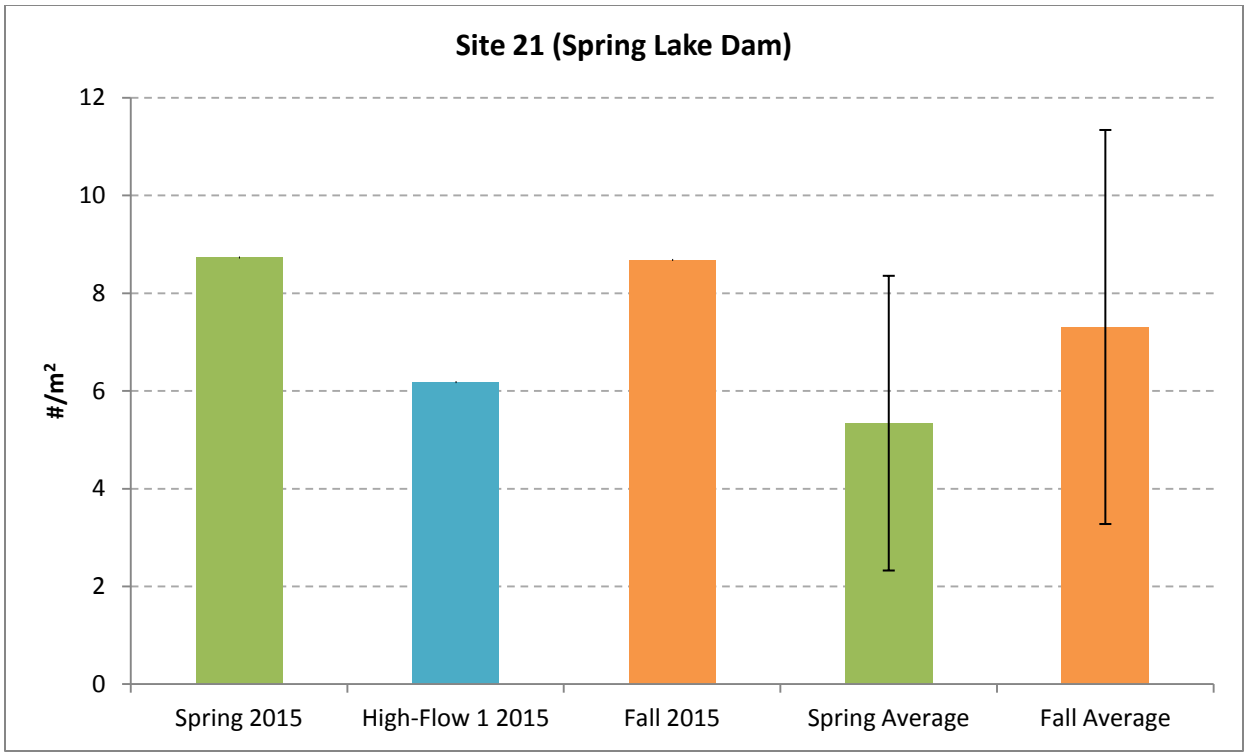

Figure 28. San Marcos salamander densities at Site 21 (Spring Lake Dam Site) in 2015. Long-term study averages are provided with error bars representing one standard deviation from the mean.

San Marcos salamander densities at all sites were within (or above) the long-term study averages standard deviation at all sites in 2015. While densities decreased following the spring high-flow event, much of the flooding in the San Marcos River was confined to the lower reaches, which are outside of the San Marcos salamander's range. The November high-flow flooding event was very different in nature. This flooding was mostly generated in the upper reaches of the San Marcos River, in particular the Sink Creek and Purgatory Creek drainages. While the Purgatory Creek confluence is below the downstream extent of the salamander's range, the flooding at Sink Creek and the Slough Arm of Spring Lake may have a large effect on population densities at all sites.

These results will be presented in the 2016 addendum.

Macroinvertebrate Community

Over the course of 2015 macroinvertebrate community sampling efforts in the San Marcos system, 5,855 organisms were collected during the spring comprehensive sampling event and 3,331 organisms were collected during the fall comprehensive sampling event (counts include Cladocera, Euhirundea, Gastropoda, Oligochaeta, and Ostracoda). Of the three study reaches sampled in spring and fall 2015, the I-35 Reach had the highest total count of organisms collected (*n*=3,356, 36.5%), followed closely by City Park (*n*=3,316, 36.1%) and the Spring Lake Dam reaches (*n*=2,514, 27.4%) (Table 15). In addition, snails contribute to a large portion of the macroinvertebrate community, with the I-35 Reach exhibiting the highest number and greatest relative proportion (*n*=1,115, 33.2%), followed by Spring Lake Dam (*n*=479, 19.0%), and City Park reaches (*n*=342, 10.3%). Indeed, when comparing reaches for relative abundance

of all macroinvertebrates collected *excluding* snails, the reach with the highest macroinvertebrate abundance was City Park Reach (*n*=2,974, 41.0%), followed by I-35 Reach (*n*=2,241, 30.9%), and the Spring Lake Dam Reach (*n*=2,035, 28.1%).

Between 2015 spring and fall sampling efforts, organisms were collected from 17 distinct taxonomic orders/classes, 38 distinct families, and 53 taxonomic subfamilies/genera/species from the San Marcos system (Table 16). Amphipoda and Gastropoda comprised 64% of all organisms sampled during spring and fall 2014 (43% [*n*=3,985] and 21% [1,936], respectively) (Figure 29). Taxonomic diversity varied between reaches (Figure 30). Amphipods were most dominant in the Spring Lake Dam Reach (*n*=1,573, 61%), followed by the City Park (*n*=1,256, 38%) and I-35 reaches (*n*=1,192, 36%), while dipterans were very common at the City Park Reach only (*n*=609, 18%) (Figure 30). While gastropods were common at all reaches, they were relatively less common at the City Park Reach (*n*=342, 19%). Mayflies (Ephemeroptera) were also common at all reaches, which is important because they make up a portion of the preferred diet of fountain darters (Schenck and Whiteside 1977).

Table 15. Summary of count and taxonomic richness data from spring and fall 2015 in the San Marcos River.

REACH	NUMBER ORGANISMS COLLECTED	NUMBER ORGANISMS COLLECTED (ALL MACROINVERTEBRATES EXCEPT SNAILS)	FOUNTAIN DARTER PREY ORGANISMS	NUMBER OF UNIQUE TAXA IDENTIFIED
Spring Lake Dam	2,514	2,035	1,982	39
City Park	3,316	2,974	2,875	47
I-35	3,356	2,241	2,128	44
All sites	9,186	7,250	6,985	64

Table 16. Number of distinct macroinvertebrate taxa and taxonomic orders/classes, families, and genera identified from each reach during 2015 spring, and fall sampling events. [a, b]

2015 SAMPLING EVENT	NUMBER OF TAXONOMIC ORDERS/CLASSES COLLECTED [a]	NUMBER OF TAXONOMIC FAMILIES COLLECTED [b]	NUMBER OF TAXONOMIC SUBFAMILIES/GENERA/SPECIES COLLECTED [b]
Spring	15	32	40
Fall	14	29	42
Total	17	38	53

[a] Includes orders/classes Cladocera, Euhirundea, Gastropoda, Oligochaeta, and Ostracoda. [b] Some organisms were only identified to order/class or family; such taxa therefore not accounted for in the tallies of taxonomic categories lower than the level of identification achieved.

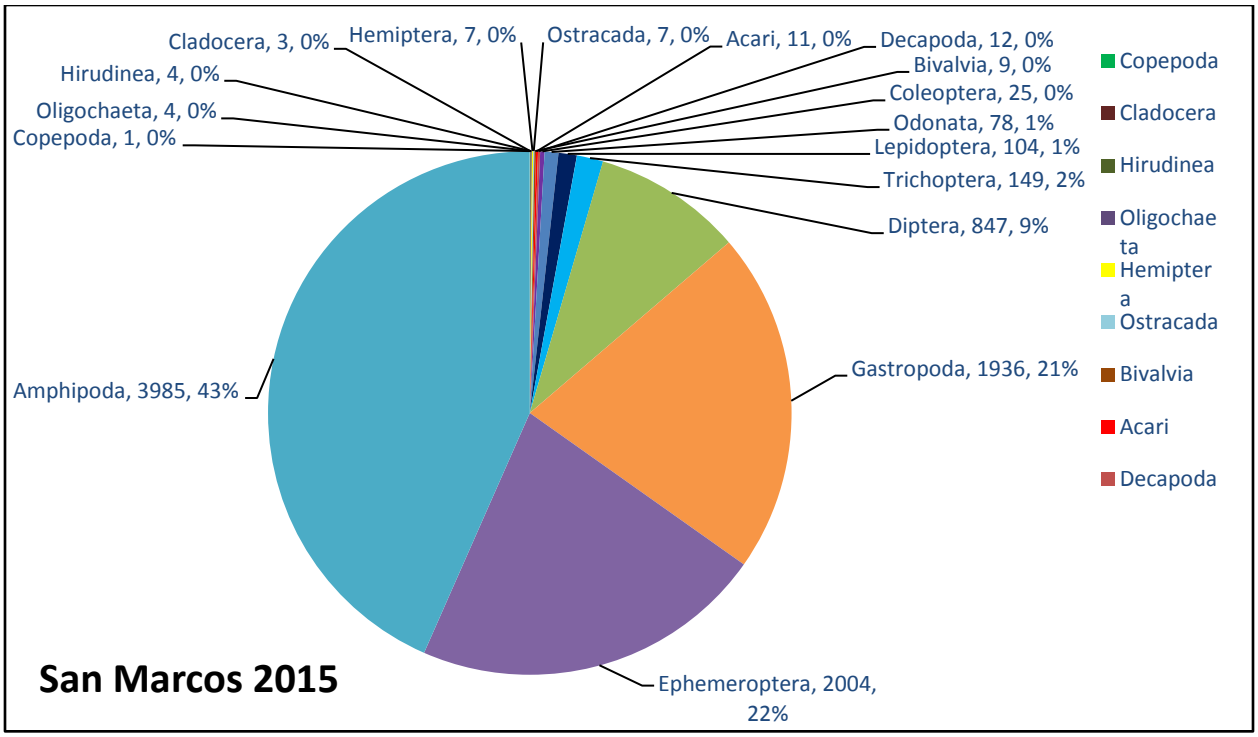

Figure 29. **Relative percentage of macroinvertebrate abundance by order/class from combined 2015 spring and fall comprehensive sampling events in the San Marcos system. Data labels show frequency and relative percent abundance of each order/class collected.**

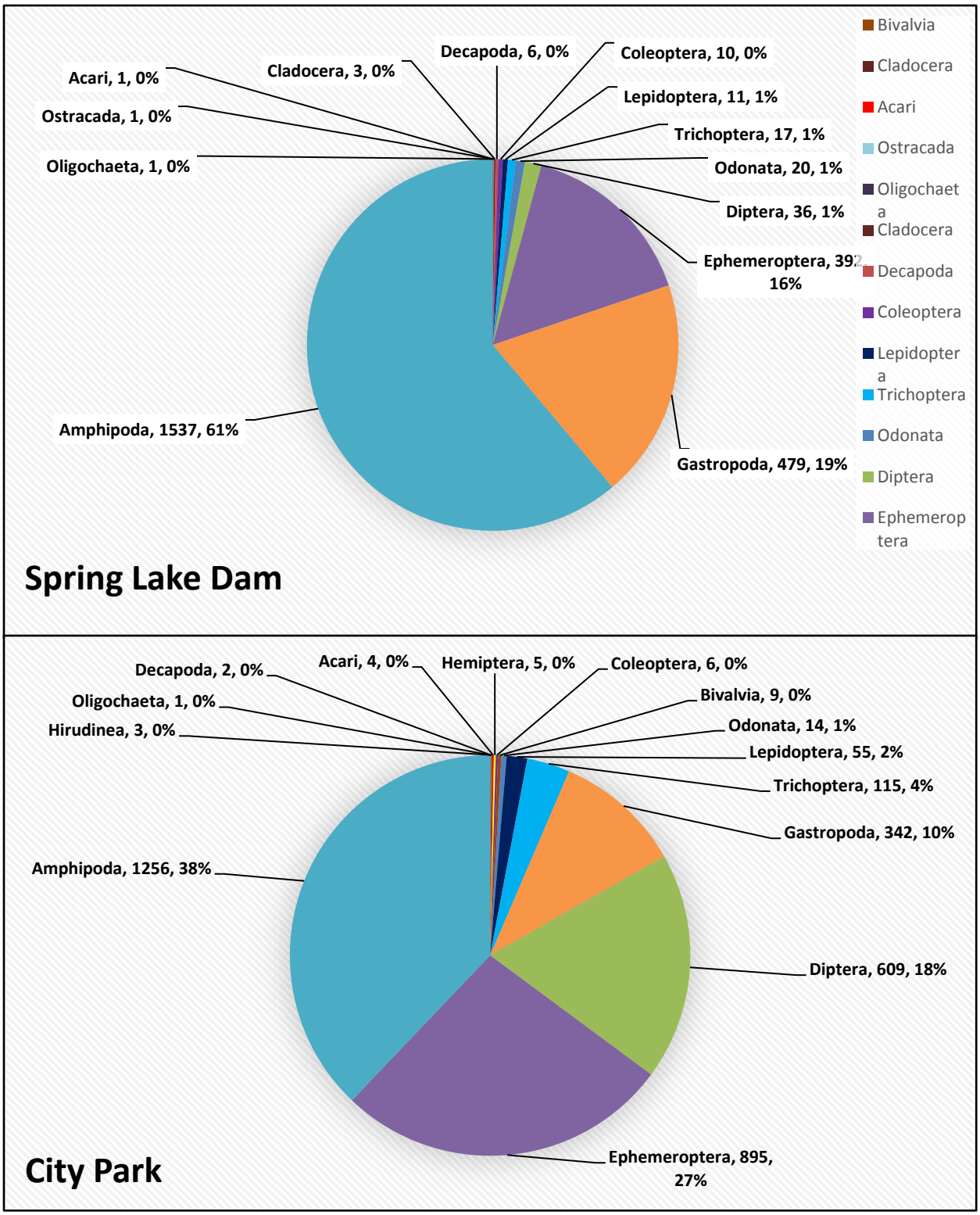

Figure 30. **Frequencies and relative percentage of macroinvertebrate abundance by order/class from combined 2015 spring and fall comprehensive sampling events in the San Marcos system. Data labels show frequency and relative percent abundance of each order/class collected.**

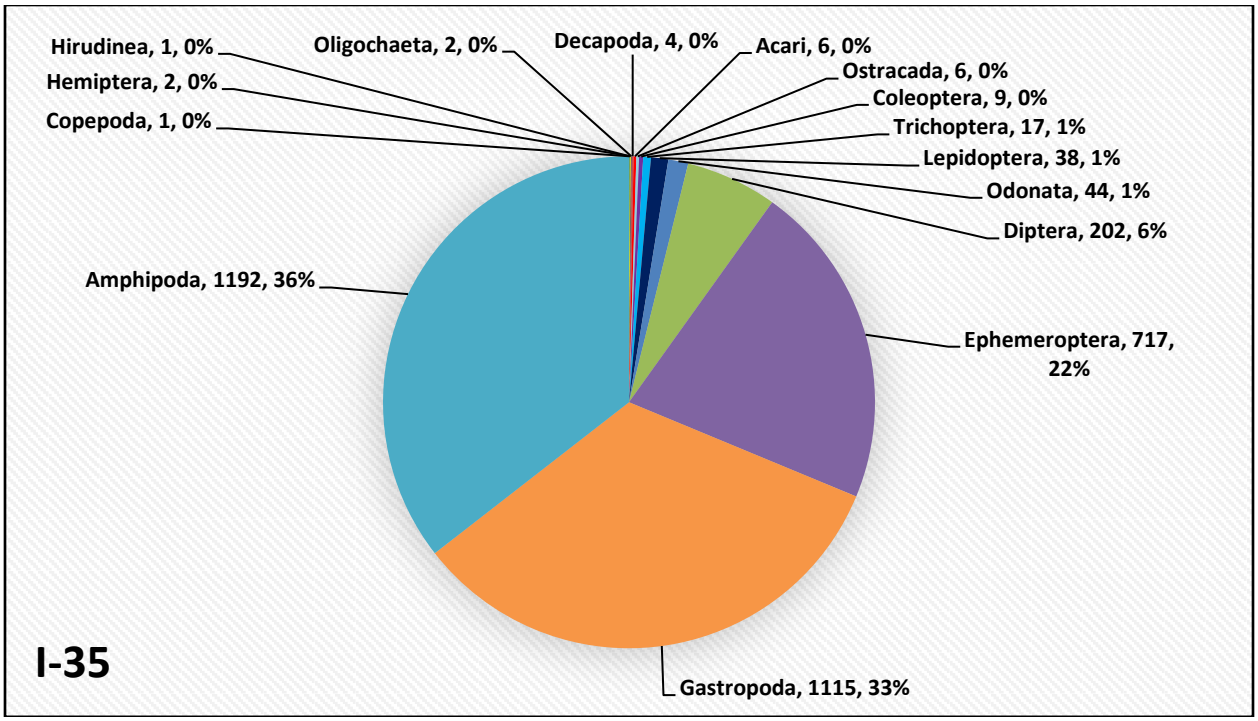

Figure 30. (Continued.) Frequencies and relative percentage of macroinvertebrate abundance by order/class from combined 2015 spring and fall comprehensive sampling events in the San Marcos system. Data labels show frequency and relative percent abundance of each order/class collected.

Relative percent abundance of four macroinvertebrate orders/classes (Amphipoda, Diptera, Ephemeroptera, and Trichoptera) representative of fountain darter food sources (Schenk and Whiteside 1977) were examined in order to better understand factors affecting fountain darter prey availability. Between the three San Marcos River sample reaches, City Park Reach had the highest abundance of fountain darter prey taxa (*n*=2,875, 41.2%), followed by the I-35 Reach (*n*=2,128, 30.5%) and Spring Lake Dam Reach (*n*=1,982, 28.4%) (Note: one less vegetation type was sampled at the Spring Lake Dam Reach in fall due to lack of ample vegetation) (Table 17). It is interesting to note that this trend closely matches that of relative abundance of all collected macroinvertebrates when snails are excluded (i.e., within 1 percentage point for all relative percent abundances), ostensibly due to the fact that fountain darter prey taxa comprise the vast bulk of all non-snail macroinvertebrates collected at each reach: 97.4% at Spring Lake Dam Reach, 96.7% at City Park Reach, and 95.0% at the I-35 Reach. Relative abundance of all fountain darter prey taxa was higher in spring (*n*=4,636, 66.4%) than in fall (*n*=2,349, 33.6%), most likely due to larval-to-adult ecdysis and emergence of many species grouped within the fountain darter prey taxa.

In terms of prey availability to fountain darters, amphipods and mayflies were the most commonly collected (Figure 31). Amphipods made up the largest proportion of prey at the Spring Lake Dam Reach (77%), followed by the I-35 (56%) and City Park reaches (44%). While mayflies were common prey items at all reaches, only the City Park Reach had a large proportion of true flies (Diptera, 21%).

Table 17. Average abundance of fountain darter prey taxa collected per sampling event by reach and vegetation type; values are from 2015 spring, fall, and combined macroinvertebrate collection efforts in the San Marcos system.

REACH	VEGETATION SAMPLED	NO. OF FOOD SOURCE ORGANISMS PER VEGETATION TYPE IN SPRING 2015 [a]	NO. OF FOOD SOURCE ORGANISMS PER VEGETATION TYPE IN FALL 2015[a]	AVERAGE NO. OF FOOD SOURCE ORGANISMS PER VEGETATION TYPE IN 2015 [a]
Spring Lake Dam	*Hydrilla*	903, n=1	394, n=1	648.5±359.92, n=2
Spring Lake Dam	*Hygrophila*	101, n=1	46, n=1	73.5±38.89, n=2
Spring Lake Dam	*Potamogeton*	4, n=1	244, n=1	124.0±169.71, n=2
Spring Lake Dam	*Sagittaria*	65, n=1	159, n=1	112.0±66.47, n=2
Spring Lake Dam	*Vallisneria*	66, n=1	Not sampled [b]	Not sampled [b]
City Park	*Hydrilla*	725, n=1	670, n=1	697.5±38.89, n=2
City Park	*Hygrophila*	276, n=1	53, n=1	164.5±157.68, n=2
City Park	*Potamogeton*	845, n=1	191, n=1	518.0±462.45, n=2
City Park	*Sagittaria*	93, n=1	22, n=1	57.5±50.20, n=2
I-35	*Cabomba*	1354, n=1	228, n=1	791.0±796.20, n=2
I-35	*Hygrophila*	168, n=1	57, n=1	112.5±78.49, n=2
I-35	*Hydrilla*	17, n=1	276, n=1	146.5±183.14, n=2
I-35	*Ludwigia*	19, n=1	9, n=1	14.0±7.07, n=2

[a] Includes only Amphipoda, Diptera, Ephemeroptera, and Trichoptera (Schenk and Whiteside, 1977).
[b] Not sampled = Reach not sampled for this vegetation type during this event.

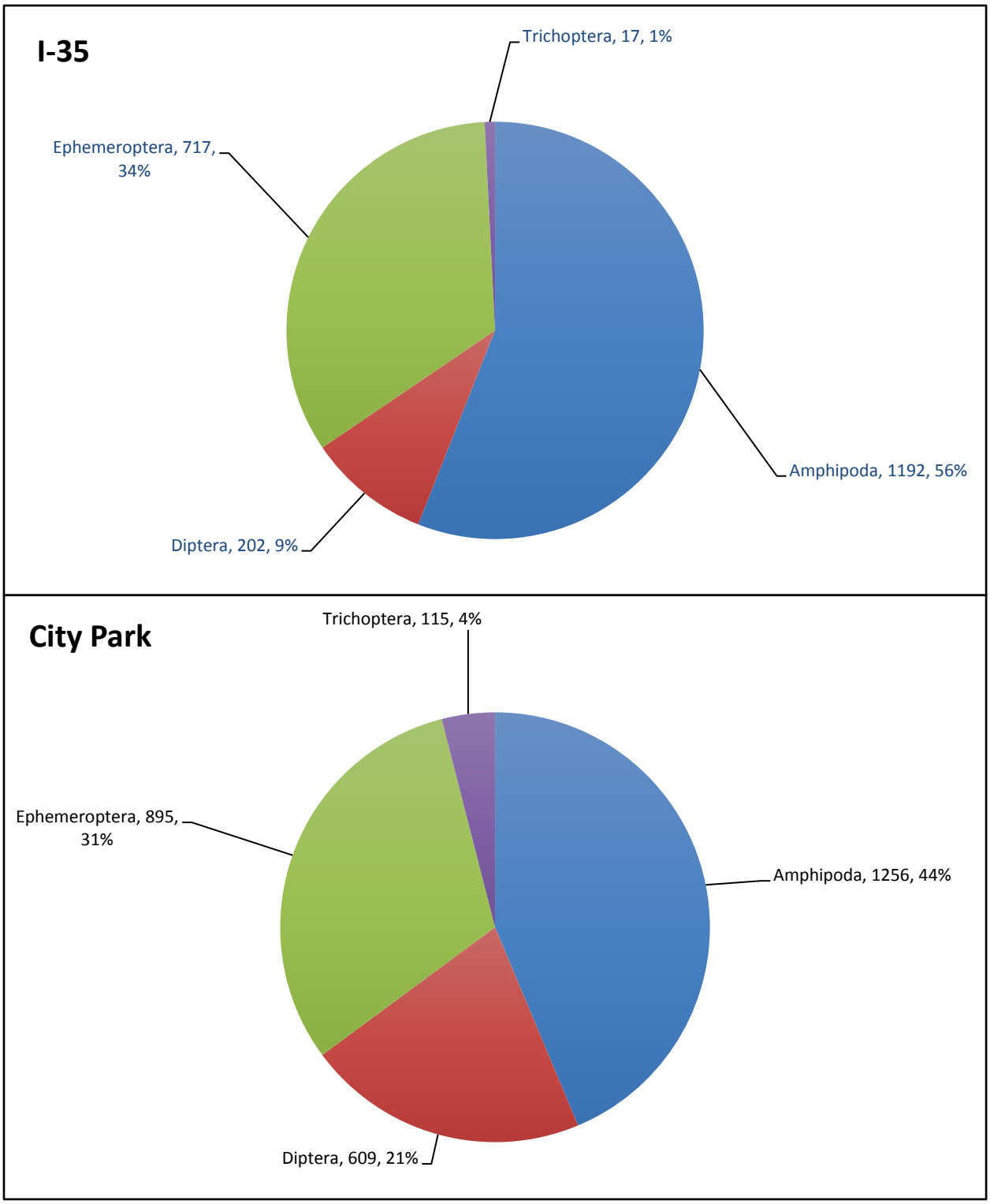

Figure 31. **Relative percent abundance of four macroinvertebrate taxa (Amphipoda, Diptera, Ephemeroptera, Trichoptera) representative of fountain darter food sources collected by dominant vegetation type in each reach of the San Marcos system during 2015 spring and fall comprehensive monitoring events.**

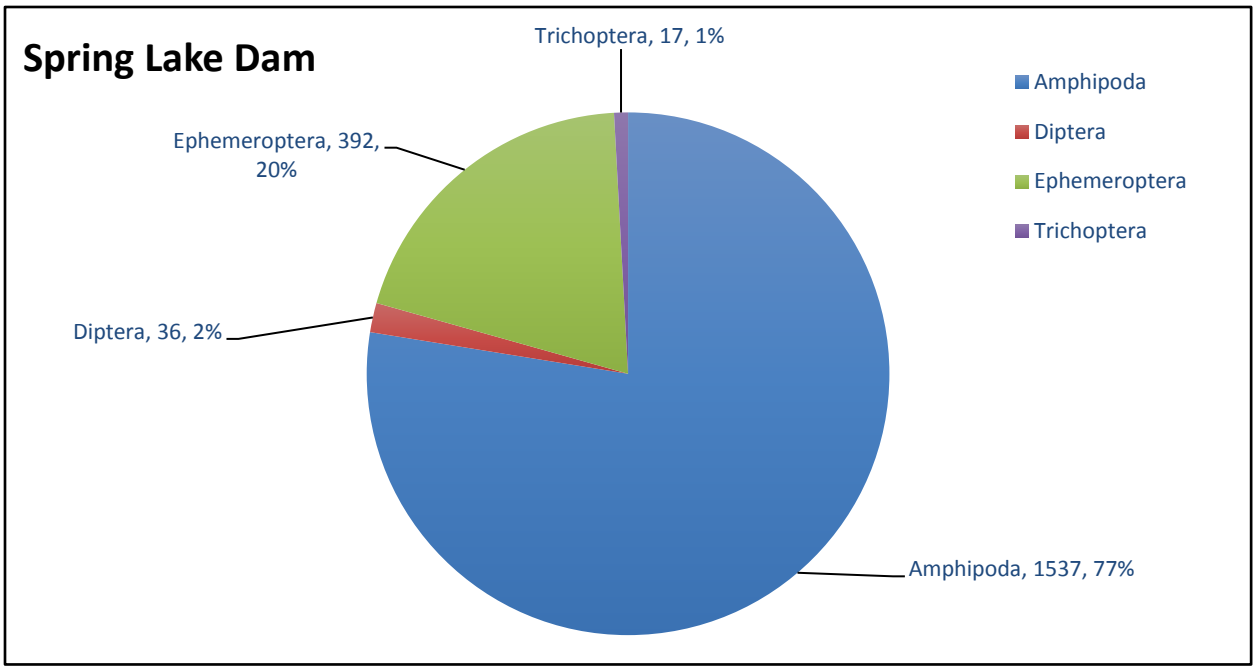

Figure 31. (Continued.) Relative percent abundance of four macroinvertebrate taxa (Amphipoda, Diptera, Ephemeroptera, Trichoptera) representative of fountain darter food sources collected by dominant vegetation type in each reach of the San Marcos system during 2015 spring and fall comprehensive monitoring events.

CONCLUSIONS

Lower-than-average flows resulting from the prolonged drought in central Texas was the central theme for 2014. However, unlike the Comal River, flow in the San Marcos River was relatively stable with average monthly discharge fluctuating between 110 and 160 cfs. The weather pattern in 2015 shifted, which resulted in major precipitation events that caused flooding in and around the San Marcos River watershed. Over Memorial Day weekend, historic flooding in the Blanco River caused water to back up into the San Marcos River, resulting in a high-flow Critical Period sampling effort. Typically, high-flow events result in scouring of vegetation and shifting sediment, which affects all biota in the river. However, because the flow came upstream from the Blanco River, most habitats and the biota in the San Marcos River were relatively unaffected. Some limited scouring did occur in the I-35 Reach due to its proximity to the Blanco River confluence. Thermistor temperature data and standard water quality parameters collected in conjunction with biological sampling indicated that the water quality of the San Marcos system was sufficient to support the system's endangered species and endangered species habitat. Mapping in summer 2015 revealed that Texas wild-rice coverage surpassed 7,000 m^2 for this first time since this study began. This milestone is the result of HCP planting and concentrated efforts to protect this endangered species.

By fall 2015, recreation pressure was the driving force affecting aquatic vegetation in certain areas of the river. Most notably, nearly all of the submerged aquatic vegetation in the Spring Lake Dam Reach was lost over the summer near where bank restoration construction allowed for easier access to the river. Similar losses of aquatic vegetation occurred in the City Park Reach, which is typical during the summer months. The I-35 Reach was relatively unaffected due to limited recreation access points, highlighting the fact that the designed modification of access points has limited pressure to aquatic vegetation (including Texas wild-rice) in other sections of the river.

Undoubtedly, the greatest driving factor affecting the biota and endangered species of the San Marcos River in 2015 was the flooding event at the end of October. Although the USGS has yet to estimate the peak flow of this event, the damage wrought throughout the City of San Marcos indicates it was significant. Unlike the late-May event, most of the flow came in from the Sink Creek and Purgatory Creek watersheds. These creeks enter the San Marcos River at Spring Lake (Sink Creek) and immediately below Hopkins Street (Purgatory Creek). All of the study reaches were affected by this flood. A description of the data collected and results obtained from follow-up biological monitoring will be presented in an addendum to this report in early 2016.

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APPENDIX A: CRITICAL PERIOD MONITORING SCHEDULES

SAN MARCOS RIVER/SPRINGS
Critical Period Low-Flow Sampling – Schedule and Parameters

FLOW TRIGGER (+ or - 5 cfs)	**PARAMETERS**
120 cfs	Wild Rice vulnerable stands - Every 5 cfs decline (maximum weekly)
100 cfs	Full Sampling Event
100 cfs - 85 cfs	Habitat Evaluations - Every 5 cfs decline (maximum weekly)
85 cfs	Full Sampling Event
85 cfs - 60 cfs	Habitat Evaluations - Every 5 cfs decline (maximum weekly)
60 cfs	Full Sampling Event
60 cfs - 25 cfs	Habitat Evaluations - Every 5 cfs decline (maximum weekly)
25 cfs	Full Sampling Event
25 cfs - 0 cfs	Habitat Evaluations - Every 5 cfs decline (maximum weekly)
10 - 0 cfs	Full Sampling Event
RECOVERY	
25 cfs - 85 cfs	Full Sampling Event (dependant on flow stabilization)
85 cfs - 125 cfs	Full Sampling Event (dependant on flow stabilization)

PARAMETER DESCRIPTION

Wild Rice Monitoring	Physical changes vulnerable stands
Full Sampling Event	Aquatic Vegetation Mapping - including Texas Wild-Rice Fountain Darter Sampling Drop Net, Dip net (Presence/Absence), and Visual Parasite evaluations Fish Community Sampling Salamander Sampling - Visual Fish sampling - Exotics / Predation (85 cfs and below) Water Quality - Suite I and Suite II
Habitat Evaluations	Photographs

SAN MARCOS RIVER/SPRINGS
Species-Specific Triggered Sampling (New HCP component 2013)

Flow Rate (+ or - 10 cfs)	Species	Frequency	Parameter
≤80 cfs or ≥ 50 cfs continuing until flow rate restores to ≥100 cfs	fountain darter	every other month	Aquatic vegetation mapping at Spring Lake Dam reach, City Park reach, and IH-35 reach
≤80 cfs or ≥ 50 cfs continuing until flow rate restores to ≥100 cfs	fountain darter	every other month	Conduct dip net sampling/visual parasite evaluations at 50 sites in high quality habitat to include fifteen (15) sites in Spring Lake Dam reach; twenty (20) sites in City Park reach, and fifteen (15) sites in IH-35 reach.
≤50 cfs	fountain darter	monthly	Aquatic vegetation mapping at Spring Lake Dam reach, City Park reach, and IH-35 reach
≤50 cfs	fountain darter	weekly	Conduct dip net sampling/visual parasite evaluations at 50 sites in high quality habitat to include fifteen (15) sites in Spring Lake Dam reach; twenty (20) sites in City Park reach, and fifteen (15) sites in IH-35 reach.
≤80 cfs or ≥ 50 cfs	San Marcos salamander	every other week	Salamander surveys (SCUBA and snorkel) will be conducted at the Hotel Area, Riverbed area, and eastern spillway of Spring Lake Dam
<50 cfs	San Marcos salamander	weekly	Salamander surveys (SCUBA and snorkel) will be conducted at the Hotel Area, Riverbed area, and eastern spillway of Spring Lake Dam
100 cfs	Texas wild-rice	once	Mapping of Texas wild-rice coverage for the entire San Marcos River will be conducted
≤100 cfs or ≥60 cfs	Texas wild-rice	every other week	Physical parameters of Texas wild-rice will be monitored in designated "vulnerable" areas
<80 cfs	Texas wild-rice	monthly	Mapping of Texas wild-rice coverage for the entire San Marcos River will be conducted
<80 cfs	Texas wild-rice	weekly	Physical visual observations of Texas wild-rice will occur

APPENDIX B: AQUATIC VEGETATION MAPS

Spring Lake Dam Reach

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study Reach
April 2015

Surveyed: April 14, 2015

SPRING LAKE DAM

Study Reach	4,381.9 m^2

Vegetation Types

Zizania	748.4 m^2
Hydrilla	194.1 m^2
Hydrocotyle	81.1 m^2
Hygrophila	61.9 m^2
Bacopa	0.4 m^2
Potamogeton	107.9 m^2
Sagittaria	12.3 m^2
Vallisneria	63.1 m^2

0 25 50 100 Feet

0 10 20 Meters

N

BIO-WEST
www.bio-west.com
512.990.3954

Projection: UTM, NAD 83, 14 North
Map Revised: December 15, 2014

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study Reach
June 2015

Surveyed: June 5, 2015

SPRING LAKE DAM

Study Reach	4,381.9 m^2

Vegetation Types

Zizania	730.6 m^2
Hydrilla	21.3 m^2
Hydrocotyle	142.5 m^2
Hygrophila	63.5 m^2
Ludwigia	3.1 m^2
Potamogeton	63.7 m^2
Sagittaria	20.0 m^2
Vallisneria	17.0 m^2

0 25 50 100 Feet

0 10 20 Meters

N

BIO-WEST
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Projection: UTM, NAD 83, 14 North
Map Revised: December 15, 2014

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study Reach
October 2015

Surveyed: October 12, 2015

SPRING LAKE DAM

Study Reach	4,381.9 m^2

Vegetation Types

Zizania	656.5 m^2
Hydrilla	30.5 m^2
Hydrocotyle	28.1 m^2
Hygrophila	58.1 m^2
Ludwigia	1.4 m^2
Potamogeton	6.0 m^2
Sagittaria	21.1 m^2
Vallisneria	2.7 m^2

0 25 50 100 Feet

0 10 20 Meters

N

BIO-WEST
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Projection: UTM, NAD 83, 14 North
Map Revised: December 15, 2014

City Park Reach

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study Reach
April 2015

Surveyed: April 15-16, 2015

City Park

Study Reach	6,389.0 m^2

Vegetation Types

Zizania	1,344.8 m^2
Vallisneria	4.7 m^2
Heteranthera	15.9 m^2
Hydrilla	1,097.7 m^2
Hygrophila	640.0 m^2
Ludwigia	5.3 m^2
Nasturtium	43.3 m^2
Potamogeton	107.3 m^2
Sagittaria	128.5 m^2

0 37.5 75 150 Feet

0 20 40 Meters

N

BIO-WEST
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512.990.3954

Projection: UTM, NAD 83, 14 North
Map Revised: November 24, 2014

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study Reach
June 2015

Surveyed: June 4-5, 2015

City Park

Study Reach	6,389.0 m^2

Vegetation Types

Zizania	1,470.2 m^2
Bacopa	1.2 m^2
Heteranthera	34.2 m^2
Hydrilla	640.4 m^2
Hygrophila	448.6 m^2
Ludwigia	10.8 m^2
Nasturtium	7.0 m^2
Potamogeton	58.1 m^2
Sagittaria	120.4 m^2

0 37.5 75 150 Feet

0 20 40 Meters

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BIO-WEST
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Projection: UTM, NAD 83, 14 North
Map Revised: November 24, 2014

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study Reach
October 2015

Surveyed: October 14, 2015

City Park

Study Reach	6,389.0 m^2

Vegetation Types

Zizania	1,448.9 m^2
Bacopa	1.2 m^2
Heteranthera	8.9 m^2
Hydrilla	750.9 m^2
Hygrophila	294.6 m^2
Ludwigia	1.7 m^2
Nasturtium	7.0 m^2
Potamogeton	59.0 m^2
Sagittaria	129.1 m^2

0 37.5 75 150 Feet

0 20 40 Meters

N

BIO-WEST
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Projection: UTM, NAD 83, 14 North
Map Revised: November 24, 2014

I-35 Reach

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study Reach
April 2015

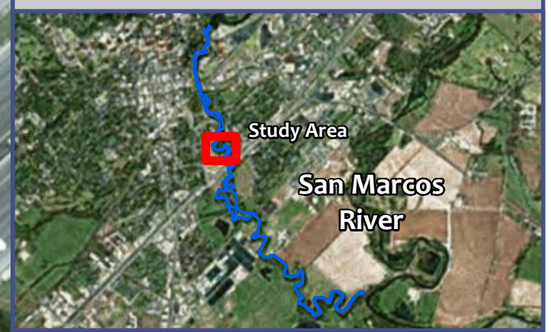
Surveyed: April 13-14, 2015

I - 35

Study Reach	10,969.7 m^2

Vegetation Types

Zizania	424.0 m^2
Acmella	41.4 m^2
Bryophytes	4.8 m^2
Cabomba	161.9 m^2
Colocasia	35.5 m^2
Hydrilla	781.5 m^2
Hygrophila	349.1 m^2
Ludwigia	19.0 m^2
Nuphar	22.7 m^2
Sagittaria	212.5 m^2



0 50 100 200 Feet

0 20 40 Meters

N

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Projection: UTM, NAD 83, 14 North
Map Revised: November 24, 2014

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study Reach
June 2015

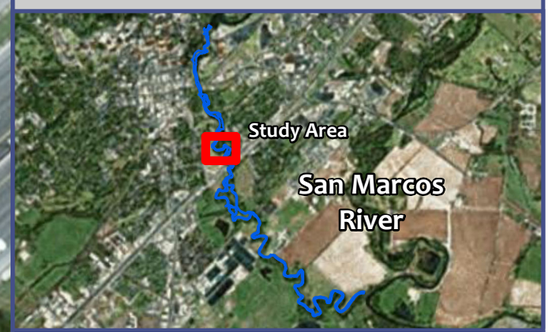
Surveyed: June 8-9, 2015

I - 35

Study Reach	10,969.7 m^2

Vegetation Types

Zizania	308.0 m^2
Acmella	25.5 m^2
Bacopa	6.4 m^2
Cabomba	183.2 m^2
Colocasia	55.1 m^2
Hydrilla	312.4 m^2
Hygrophila	239.6 m^2
Ludwigia	74.5 m^2
Nuphar	12.8 m^2
Sagittaria	241.9 m^2



0 50 100 200 Feet

0 20 40 Meters

N

BIO-WEST
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Projection: UTM, NAD 83, 14 North
Map Revised: November 24, 2014

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study Reach
October 2015

Surveyed: October 13, 2015

I - 35

Study Reach	10,969.7 m^2

Vegetation Types

Zizania	374.2 m^2
Bryophytes	16.0 m^2
Cabomba	251.8 m^2
Ceratophyllum	10.3 m^2
Colocasia	15.5 m^2
Heteranthera	1.1 m^2
Hydrilla	180.7 m^2
Hygrophila	522.8 m^2
Ludwigia	73.3 m^2
Nuphar	17.9 m^2
Sagittaria	271.2 m^2

0 50 100 200 Feet

0 20 40 Meters

N

BIO-WEST
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512.990.3954

Projection: UTM, NAD 83, 14 North
Map Revised: November 24, 2014

Texas Wild Rice

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study
Texas Wild Rice, June 2015

FULL SYSTEM MAP

San Marcos River's Edge

Vegetation Types

Zizania

Zizania Cover for Full System = 7,489.0 m^2

0 50 100 200 Feet

0 20 40 Meters

N

BIO-WEST
www.bio-west.com
512.990.3954

Projection: UTM, NAD 83, 14 North
Map Revised: December 15, 2014

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study
Texas Wild Rice, June 2015

FULL SYSTEM MAP

San Marcos River's Edge

Vegetation Types

Zizania

Zizania Cover for Full System = 7,489.0 m^2

0 50 100 200 Feet

0 20 40 Meters

N

BIO-WEST
www.bio-west.com
512.990.3954

Projection: UTM, NAD 83, 14 North
Map Revised: December 15, 2014

SAN MARCOS RIVER
San Marcos, Texas

Aquatic Vegetation Study
Texas Wild Rice, June 2015

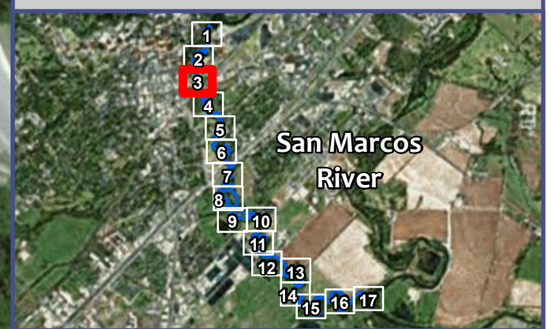
FULL SYSTEM MAP

San Marcos River's Edge

Vegetation Types

Zizania

Zizania Cover for Full System = 7,489.0 m^2



0 50 100 200 Feet

0 20 40 Meters

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BIO-WEST
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Projection: UTM, NAD 83, 14 North
Map Revised: December 15, 2014

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study
Texas Wild Rice, June 2015

FULL SYSTEM MAP

San Marcos River's Edge

Vegetation Types

Zizania

Zizania Cover for Full System = 7,489.0 m^2

0 50 100 200 Feet

0 20 40 Meters

N

BIO-WEST
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Projection: UTM, NAD 83, 14 North
Map Revised: December 15, 2014

SAN MARCOS RIVER

San Marcos, Texas

Aquatic Vegetation Study
Texas Wild Rice, June 2015

FULL SYSTEM MAP

San Marcos River's Edge

Vegetation Types

Zizania

Zizania Cover for Full System = 7,489.0 m^2

0 50 100 200 Feet

0 20 40 Meters

N

BIO-WEST
www.bio-west.com
512.990.3954

Projection: UTM, NAD 83, 14 North
Map Revised: December 15, 2014

SAN MARCOS RIVER
San Marcos, Texas

Aquatic Vegetation Study
Texas Wild Rice, June 2015

FULL SYSTEM MAP

San Marcos River's Edge

Vegetation Types

Zizania

Zizania Cover for Full System = 7,489.0 m^2

0 50 100 200 Feet

0 20 40 Meters

N

BIO-WEST
www.bio-west.com
512.990.3954

Projection: UTM, NAD 83, 14 North
Map Revised: December 15, 2014

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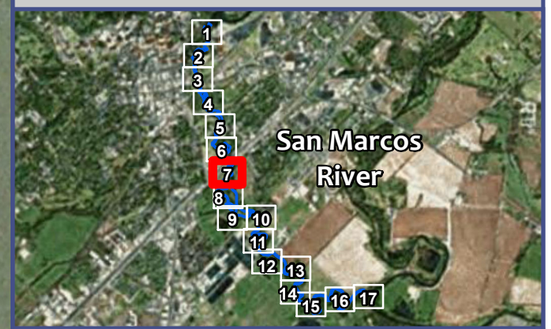

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0 20 40 Meters

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BIO-WEST
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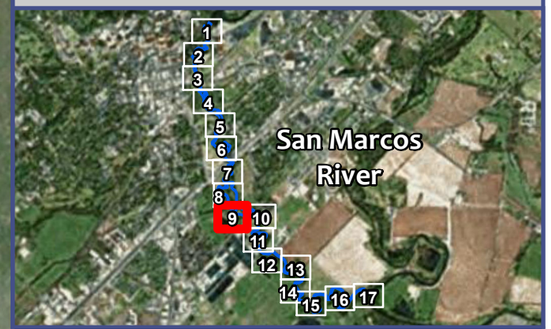

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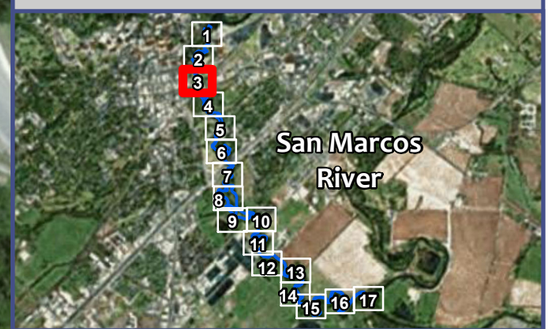

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0 20 40 Meters

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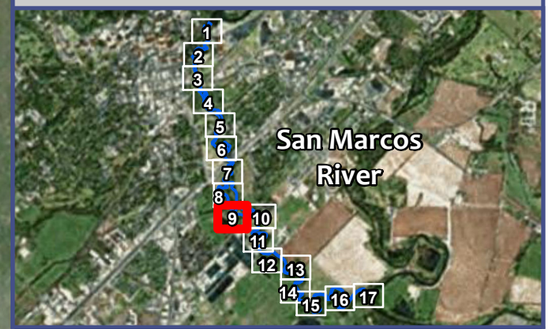

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0 50 100 200 Feet

0 20 40 Meters

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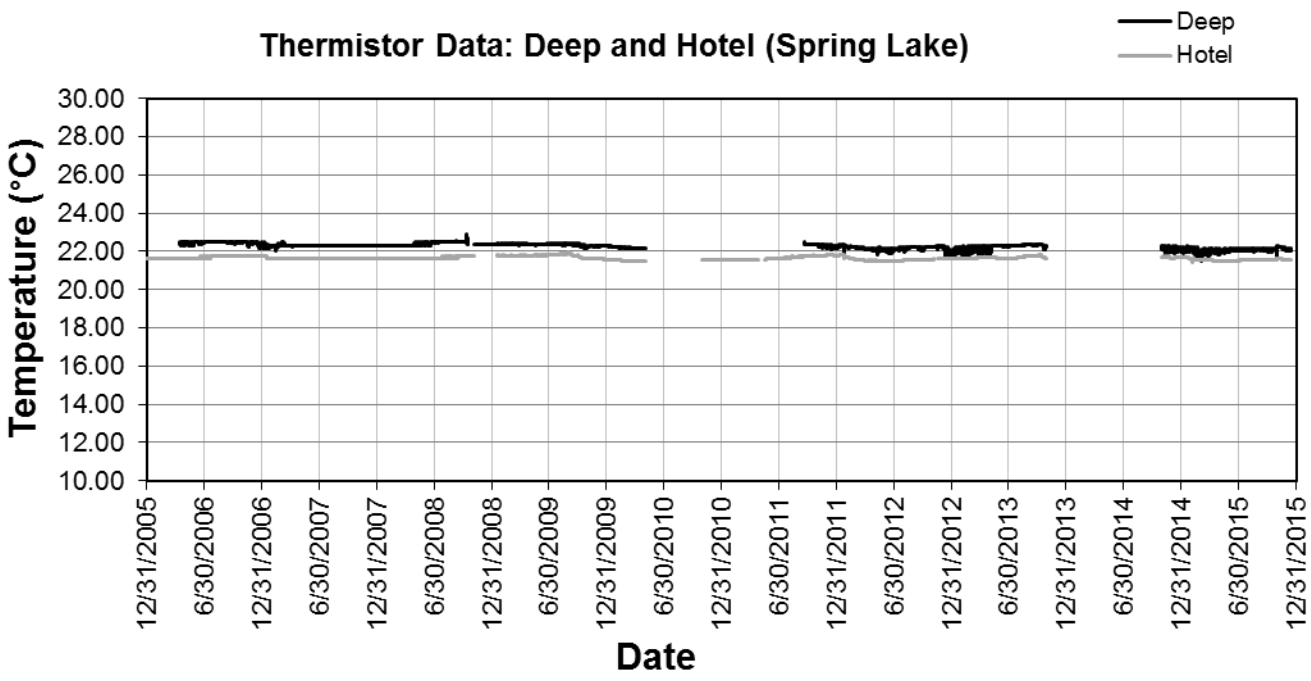
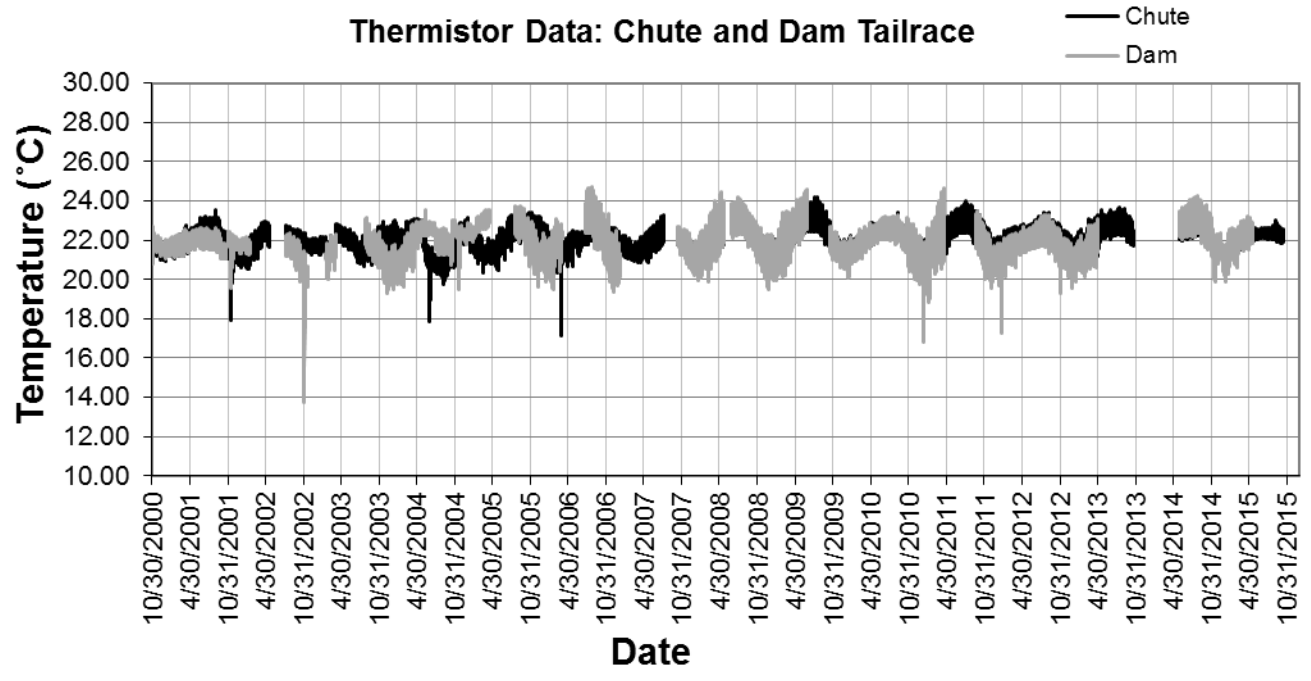
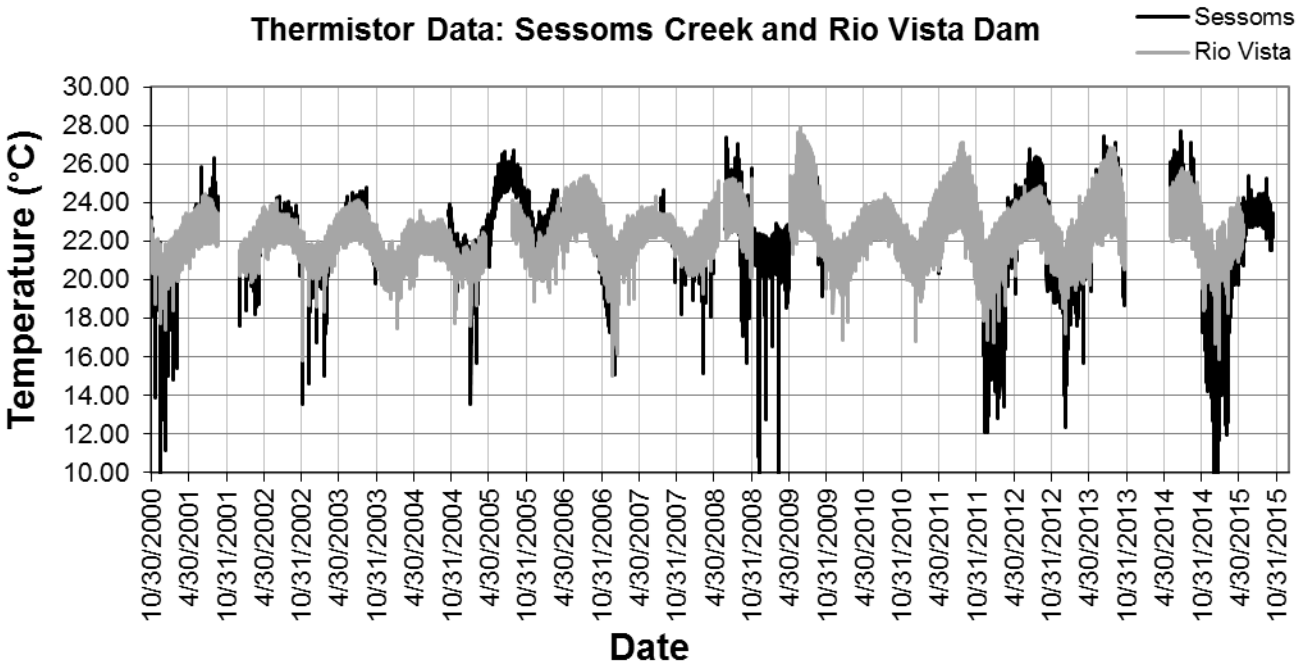
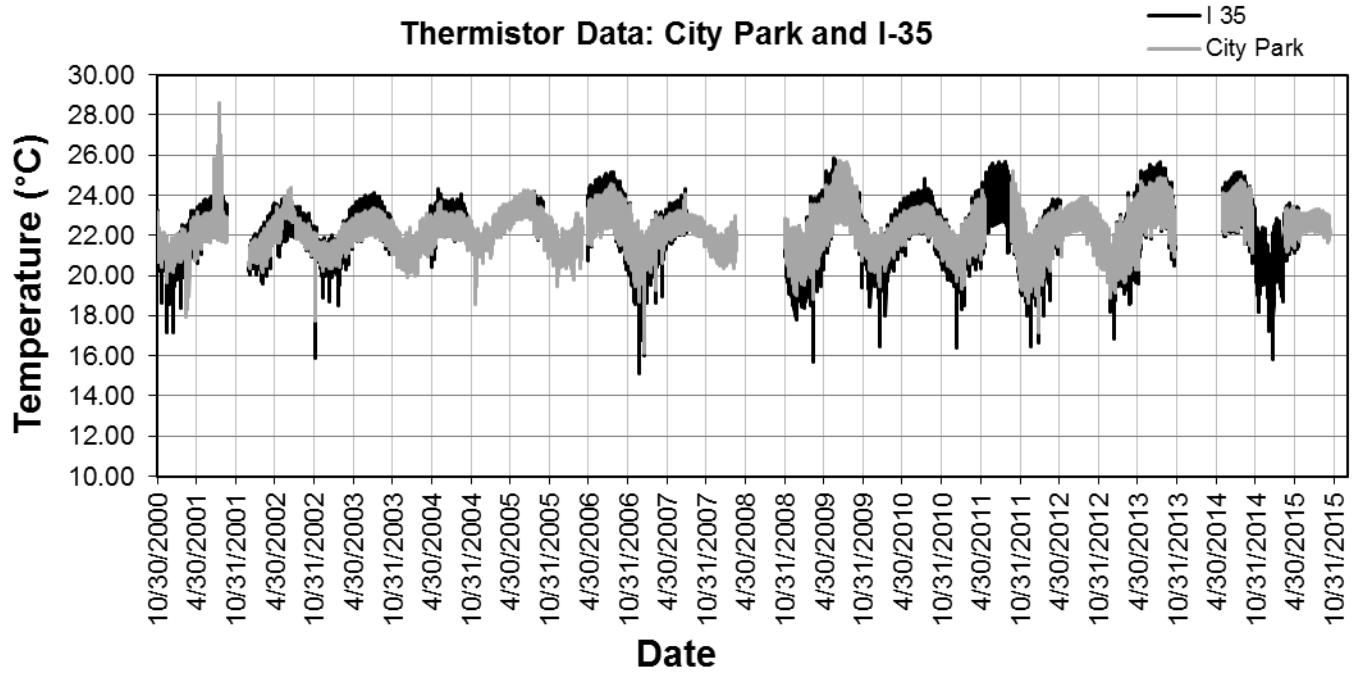
APPENDIX C: DATA AND GRAPHS

Thermistor Graphs


Thermistor Data: Deep and Hotel (Spring Lake)
Deep
Hotel
Temperature (°C)
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
12/31/2005
6/30/2006
12/31/2006
6/30/2007
12/31/2007
6/30/2008
12/31/2008
6/30/2009
12/31/2009
6/30/2010
12/31/2010
6/30/2011
12/31/2011
6/30/2012
12/31/2012
6/30/2013
12/31/2013
6/30/2014
12/31/2014
6/30/2015
12/31/2015
Date


Thermistor Data: Chute and Dam Tailrace
Chute
Dam
Temperature (°C)
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
10/30/2000
4/30/2001
10/31/2001
4/30/2002
10/31/2002
4/30/2003
10/31/2003
4/30/2004
10/31/2004
4/30/2005
10/31/2005
4/30/2006
10/31/2006
4/30/2007
10/31/2007
4/30/2008
10/31/2008
4/30/2009
10/31/2009
4/30/2010
10/31/2010
4/30/2011
10/31/2011
4/30/2012
10/31/2012
4/30/2013
10/31/2013
4/30/2014
10/31/2014
4/30/2015
10/31/2015
Date


Thermistor Data: Sessoms Creek and Rio Vista Dam
Sessoms
Rio Vista
Temperature (°C)
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
10/30/2000
4/30/2001
10/31/2001
4/30/2002
10/31/2002
4/30/2003
10/31/2003
4/30/2004
10/31/2004
4/30/2005
10/31/2005
4/30/2006
10/31/2006
4/30/2007
10/31/2007
4/30/2008
10/31/2008
4/30/2009
10/31/2009
4/30/2010
10/31/2010
4/30/2011
10/31/2011
4/30/2012
10/31/2012
4/30/2013
10/31/2013
4/30/2014
10/31/2014
4/30/2015
10/31/2015
Date


Thermistor Data: City Park and I-35
I 35
City Park
Temperature (°C)
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
10/30/2000
4/30/2001
10/31/2001
4/30/2002
10/31/2002
4/30/2003
10/31/2003
4/30/2004
10/31/2004
4/30/2005
10/31/2005
4/30/2006
10/31/2006
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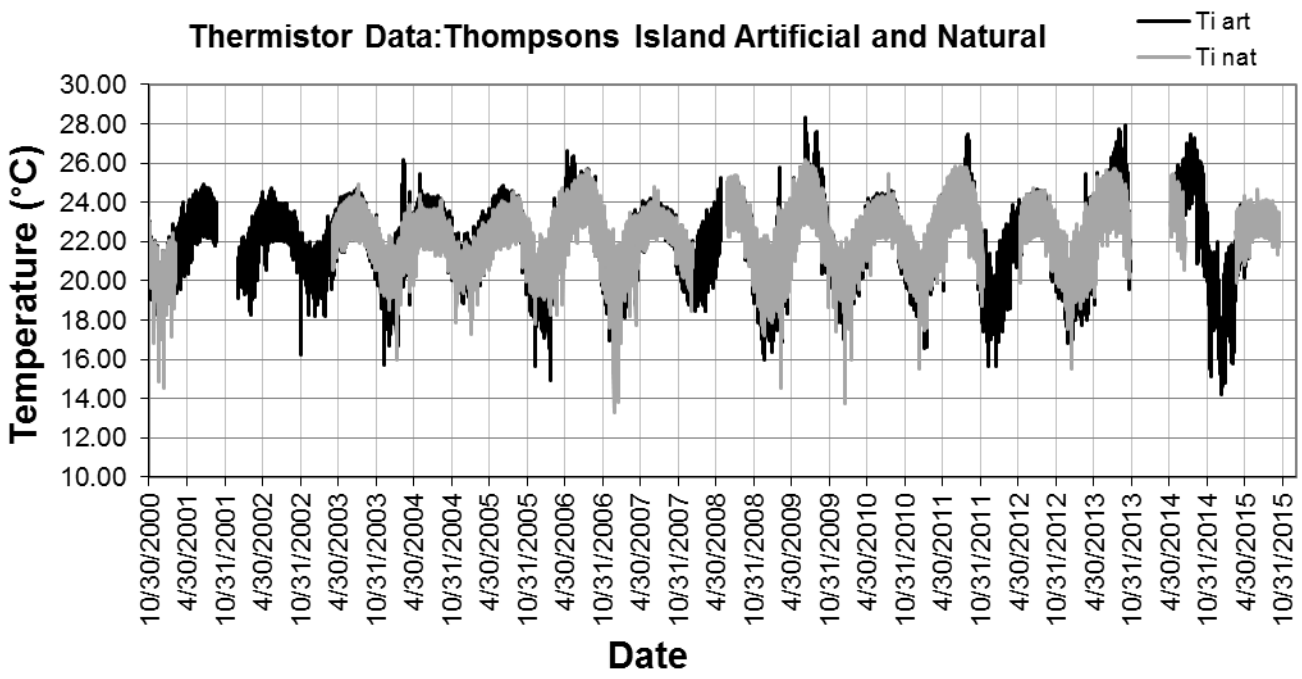
4/30/2011
10/31/2011
4/30/2012
10/31/2012
4/30/2013
10/31/2013
4/30/2014
10/31/2014
4/30/2015
10/31/2015
Date


Thermistor Data:Thompsons Island Artificial and Natural
Ti art
Ti nat
Temperature (°C)
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
10/30/2000
4/30/2001
10/31/2001
4/30/2002
10/31/2002
4/30/2003
10/31/2003
4/30/2004
10/31/2004
4/30/2005
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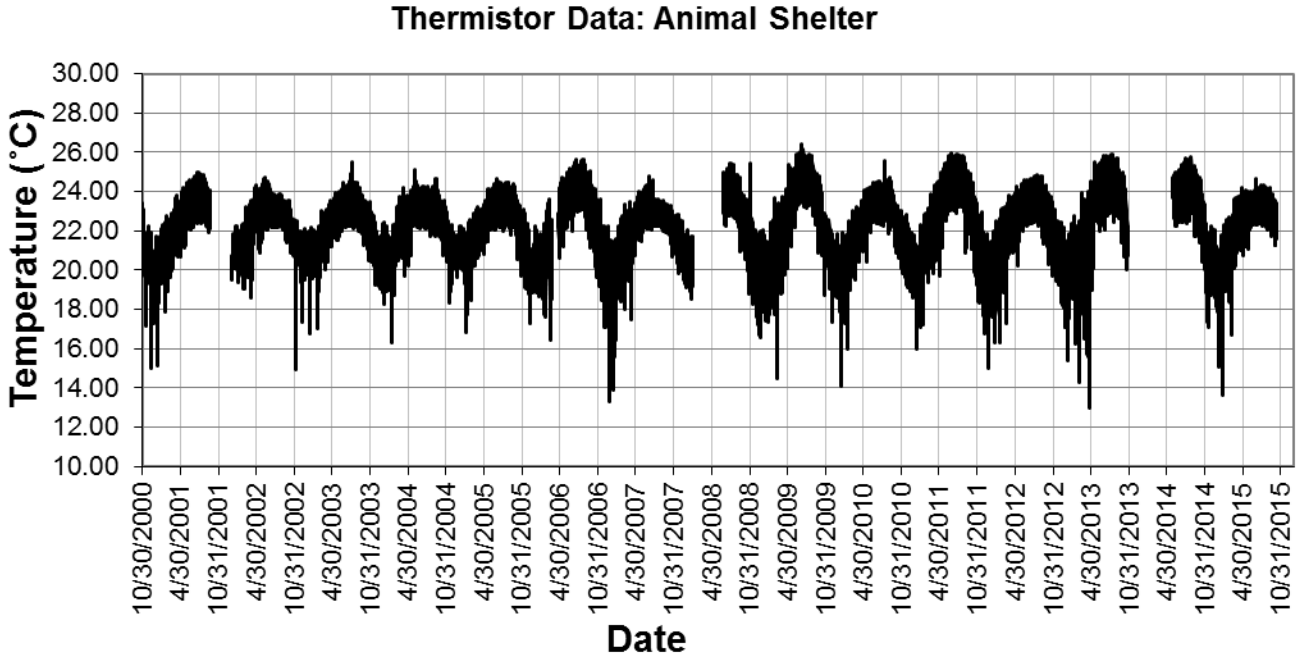
10/31/2011
4/30/2012
10/31/2012
4/30/2013
10/31/2013
4/30/2014
10/31/2014
4/30/2015
10/31/2015
Date


Thermistor Data: Animal Shelter
Temperature (°C)
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
10/30/2000
4/30/2001
10/31/2001
4/30/2002
10/31/2002
4/30/2003
10/31/2003
4/30/2004
10/31/2004
4/30/2005
10/31/2005
4/30/2006
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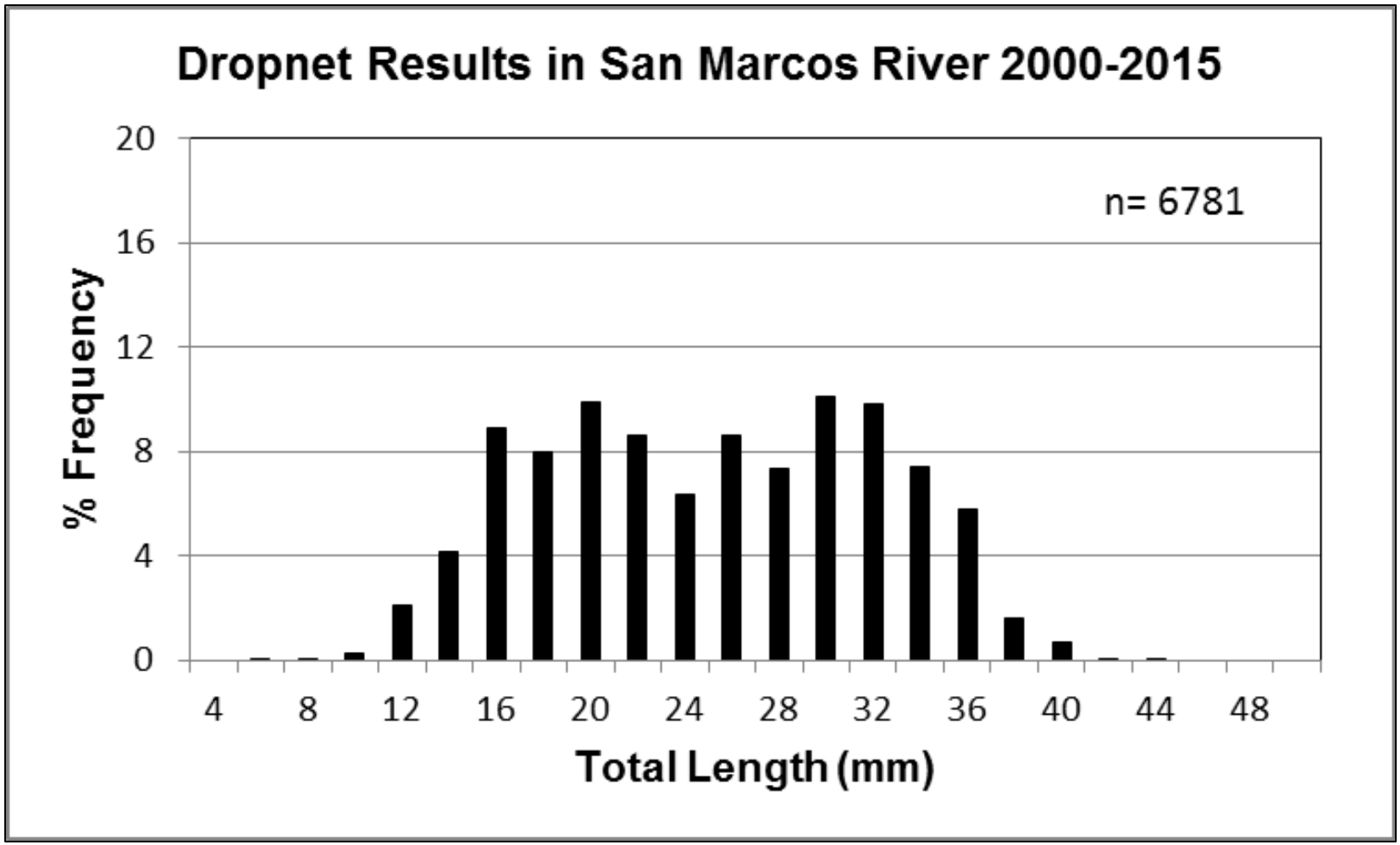
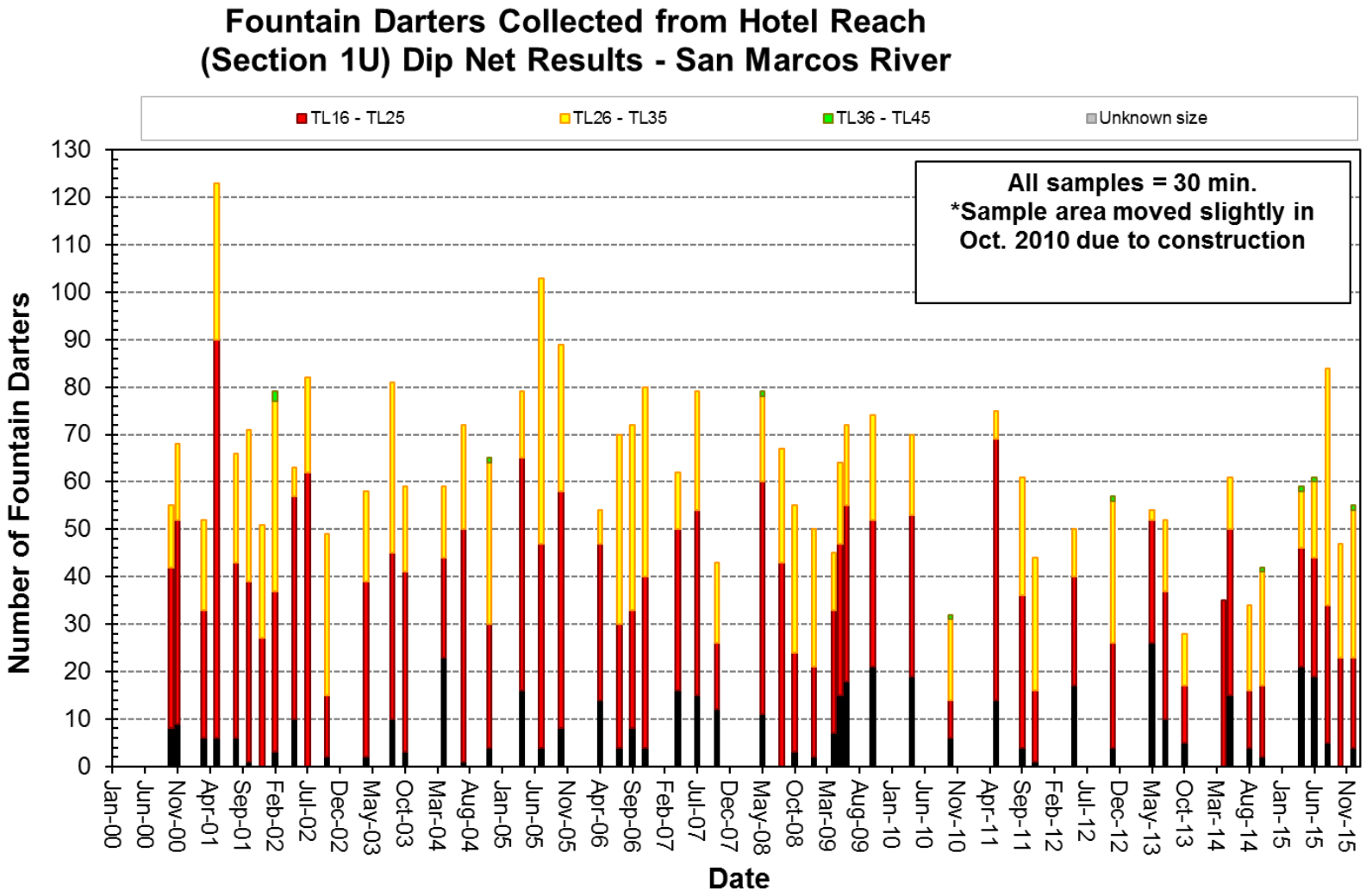
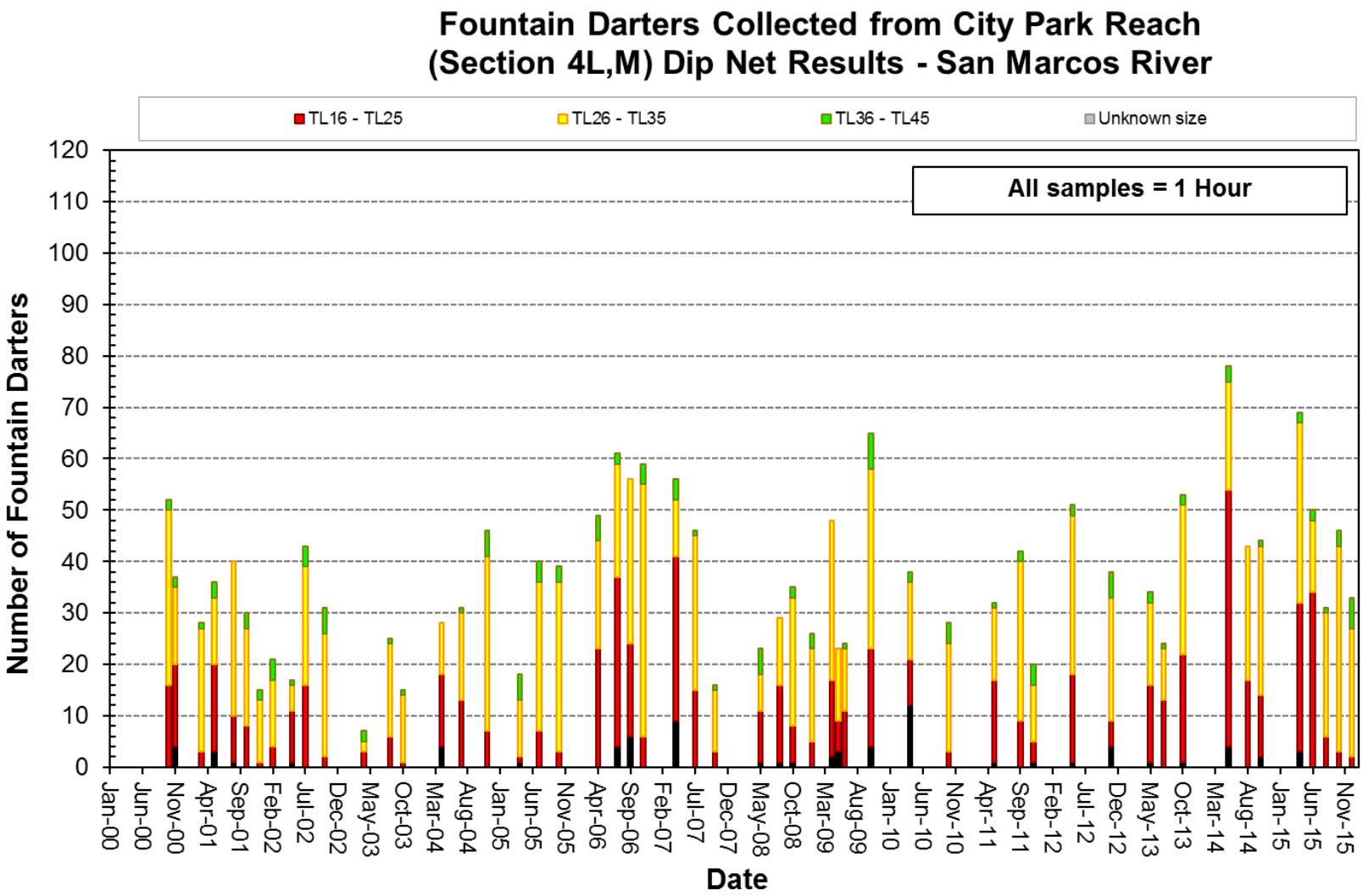
4/30/2007
10/31/2007
4/30/2008
10/31/2008
4/30/2009
10/31/2009
4/30/2010
10/31/2010
4/30/2011
10/31/2011
4/30/2012
10/31/2012
4/30/2013
10/31/2013
4/30/2014
10/31/2014
4/30/2015
10/31/2015
Date

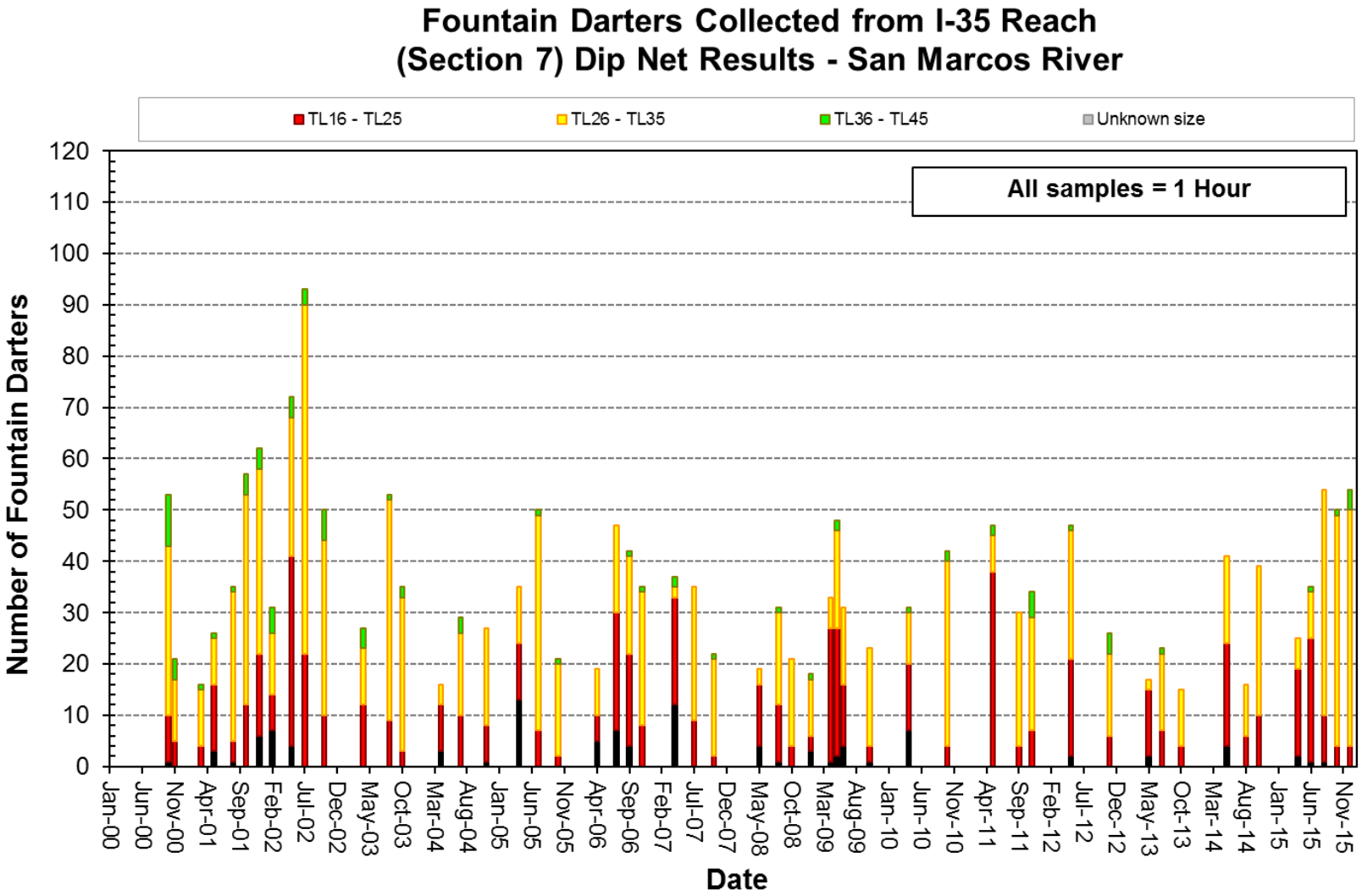
Drop net Graph

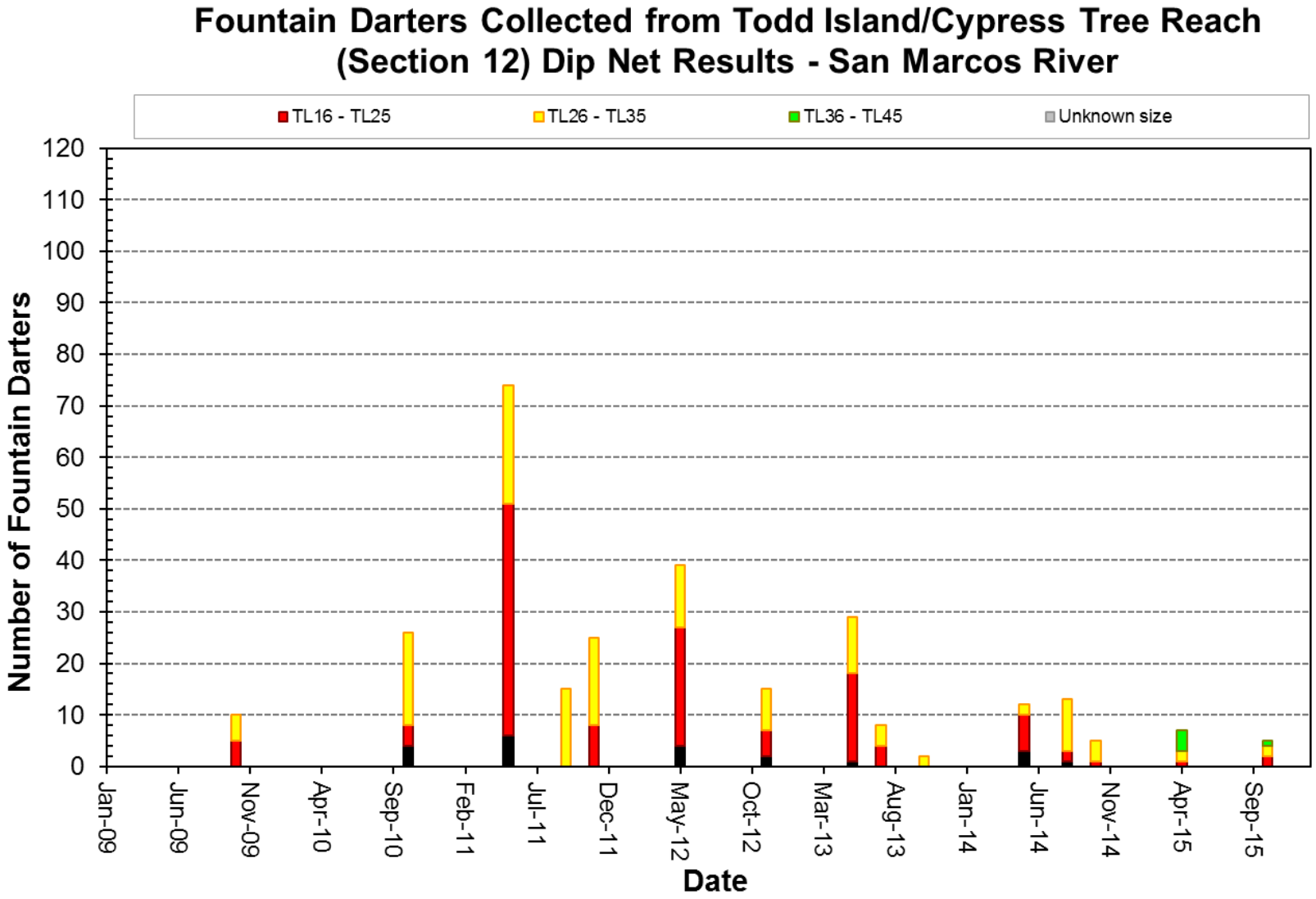

Dropnet Results in San Marcos River 2000-2015
n= 6781
% Frequency
0
4
8
12
16
20
4
8
12
16
20
24
28
32
36
40
44
48
Total Length (mm)

Dip Net Graphs


Fountain Darters Collected from Hotel Reach
(Section 1U) Dip Net Results - San Marcos River
TL16 - TL25
TL26 - TL35
TL36 - TL45
Unknown size
All samples = 30 min.
*Sample area moved slightly in
Oct. 2010 due to construction
Number of Fountain Darters
0
10
20
30
40
50
60
70
80
90
100
110
120
130
Jan-00
Jun-00
Nov-00
Apr-01
Sep-01
Feb-02
Jul-02
Dec-02
May-03
Oct-03
Mar-04
Aug-04
Jan-05
Jun-05
Nov-05
Apr-06
Sep-06
Feb-07
Jul-07
Dec-07
May-08
Oct-08
Mar-09
Aug-09
Jan-10
Jun-10
Nov-10
Apr-11
Sep-11
Feb-12
Jul-12
Dec-12
May-13
Oct-13
Mar-14
Aug-14
Jan-15
Jun-15
Nov-15
Date


Fountain Darters Collected from City Park Reach
(Section 4L,M) Dip Net Results - San Marcos River
TL16 - TL25
TL26 - TL35
TL36 - TL45
Unknown size
All samples = 1 Hour
Number of Fountain Darters
0
10
20
30
40
50
60
70
80
90
100
110
120
Jan-00
Jun-00
Nov-00
Apr-01
Sep-01
Feb-02
Jul-02
Dec-02
May-03
Oct-03
Mar-04
Aug-04
Jan-05
Jun-05
Nov-05
Apr-06
Sep-06
Feb-07
Jul-07
Dec-07
May-08
Oct-08
Mar-09
Aug-09
Jan-10
Jun-10
Nov-10
Apr-11
Sep-11
Feb-12
Jul-12
Dec-12
May-13
Oct-13
Mar-14
Aug-14
Jan-15
Jun-15
Nov-15
Date


Fountain Darters Collected from I-35 Reach
(Section 7) Dip Net Results - San Marcos River
TL16 - TL25
TL26 - TL35
TL36 - TL45
Unknown size
All samples = 1 Hour
Number of Fountain Darters
0
10
20
30
40
50
60
70
80
90
100
110
120
Jan-00
Jun-00
Nov-00
Apr-01
Sep-01
Feb-02
Jul-02
Dec-02
May-03
Oct-03
Mar-04
Aug-04
Jan-05
Jun-05
Nov-05
Apr-06
Sep-06
Feb-07
Jul-07
Dec-07
May-08
Oct-08
Mar-09
Aug-09
Jan-10
Jun-10
Nov-10
Apr-11
Sep-11
Feb-12
Jul-12
Dec-12
May-13
Oct-13
Mar-14
Aug-14
Jan-15
Jun-15
Nov-15
Date


Fountain Darters Collected from Todd Island/Cypress Tree Reach (Section 12) Dip Net Results - San Marcos River
TL16 - TL25
TL26 - TL35
TL36 - TL45
Unknown size
Number of Fountain Darters
0
10
20
30
40
50
60
70
80
90
100
110
120
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Mar-13
Aug-13
Jan-14
Jun-14
Nov-14
Apr-15
Sep-15
Date

Macroinvertebrate Data

Spring

Order/Class	Family	Genus	SLD-HYG	SLD-POT	SLD-HYD	SLD-VAL	SLD-SAG	CP-HYG	CP-POT	CP-HYD	CP-SAG	I35-CAB	I35-HYG	I35-HYD	I35-LUD
Ephemeroptera	Baetidae	Fallceon quilleri			6	1			58	17			4		
"	"	Baetis							40						
"	Ephemeridae	Hexagenia	1		3			9		1		1			
"	Leptohyphidae	Tricorythodes	2	4	196	22	19	24	56	391	40	271	112	5	4
"	"	Leptohyphes							30	1			1		
Odonata	Calopterygidae	Hetaerina													1
"	Ceonagrionidae	Enallagma			8			2		1		1	3		1
"	Macromiidae	Macromia			1										
Hemiptera	Naucoridae	Limnocoris							5					1	
Trichoptera	Leptoceridae	Nectopsyche						1	11	3		8	1		
"	"	Oecetis						1							
"	Hydroptilldae	Hydroptila							9		1			1	
"	"	Ochrotrichia nigrita													
"	"	Oxytheria			6				2						
"	Hydropsychidae	Smicridea							6						
"	Heliocopyschidae	Heliocopysche piroa							5			1			
"	Hydrobiosidae	Atopsyche							1						
"	Glossosomatidae	Protoptila							70					1	
"	Polycentropodidae	Polycentropus			2										
Lepidoptera	Crambidae	Paraponyx	3			2		10	21	3	2	6	9		2
"	"	Oxyelophila c.f.			1			2							2
Coleoptera	Elmidae	Microcylloepus pusillus		1	2	1	1	2							
"	"	Hexacylloepus ferrugineus						1					1		
"	"	Phanocerus clavicornis			1										
"	"	Dubiraphia										2			
"	Psephinidae	Psephenus							1						
Diptera	Cyclorrhaphous-Brachycera								6						
"	Empididae	Hemerodromia	1						57						
"	Ceratopogonidae	Sphaeromias										1			
"	Simuliidae	Simulium							146	1					
"	Chironomidae	Chironomini			1			3	1	4		153			
"	"	Tanytarsini			7			12	39	26		6			
"	"	Tanypodinae	1		7			1	1	5		18	2		
"	"	Orthocladinae			3			3	277	1		1			
"	"	Pseudochironomini			6				8	1		1			
Amphipoda	Hyalellidae	Hyalella	96		666	43	46	222	22	273	52	893	48	10	15
Cladocera										1					
Decapoda	Cambaridae		1		1	1									
Copepod												1			
Gastropoda	Thiaridae	M. tuberculata	2		1			1		2		8	27	2	18
"	"	Terabia	56	4	19	1	23	95	65	9	1	71	129	2	32
"	Planorbidae	Helisoma			1				1	1			3		3
"	"	Gyraulus	1	1											
"	Pleuroceridae	Elimia	50	38	41	5	17	28	26	57	5	15	60	5	39
"	Ancylidae											1			
"	Hydrobiidae		5	3	16	1	2	4		17	1	44	6	1	
"	Physidae	Physa	2		7	2		1		2		4			7
Acari	Hydracarina							1	2	1		5			
Ostrocada												6			
Veneroida	Spheriidae									9					

Fall

Order/Class	Family	Genus	SLD-HYG	SLD-POT	SLD-HYD	SLD-SAG	CP-HYG	CP-POT	CP-HYD	CP-SAG	I35-CAB	I35-HYG	I35-HYD	I35-LUD
Ephemeroptera	Baetidae	Callibaetis		1		1								
"	"	Fallceon quilleri					3	7	1	1		5	72	1
"	"	Baetis					3	2				1	3	
"	Ephemeridae	Hexagenia	3		1									
"	Leptohyphidae	Tricorythodes	4	63	46	19	13	2	182	11	65	34	127	
"	"	Leptohyphes					2	1				1	9	
"	Heptagenidae	Stenacron											1	
Odonata	Calopterygidae	Hetaerina					2					3	1	
"	Ceonagrionidae	Argia									1			
"	"	Enallagma		2			1	1	6		5	7	13	8
"	"	Ischnura		1					1					
"	Libellulidae	Erythemis		3		2								
"	"	Tramea		1										
"	Corduliidae	Epitheca	1			1								
Hemiptera	Naucoridae	Limnocoris											1	
Trichoptera	Leptoceridae	Nectopsyche		3		1		2			3			
"	Hydroptilldae	Oxytheria		3	1									
"	Hydropsychidae	Smicridea					2							1
"	Hydrobiosidae	Atopsyche										1		
"	Polycentropodidae	Polycentropus				1			1					
Lepidoptera	Crambidae	Early Instar/Pupa										1		
"	"	Paraponyx	2		3		7	9	1		2	6		1
"	"	Oxyelophila c.f.									1	8		
Coleoptera	Elmidae	Microcylloepus pusillus	1											
"	"	Hexacylloepus ferrugineus						1				2		
"	"	Phanocerus clavicornis	2		1			1			1		1	2
	Stratiomyidae	Caloparyphus		1										
"	Empididae	Empididae Pupa												
"	"	Hemerodromia						1				1	1	
"	Ceratopogonidae	Ceratopogon	1											
"	Simuliidae	Simulium												
"	Chironomidae	Chironomid Pupae												
"	"	Chironomini	3											
"	"	Tanytarsini		1			11		1		1	5	5	
"	"	Tanypodinae		1	1		1			1	1	3	1	1
"	"	Orthocladinae						2				1		
"	"	Pseudochironomini		1		1								
Amphipoda	Hyalellidae	Hyalella	35	170	345	136	18	174	483	9	157	5	57	6
"	Crangonyictidae	Crangonyx							2		1			
Decapoda	Palaemonidae	Palaemonetes			1				2		4			
"	Palaemonidae	Palaemonetes	1	4										
Gastropoda	Thiaridae	M. tuberculata									2	29	7	1
"	"	Terabia	5		45	6		4	1		63	54		213
"	Pleuroceridae	Elimia	19	21	32	37	9	1	5	5	1	58	115	88
"	Ancylidae									1		4		
"	Hydrobiidae		4	3	8						2			
"	Physidae	Physa			1						1			
Acari	Hydracarina			1							1			
Ostrocada					1									
Euhirundea								1	1	1	1			
Oligochaeta					1			1			1	1		

APPENDIX D: DROP NET RAW DATA

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		**Site:**	**Map site:**
Spring Lake Dam		POT1- Site 1	
Date:	**Time:**	**Observer(s):**	
4/21/2015	8:22-8:35	JG,JH,JW,TJ	

Overall	**Species**	**Number**	**Avg. Length (mm)**
8	*Etheostoma fonticola*		
1	*Lepomis sp.*		
14	*Gambusia sp.*		
7	*Procambarus* sp.		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	*Etheostoma fonticola*	3	20,21,17
	Lepomis sp.	1	13
	Gambusia sp.	8	21,10,19,16,12,12,10,12
2	*Etheostoma fonticola*	2	14,19
3	*Gambusia sp.*	1	13
	Procambarus sp.	2	
4	*Gambusia sp.*	1	13
	Etheostoma fonticola	1	16
5	*Procambarus* sp.	2	
	Gambusia sp.	2	20,24
6	*Gambusia sp.*	1	13
7	*Procambarus* sp.	1	
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	*Etheostoma fonticola*	1	33
	Procambarus sp.	1	
11	*Etheostoma fonticola*	1	19
	Gambusia sp.	1	13
12	No fish or crustaceans collected		
13	*Procambarus* sp.	1	
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		V1- Site 2	
Date:	**Time:**	**Observer(s):**	
4/21/2015	8:38-8:58	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
16	*Etheostoma fonticola*		
18	*Gambusia* sp.		
28	*Procambarus* sp.		
2	*Palaemonetes* sp.		
1	*Lepomis miniatus*		
1	*Ameiurus natalis*		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	5	24,21,13,15,16
	Gambusia sp.	8	13,12,13,14,13,12,13,20
	Procambarus sp.	3	
	Palaemonetes sp.	1	
2	*Gambusia* sp.	4	15,12,12,12
	Etheostoma fonticola	3	18,18,13
	Procambarus sp.	1	
	Palaemonetes sp.	1	
3	*Lepomis miniatus*	1	35
	Gambusia sp.	2	11,17
4	*Ameiurus natalis*	1	36
	Procambarus sp.	11	
5	*Etheostoma fonticola*	1	15
	Gambusia sp.	2	15,12
	Procambarus sp.	2	
6	*Etheostoma fonticola*	1	25
	Gambusia sp.	1	12
	Procambarus sp.	4	
7	*Etheostoma fonticola*	3	20,19,13
	Procambarus sp.	1	
8	*Gambusia* sp.	1	12
9	No fish or crustaceans collected		
10	*Procambarus* sp.	1	
11	*Etheostoma fonticola*	1	17
12	*Etheostoma fonticola*	2	26,20
	Procambarus sp.	3	
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	*Procambarus* sp.	2	

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		**Site:**	**Map site:**
Spring Lake Dam		V2 - Site 3	
Date:	**Time:**	**Observer(s):**	
4/21/2015	9:00-9:18	JG,JH,JW,TJ	

Overall	**Species**	**Number**	**Avg. Length (mm)**
8	*Etheostoma fonticola*		
2	*Gambusia* sp.		
17	*Palaemonetes* sp.		
12	*Procambarus* sp.		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	*Etheostoma fonticola*	2	20,19
	Gambusia sp.	1	25
	Procambarus sp.	2	
	Palaemonetes sp.	8	
2	*Palaemonetes* sp.	1	
3	*Procambarus* sp.	2	
	Palaemonetes sp.	3	
4	*Gambusia* sp.	1	20
	Etheostoma fonticola	1	17
	Procambarus sp.	2	
5	*Palaemonetes* sp.	1	
6	*Etheostoma fonticola*	1	22
	Palaemonetes sp.	1	
	Procambarus sp.	1	
7	No fish or crustaceans collected		
8	*Palaemonetes* sp.	1	
	Procambarus sp.	1	
	Etheostoma fonticola	1	20
9	*Etheostoma fonticola*	1	19
	Procambarus sp.	1	
10	*Procambarus* sp.	1	
	Palaemonetes sp.	2	
11	No fish or crustaceans collected		
12	*Etheostoma fonticola*	2	19,21
13	*Procambarus* sp.	2	
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		

**Tarebia granifera - slight*

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		POT2- Site 4	
Date:	**Time:**	**Observer(s):**	
4/21/2015	9:20-9:27	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		HD2 - Site 5	HD4
Date:	**Time:**	**Observer(s):**	
4/21/2015	9:31-9:48	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
3	*Etheostoma fonticola*		
4	*Gambusia* sp.		
1	*Lepomis miniatus*		
3	*Palaemonetes* sp.		
2	*Lepomis gulosus*		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	2	17,16
	Gambusia sp.	1	12
2	*Etheostoma fonticola*	1	34
	Gambusia sp.	1	23
	Lepomis miniatus	1	46
	Palaemonetes sp.	1	
3	*Palaemonetes* sp.	1	
	Gambusia sp.	1	10
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	*Palaemonetes* sp.	1	
7	No fish or crustaceans collected		
8	*Lepomis gulosus*	1	145
9	No fish or crustaceans collected		
10	*Lepomis gulosus*	1	136
11	*Gambusia* sp.	1	21
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	**Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		H1 - Site 6	
Date:	**Time:**	**Observer(s):**	
4/21/2015	9:50-10:06	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
17	*Gambusia* sp.		
3	*Etheostoma fonticola*		
1	*Micropterus salmoides*		
1	*Ambloplites rupestris*		
4	*Lepomis miniatus*		
2	*Procambarus* sp.		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia* sp.	4	13,30,23,30
	Procambarus sp.	1	
2	*Gambusia* sp.	6	40,41,23,36,25,35
	Lepomis miniatus	2	53,57
3	*Gambusia* sp.	1	40
	Etheostoma fonticola	2	33,30
	Micropterus salmoides	1	89
4	*Lepomis miniatus*	1	50
	Procambarus sp.	1	
5	*Gambusia* sp.	1	36
6	*Gambusia* sp.	1	36
7	*Gambusia* sp.	1	40
8	*Gambusia* sp.	1	36
	Etheostoma fonticola	1	17
9	No fish or crustaceans collected		
10	*Gambusia* sp.	2	31,18
	Ambloplites rupestris	1	100
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	*Lepomis miniatus*	1	60
15	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		H2 - Site 7	
Date:	**Time:**	**Observer(s):**	
4/21/2015	10:08-10:26	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
1	*Herichthys cyanoguttatus*		
21	*Gambusia* sp.		
7	*Procambarus* sp.		
3	*Palaemonetes* sp.		
1	*Ambloplites rupestris*		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia* sp.	11	20,20,30,20,20,22,15,17,36,12,23
	Palaemonetes sp.	2	
2	*Gambusia* sp.	5	24,18,21,28,16
	Procambarus sp.	1	
3	*Herichthys cyanoguttatus*	1	44
	Gambusia sp.	2	22,17
	Procambarus sp.	2	
	Palaemonetes sp.	1	
4	*Gambusia* sp.	1	20
5	*Procambarus* sp.	1	
6	*Gambusia* sp.	1	23
7	*Procambarus* sp.	1	
8	*Procambarus* sp.	1	
	Gambusia sp.	1	20
	Ambloplites rupestris	1	93
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	*Procambarus* sp.	1	

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		HD1 - Site 8	
Date:	**Time:**	**Observer(s):**	
4/21/2015	10:29-10:51	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
1	*Etheostoma fonticola*		
9	*Palaemonetes* sp.		
25	*Gambusia* sp.		
4	*Procambarus* sp.		
6	*Lepomis miniatus*		
1	*Ameiurus natalis*		
1	*Lepomis gulosus*		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	1	35
	Palaemonetes sp.	2	
	Gambusia sp.	5	19,22,20,16,17
	Procambarus sp.	1	
2	*Lepomis miniatus*	3	75,52,36
	Procambarus sp.	2	
	Palaemonetes sp.	4	
	Gambusia sp.	2	20,20
3	*Gambusia* sp.	7	20,10,20,20,15,18,17
	Palaemonetes sp.	2	
4	*Gambusia* sp.	4	15,13,15,11
5	*Ameiurus natalis*	1	21
6	*Gambusia* sp.	3	15,20,15
7	*Gambusia* sp.	1	12
8	No fish or crustaceans collected		
9	*Palaemonetes* sp.	1	
	Procambarus sp.	1	
10	No fish or crustaceans collected		
11	*Lepomis miniatus*	2	40,43
	Gambusia sp.	1	11
12	*Lepomis gulosus*	1	205
13	*Gambusia* sp.	1	20
	Lepomis miniatus	1	50
14	*Gambusia* sp.	1	16
15	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		O2 - Site 9	
Date:	**Time:**	**Observer(s):**	
4/21/2015	10:53-10:57	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		O1 - Site 10	
Date:	**Time:**	**Observer(s):**	
4/21/2015	10:59-11:01	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		**Site:**	**Map site:**
Spring Lake Dam		V2 - Site 1	
Date:	**Time:**	**Observer(s):**	
6/10/2015	1317-1332	JG,JH,JW,TJ	

Overall	**Species**	**Number**	**Avg. Length (mm)**
13	*Etheostoma fonticola*		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	*Etheostoma fonticola*	4	17,19,19,18
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	*Etheostoma fonticola*	3	20,21,18
9	No fish or crustaceans collected		
10	*Etheostoma fonticola*	4	22,21,16,15
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	*Etheostoma fonticola*	2	19,17
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	**A lot of recreation at site*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		V1- Site 2	
Date:	**Time:**	**Observer(s):**	
6/10/2015	1333-1347	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
1	*Etheostoma fonticola*		
2	*Gambusia* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	*Gambusia* sp.	1	11
4	*Gambusia* sp.	1	12
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	*Etheostoma fonticola*	1	15
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		POT1- Site 3	
Date:	**Time:**	**Observer(s):**	
6/10/2015	1349-1405	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
18	*Etheostoma fonticola*		
1	*Palaemonetes* sp.		
2	*Gambusia sp.*		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	1	22
2	*Etheostoma fonticola*	2	22,13
3	*Gambusia sp.*	1	19
	Etheostoma fonticola	1	18
4	*Etheostoma fonticola*	1	20
5	*Etheostoma fonticola*	4	32,22,26,27
	Palaemonetes sp.	1	
6	*Gambusia sp.*	1	16
	Etheostoma fonticola	1	16
7	*Etheostoma fonticola*	1	24
8	*Etheostoma fonticola*	3	18,30,26
9	*Etheostoma fonticola*	1	30
10	No fish or crustaceans collected		
11	No fish or crustaceans collected		
12	*Etheostoma fonticola*	2	20,28
13	*Etheostoma fonticola*	1	30
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):	Site:	Map site:
Spring Lake Dam	POT2- Site 4	POT3

Date:	Time:	Observer(s):
6/10/2015	1406-1421	JG,JH,JW,TJ

Overall	Species	Number	Avg. Length (mm)
3	*Gambusia sp.*		
2	*Palaemonetes* sp.		
8	*Etheostoma fonticola*		
1	*Procambarus* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia sp.*	1	22
	Palaemonetes sp.	1	
2	*Etheostoma fonticola*	3	30,19,26
	Palaemonetes sp.	1	
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	*Gambusia sp.*	1	13
6	*Etheostoma fonticola*	1	31
7	No fish or crustaceans collected		
8	*Etheostoma fonticola*	1	13
9	*Etheostoma fonticola*	1	27
10	*Etheostoma fonticola*	2	28,27
	Gambusia sp.	1	13
11	No fish or crustaceans collected		
12	*Procambarus* sp.	1	
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		HD2 - Site 5	HD4
Date:	**Time:**	**Observer(s):**	
6/10/2015	1423-1438	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
9	*Etheostoma fonticola*		
3	*Procambarus* sp.		
3	*Palaemonetes* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	*Etheostoma fonticola*	3	26,22,23
3	*Palaemonetes* sp.	1	
4	*Palaemonetes* sp.	1	
5	*Procambarus* sp.	1	
6	*Etheostoma fonticola*	2	26,22
	Procambarus sp.	1	
7	No fish or crustaceans collected		
8	*Etheostoma fonticola*	3	2216
9	No fish or crustaceans collected		
10	*Etheostoma fonticola*	1	27
11	*Palaemonetes* sp.	1	
12	*Procambarus* sp.	1	
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	**Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		H1 - Site 6	
Date:	**Time:**	**Observer(s):**	
6/10/2015	1440-1504	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
20	*Lepomis miniatus*		
2	*Gambusia* sp.		
3	*Etheostoma fonticola*		
3	*Astyanax mexicanus*		
2	*Palaemonetes* sp.		
1	*Lepomis gulosus*		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Lepomis miniatus*	6	136,115,125,65,26,78
	Palaemonetes sp.	1	
2	*Lepomis miniatus*	2	66,106
	Gambusia sp.	2	17,18
	Astyanax mexicanus	1	37
3	*Lepomis miniatus*	4	141,142,46,101
	Astyanax mexicanus	1	38
4	*Lepomis miniatus*	1	60
5	No fish or crustaceans collected		
6	*Lepomis gulosus*	1	142
	Lepomis miniatus	3	84,44,51
	Etheostoma fonticola	1	18
7	*Lepomis miniatus*	2	112,80
	Palaemonetes sp.	1	
8	*Etheostoma fonticola*	1	21
9	*Etheostoma fonticola*	1	22
	Astyanax mexicanus	1	30
10	No fish or crustaceans collected		
11	*Lepomis miniatus*	2	59,25
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	**Tarebia granifera - slight*		
	**Melanoides - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		HD1 - Site 7	
Date:	**Time:**	**Observer(s):**	
6/10/2015	1508-1528	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
28	*Etheostoma fonticola*		
6	*Palaemonetes* sp.		
4	*Gambusia* sp.		
7	*Procambarus* sp.		
2	*Micropterus salmoides*		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	7	21,26,23,24,18,22,26
2	*Etheostoma fonticola*	1	23
	Palaemonetes sp.	3	
	Gambusia sp.	1	17
3	*Etheostoma fonticola*	2	32,22
4	*Etheostoma fonticola*	2	24,22
	Gambusia sp.	1	18
	Palaemonetes sp.	1	
5	*Etheostoma fonticola*	6	24,24,22,25,23,21
6	No fish or crustaceans collected		
7	*Etheostoma fonticola*	3	17,28,23
	Gambusia sp.	1	18
	Palaemonetes sp.	2	
8	*Etheostoma fonticola*	1	22
9	*Etheostoma fonticola*	1	32
10	*Micropterus salmoides*	2	53,122
	Etheostoma fonticola	1	24
11	*Procambarus* sp.	2	
	Etheostoma fonticola	1	29
	Gambusia sp.	1	12
12	*Procambarus* sp.	3	
	Etheostoma fonticola	1	26
13	*Procambarus* sp.	1	
	Etheostoma fonticola	2	30,23
14	No fish or crustaceans collected		
15	*Procambarus* sp.	1	
	**Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		H2 - Site 8	
Date:	**Time:**	**Observer(s):**	
6/10/2015	1536-1548	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
5	*Etheostoma fonticola*		
2	*Procambarus* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	*Etheostoma fonticola*	1	29
4	No fish or crustaceans collected		
5	*Etheostoma fonticola*	1	20
6	No fish or crustaceans collected		
7	*Etheostoma fonticola*	1	21
8	No fish or crustaceans collected		
9	*Procambarus* sp.	1	
	Etheostoma fonticola	1	16
10	No fish or crustaceans collected		
11	*Etheostoma fonticola*	1	26
	Procambarus sp.	1	
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		O1 - Site 9	
Date:	**Time:**	**Observer(s):**	
6/10/2015	1550-1553	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		O2 - Site 10	
Date:	**Time:**	**Observer(s):**	
6/10/2015	1554-1556	JG,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):	Site:	Map site:
Spring Lake Dam	HD2 - Site 1	HD3

Date:	Time:	Observer(s):
10/19/2015	920-947	ME,JH,JW,TJ

Overall	Species	Number	Avg. Length (mm)
13	*Etheostoma fonticola*		
3	*Lepomis miniatus*		
4	*Herichthys cyanoguttatus*		
3	*Gambusia* sp.		
10	*Procambarus* sp.		
6	*Palaemonetes* sp.		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	1	31
	Gambusia sp.	1	12
2	*Gambusia* sp.	1	14
	Procambarus sp.	2	
	Palaemonetes sp.	1	
3	*Etheostoma fonticola*	3	30,36,19
	Lepomis miniatus	1	25
	Herichthys cyanoguttatus	1	31
	Gambusia sp.	1	22
	Procambarus sp.	2	
	Palaemonetes sp.	3	
4	*Etheostoma fonticola*	1	26
5	*Procambarus* sp.	2	
	Etheostoma fonticola	3	33,35,20
6	*Palaemonetes* sp.	1	
	Procambarus sp.	1	
	Etheostoma fonticola	1	35
7	*Herichthys cyanoguttatus*	1	120
	Procambarus sp.	2	
	Etheostoma fonticola	1	19
8	*Lepomis miniatus*	1	31
9	No fish or crustaceans collected		
10	*Herichthys cyanoguttatus*	1	29
11	No fish or crustaceans collected		
12	*Herichthys cyanoguttatus*	1	90
	Procambarus sp.	1	
13	*Lepomis miniatus*	1	44
14	No fish or crustaceans collected		
15	*Etheostoma fonticola*	2	27,33
16	*Etheostoma fonticola*	1	35
17	*Palaemonetes* sp.	1	
	**Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		H2 - Site 2	
Date:	**Time:**	**Observer(s):**	
10/19/2015	950-1018	ME,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
10	*Lepomis miniatus*		
33	*Gambusia* sp.		
9	*Palaemonetes* sp.		
4	*Procambarus* sp.		
2	*Etheostoma fonticola*		
1	*Micropterus salmoides*		
2	*Herichthys cyanoguttatus*		
1	*Lepomis auritus*		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia* sp.	16	14,29,21,20,22,18,15,13,25,18,17,24,16,15,16,17
	Lepomis miniatus	3	44,43,25
	Palaemonetes sp.	6	
	Herichthys cyanoguttatus	1	42
2	*Gambusia* sp.	9	25,24,23,21,17,22,22,18,22
	Lepomis miniatus	1	30
3	*Lepomis miniatus*	2	115,43
	Gambusia sp.	7	
	Palaemonetes sp.	2	
	Procambarus sp.	1	
	Etheostoma fonticola	1	30
4	*Herichthys cyanoguttatus*	1	32
5	*Procambarus* sp.	1	
6	*Micropterus salmoides*	1	60
	Lepomis miniatus	1	44
	Etheostoma fonticola	1	36
7	*Lepomis auritus*	1	171
	Lepomis miniatus	1	115
8	No fish or crustaceans collected		
9	*Procambarus* sp.	1	
10	*Gambusia* sp.	1	
	Palaemonetes sp.	1	
11	*Lepomis miniatus*	1	35
12	*Procambarus* sp.	1	
13	*Lepomis miniatus*	1	85
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	**Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		H1 - Site 3	
Date:	**Time:**	**Observer(s):**	
######	1021-1045	ME,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
4	*Herichthys cyanoguttatus*		
8	*Lepomis miniatus*		
17	*Palaemonetes* sp.		
7	*Etheostoma fonticola*		
33	*Gambusia* sp.		
5	*Procambarus* sp.		
1	*Astyanax mexicanus*		
4	*Ameiurus natalis*		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Herichthys cyanoguttatus*	2	83,34
	Lepomis miniatus	2	56,30
	Palaemonetes sp.	8	
	Etheostoma fonticola	2	28,26
	Gambusia sp.	11	25,22,22,12,14,21,27,20,12,31,20
	Procambarus sp.	1	
2	*Palaemonetes* sp.	2	
	Herichthys cyanoguttatus	2	37,39
	Procambarus sp.	2	
	Gambusia sp.	1	20
	Astyanax mexicanus	1	57
	Etheostoma fonticola	1	33
3	*Gambusia* sp.	13	31,30,30,30,29,27,34,31,25,23,25,25,24
	Etheostoma fonticola	2	35,30
	Procambarus sp.	1	
4	*Lepomis miniatus*	2	32,42
	Gambusia sp.	2	
5	*Palaemonetes* sp.	1	
6	*Gambusia* sp.	4	
	Etheostoma fonticola	1	37
	Lepomis miniatus	1	30
	Palaemonetes sp.	2	
7	*Palaemonetes* sp.	3	
	Procambarus sp.	1	
	Gambusia sp.	1	
8	*Lepomis miniatus*	1	44
	Ameiurus natalis	4	45
9	*Palaemonetes* sp.	1	
10	*Etheostoma fonticola*	1	33
	Gambusia sp.	1	
11	*Lepomis miniatus*	1	34
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	*Lepomis miniatus*	1	31
	**Tarebia granifera - slight*		
	**Melanoides - slight*		

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		HD1 - Site 4	
Date:	**Time:**	**Observer(s):**	
10/19/2015	1050-1115	ME,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
66	*Etheostoma fonticola*		
66	*Palaemonetes* sp.		
22	*Procambarus* sp.		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	5	27,26,30,32,29
	Palaemonetes sp.	30	
2	*Etheostoma fonticola*	5	22,22,24,31,28
	Procambarus sp.	7	
	Palaemonetes sp.	13	
3	*Etheostoma fonticola*	13	29,32,28,26,33,31,29,27,22,29,26,28,23
	Palaemonetes sp.	15	
4	*Etheostoma fonticola*	4	28,25,30,26
5	*Etheostoma fonticola*	8	26,34,22,27,30,22,22,27
	Palaemonetes sp.	2	
	Procambarus sp.	2	
6	*Etheostoma fonticola*	7	28,36,37,33,26,31,24
	Procambarus sp.	3	
	Palaemonetes sp.	1	
7	*Etheostoma fonticola*	1	24
8	*Etheostoma fonticola*	2	28,20
	Palaemonetes sp.	1	
9	*Etheostoma fonticola*	2	32,24
10	No fish or crustaceans collected		
11	*Etheostoma fonticola*	14	32,28,32,28,24,27,35,28,32,26,30,24,24,26
	Procambarus sp.	2	
	Palaemonetes sp.	1	
12	*Procambarus* sp.	1	
13	*Etheostoma fonticola*	1	21
	Procambarus sp.	2	
	Palaemonetes sp.	1	
14	*Procambarus* sp.	3	
	Etheostoma fonticola	3	32,25,33
	Palaemonetes sp.	2	
15	*Etheostoma fonticola*	1	32
16	*Procambarus* sp.	2	

**Tarebia granifera - slight*

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		O2 - Site 5	
Date:	**Time:**	**Observer(s):**	
10/19/2015	1121-1125	ME,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		O1 - Site 6	
Date:	**Time:**	**Observer(s):**	
10/19/2015	1126-1129	ME,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		POT1- Site 7	
Date:	**Time:**	**Observer(s):**	
10/19/2015	1131-1143	ME,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
1	*Ameiurus natalis*		
4	*Palaemonetes* sp.		
2	*Procambarus* sp.		
10	*Gambusia sp.*		
2	*Etheostoma fonticola*		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia sp.*	1	12
	Palaemonetes sp.	1	
2	*Ameiurus natalis*	1	35
	Palaemonetes sp.	1	
	Gambusia sp.	1	23
3	No fish or crustaceans collected		
4	*Etheostoma fonticola*	1	39
5	No fish or crustaceans collected		
6	*Gambusia sp.*	1	36
	Procambarus sp.	1	
7	*Etheostoma fonticola*	1	39
	Palaemonetes sp.	1	
	Gambusia sp.	1	20
8	*Procambarus* sp.	1	
	Gambusia sp.	4	21,17,18,20
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
11	*Palaemonetes* sp.	1	
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	*Gambusia sp.*	2	22,23

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:	Map site:
Spring Lake Dam		POT2- Site 8	
Date:	**Time:**	**Observer(s):**	
10/19/2015	1144-1151	ME,JH,JW,TJ	

Overall	Species	Number	Avg. Length (mm)
8	*Etheostoma fonticola*		
7	*Gambusia sp.*		
3	*Palaemonetes* sp.		
2	*Procambarus* sp.		
1	*Lepomis miniatus*		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	1	
	Gambusia sp.	5	
	Palaemonetes sp.	2	
2	No fish or crustaceans collected		
3	*Procambarus* sp.	1	
4	*Etheostoma fonticola*	1	
	Gambusia sp.	1	
5	*Procambarus* sp.	1	
6	*Etheostoma fonticola*	1	
7	*Gambusia sp.*	1	
8	No fish or crustaceans collected		
9	*Etheostoma fonticola*	2	
	Lepomis miniatus	1	
10	*Etheostoma fonticola*	1	
11	*Etheostoma fonticola*	2	
	Palaemonetes sp.	1	
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	**Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:
City Park		PH2- Site 1
Date:	**Time:**	**Observer(s):**
4/20/2015	1152-1212	TJ,JW,JH,JG

Overall	Species	Number	Avg. Length (mm)
22	*Gambusia* sp.		
3	*Etheostoma fonticola*		
14	*Procambarus* sp.		
1	*Ambloplites rupestris*		
1	*Palaemonetes* sp.		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia* sp.	7	39,28,21,16,25,20,16
	Etheostoma fonticola	1	34
2	*Gambusia* sp.	7	19,24,16,26,33,11,23
	Etheostoma fonticola	1	23
	Procambarus sp.	2	
3	*Procambarus* sp.	1	
	Gambusia sp.	1	15
4	*Ambloplites rupestris*	1	12
5	*Procambarus* sp.	1	
6	*Gambusia* sp.	1	31
7	*Etheostoma fonticola*	1	35
	Gambusia sp.	1	20
	Palaemonetes sp.	1	
	Procambarus sp.	4	
8	*Gambusia* sp.	1	15
	Procambarus sp.	2	
9	*Procambarus* sp.	2	
10	*Gambusia* sp.	2	21,20
11	*Procambarus* sp.	1	
12	*Gambusia* sp.	1	26
13	*Gambusia* sp.	1	26
14	No fish or crustaceans collected		
15	*Procambarus* sp.	1	

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:
City Park		H2 - Site 3
Date:	**Time:**	**Observer(s):**
4/20/2015	1221-1252	TJ,JW,JH,JG

Overall	Species	Number	Avg. Length (mm)
2	*Herichthys cyanoguttatus*		
1	*Ambloplites rupestris*		
1	*Lepomis auritus*		
92	*Gambusia sp.*		
2	*Lepomis miniatus*		
4	*Lepomis sp.*		
7	*Palaemonetes* sp.		
2	*Procambarus* sp.		
14	*Etheostoma fonticola*		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Herichthys cyanoguttatus*	1	75
	Ambloplites rupestris	1	30
	Lepomis auritus	1	65
	Gambusia sp.	45	20,25,11,27,10,18,17,17,19,10,20,13,28, 11,17,22,13,15,14,14,17,12,12,15,20
	Lepomis sp.	3	20,20,23
	Palaemonetes sp.	5	
	Etheostoma fonticola	1	14
2	*Etheostoma fonticola*	5	23,16,17,25
	Gambusia sp.	15	
3	*Lepomis miniatus*	1	149
	Gambusia sp.	8	
	Procambarus sp.	1	
4	*Herichthys cyanoguttatus*	1	46
	Etheostoma fonticola	2	35,33
	Gambusia sp.	12	
5	*Etheostoma fonticola*	2	25,17
	Gambusia sp.	1	
6	*Etheostoma fonticola*	1	16
	Gambusia sp.	4	
7	*Procambarus* sp.	1	
	Lepomis sp.	1	18
	Gambusia sp.	5	
8	No fish or crustaceans collected		
9	*Etheostoma fonticola*	1	35
	Gambusia sp.	2	
10	No fish or crustaceans collected		
11	No fish or crustaceans collected		
12	*Lepomis miniatus*	1	84
13	*Palaemonetes* sp.	1	
14	No fish or crustaceans collected		
15	*Etheostoma fonticola*	1	18
16	*Etheostoma fonticola*	1	18
17	*Palaemonetes* sp.	1	

SAN MARCOS RIVER -SPRING 2015 SAMPLING			
Dip net sweep	**Species**	**Number**	**Length (mm)**
	***Tarebia granifera-slight* **Melanoides - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:
City Park		HD1 - Site 4
Date:	**Time:**	**Observer(s):**
4/20/2015	1255-1325	TJ,JW,JH,JG

Overall	Species	Number	Avg. Length (mm)
34	*Etheostoma fonticola*		
2	*Lepomis miniatus*		
3	*Lepomis sp.*		
2	*Palaemonetes* sp.		
40	*Procambarus* sp.		
153	*Gambusia* sp.		
1	*Lepomis auritus*		
1	*Micropterus salmoides*		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	5	28,30,11,17,19
	Gambusia sp.	76	12,20,15,16,13,12,12,11,11,10,13,30,22,20,21,12,12, 14,11,15,12,16,20,17,25
	Procambarus sp.	2	
2	*Etheostoma fonticola*	6	26,32,24,27,12,15
	Lepomis miniatus	1	71
	Lepomis sp.	1	17
	Procambarus sp.	5	
	Gambusia sp.	14	
3	*Procambarus* sp.	2	
	Gambusia sp.	3	
4	*Etheostoma fonticola*	2	32,27
	Procambarus sp.	9	
	Gambusia sp.	9	
5	*Procambarus* sp.	2	
	Gambusia sp.	3	
6	*Etheostoma fonticola*	3	30,21,13
	Gambusia sp.	6	
	Micropterus salmoides	1	38
	Palaemonetes sp.	2	
	Procambarus sp.	8	
7	*Etheostoma fonticola*	3	28,20,12
	Gambusia sp.	3	
8	*Procambarus* sp.	1	
	Gambusia sp.	3	
9	*Gambusia* sp.	3	
	Lepomis sp.	1	25
	Procambarus sp.	1	
	Etheostoma fonticola	1	27
10	*Lepomis auritus*	1	79
	Etheostoma fonticola	3	26,24,13
	Procambarus sp.	4	
	Gambusia sp.	14	
11	*Gambusia* sp.	2	
12	*Lepomis miniatus*	1	48
	Gambusia sp.	3	
13	*Etheostoma fonticola*	2	24,24
	Lepomis sp.	1	17
	Gambusia sp.	2	

SAN MARCOS RIVER -SPRING 2015 SAMPLING			
Dip net sweep	**Species**	**Number**	**Length (mm)**
14	*Etheostoma fonticola*	4	28,28,22,25
	Gambusia sp.	2	
15	*Etheostoma fonticola*	1	21
16	*Etheostoma fonticola*	1	25
	Gambusia sp.	5	
17	*Etheostoma fonticola*	1	33
	Gambusia sp.	1	
18	*Procambarus* sp.	2	
	Etheostoma fonticola	1	21
19	*Procambarus* sp.	3	
	Etheostoma fonticola	1	14
	Gambusia sp.	3	
20	*Gambusia* sp.	1	
	Procambarus sp.	1	
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:
City Park		HD2 - Site 5
Date:	**Time:**	**Observer(s):**
4/20/2015	1328-1351	TJ,JW,JH,JG

Overall	Species	Number	Avg. Length (mm)
2	*Lepomis auritus*		
2	*Lepomis sp.*		
126	*Gambusia* sp.		
18	*Procambarus* sp.		
4	*Palaemonetes* sp.		
1	*Herichthys cyanoguttatus*		
15	*Etheostoma fonticola*		
2	*Ambloplites rupestris*		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia* sp.	70	12,24,28,28,15,12,20,20,21,23,26,22,13,15, 17,22,20,13,19,20,18,20,30,28,22
	Etheostoma fonticola	5	25,25,22,24,20
	Lepomis sp.	1	14
	Ambloplites rupestris	1	34
2	*Herichthys cyanoguttatus*	1	71
	Procambarus sp.	3	
	Gambusia sp.	9	
	Palaemonetes sp.	1	
3	*Etheostoma fonticola*	1	20
	Gambusia sp.	8	
	Procambarus sp.	1	
	Palaemonetes sp.	1	
4	*Lepomis auritus*	1	69
	Lepomis sp.	1	17
	Gambusia sp.	6	
	Procambarus sp.	5	
	Palaemonetes sp.	1	
	Etheostoma fonticola	2	19,20
5	*Gambusia* sp.	1	
6	*Etheostoma fonticola*	1	16
	Gambusia sp.	8	
	Procambarus sp.	3	
7	*Procambarus* sp.	1	
	Gambusia sp.	9	
	Etheostoma fonticola	1	22
8	*Gambusia* sp.	6	
9	*Procambarus* sp.	1	
	Etheostoma fonticola	1	15
	Gambusia sp.	5	
10	*Etheostoma fonticola*	1	22
	Gambusia sp.	1	
11	*Procambarus* sp.	1	
	Etheostoma fonticola	1	15
	Gambusia sp.	3	
12	*Palaemonetes* sp.	1	
	Lepomis auritus	1	74
	Procambarus sp.	1	
13	*Ambloplites rupestris*	1	28
	Etheostoma fonticola	2	26,17
14	*Procambarus* sp.	2	

SAN MARCOS RIVER -SPRING 2015 SAMPLING			
Dip net sweep	**Species**	**Number**	**Length (mm)**
15	No fish or crustaceans collected ***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:
City Park		O1 - Site 5
Date:	**Time:**	**Observer(s):**
4/20/2015	1353-1400	TJ,JW,JH,JG

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:
City Park		O2-Site 6
Date:	**Time:**	**Observer(s):**
4/20/2015	1402-1406	TJ,JW,JH,JG

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:
City Park		S2- Site 7
Date:	**Time:**	**Observer(s):**
4/20/2015	1422-1439	TJ,JW,JH,JG

Overall	Species	Number	Avg. Length (mm)
12	*Etheostoma fonticola*		
5	*Gambusia* sp.		
3	*Lepomis sp.*		
4	*Procambarus* sp.		
1	*Ambloplites rupestris*		
1	*Lepomis miniatus*		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	1	16
	Gambusia sp.	2	12,12
	Lepomis sp.	1	14
	Procambarus sp.	1	
2	*Etheostoma fonticola*	1	15
	Gambusia sp.	1	
	Ambloplites rupestris	1	12
3	*Etheostoma fonticola*	1	21
	Procambarus sp.	1	
4	*Lepomis sp.*	1	9
	Etheostoma fonticola	1	21
5	*Gambusia* sp.	1	22
6	*Etheostoma fonticola*	2	30,17
	Procambarus sp.	1	
7	*Gambusia* sp.	1	10
	Lepomis sp.	1	10
8	*Etheostoma fonticola*	1	30
9	No fish or crustaceans collected		
10	*Etheostoma fonticola*	2	16,15
11	*Lepomis miniatus*	1	50
	Etheostoma fonticola	1	31
12	*Etheostoma fonticola*	1	34
13	No fish or crustaceans collected		
14	*Etheostoma fonticola*	1	30
15	*Procambarus* sp.	1	
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		**Site:**
City Park		S1 - Site 6
Date:	**Time:**	**Observer(s):**
4/20/2015	1440-1455	TJ,JW,JH,JG

Overall	**Species**	**Number**	**Avg. Length (mm)**
4	*Etheostoma fonticola*		
3	*Gambusia* sp.		
1	*Lepomis auritus*		
4	*Procambarus* sp.		
2	*Palaemonetes* sp.		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	No fish or crustaceans collected		
2	*Etheostoma fonticola*	2	15,19
3	*Gambusia* sp.	2	21,25
4	*Etheostoma fonticola*	1	17
	Gambusia sp.	1	22
5	*Lepomis auritus*	1	130
6	No fish or crustaceans collected		
7	*Palaemonetes* sp.	1	
8	No fish or crustaceans collected		
9	*Procambarus* sp.	1	
10	No fish or crustaceans collected		
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	*Palaemonetes* sp.	1	
14	*Procambarus* sp.	1	
15	*Etheostoma fonticola*	1	18
16	*Procambarus* sp.	2	

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		**Site:**
City Park		PH1- Site 8
Date:	**Time:**	**Observer(s):**
4/20/2015	1501-1521	TJ,JW,JH,JG

Overall	**Species**	**Number**	**Avg. Length (mm)**
13	*Gambusia* sp.		
1	*Lepomis miniatus*		
1	*Ambloplites rupestris*		
1	*Lepomis auritus*		
2	*Palaemonetes* sp.		
10	*Procambarus* sp.		
12	*Etheostoma fonticola*		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	*Gambusia* sp.	5	23,19,20,21,21
	Lepomis auritus	1	73
2	*Gambusia* sp.	2	26,23
	Etheostoma fonticola	1	31
3	*Palaemonetes* sp.	2	
	Etheostoma fonticola	1	22
4	No fish or crustaceans collected		
5	*Etheostoma fonticola*	3	26,34,28
	Gambusia sp.	1	21
	Procambarus sp.	3	
6	*Gambusia* sp.	1	25
	Etheostoma fonticola	1	21
7	*Etheostoma fonticola*	2	16,20
	Procambarus sp.	1	
8	*Gambusia* sp.	2	30,25
	Etheostoma fonticola	1	19
9	*Procambarus* sp.	2	
10	*Ambloplites rupestris*	1	14
11	*Etheostoma fonticola*	1	26
	Gambusia sp.	1	26
12	*Etheostoma fonticola*	1	23
	Procambarus sp.	2	
13	*Etheostoma fonticola*	1	18
	Procambarus sp.	2	
14	*Lepomis miniatus*	1	78
15	*Gambusia* sp.	1	21
	***Tarebia granifera*-slight**		

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER -SPRING 2015 SAMPLING

Location (Reach):		Site:
City Park		H1 - Site 2
Date:	**Time:**	**Observer(s):**
4/20/2015	1525-1558	TJ,JW,JH,JG

Overall	Species	Number	Avg. Length (mm)
64	*Etheostoma fonticola*		
2	*Lepomis auritus*		
34	*Gambusia* sp.		
14	*Palaemonetes* sp.		
52	*Procambarus* sp.		
1	*Lepomis miniatus*		

SAN MARCOS RIVER -SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	25	14,32,35,21,18,28,21,32,24,21,27,17,20, 12,22,21,19,22,21,22,31,31,20,21,22
	Gambusia sp.	5	20,20,24,23,12
	Palaemonetes sp.	5	
	Procambarus sp.	8	
2	*Etheostoma fonticola*	13	25,21,15,20,22,16,18,22,20,19
	Lepomis auritus	1	45
	Gambusia sp.	3	18,24,12
	Palaemonetes sp.	6	19,20,10
	Procambarus sp.	5	
3	*Etheostoma fonticola*	1	20
	Palaemonetes sp.	2	
	Procambarus sp.	6	
	Gambusia sp.	2	13,12
4	*Etheostoma fonticola*	10	24,23,22,36,21,12,21,14,15,28
	Gambusia sp.	5	13,12,21,23,23
	Palaemonetes sp.	1	
	Procambarus sp.	5	
5	*Etheostoma fonticola*	1	34
	Lepomis auritus	1	58
	Procambarus sp.	6	
6	*Etheostoma fonticola*	5	28,22,11,21,19
	Procambarus sp.	4	
7	*Procambarus* sp.	2	
	Etheostoma fonticola	2	23,18
8	No fish or crustaceans collected		
9	*Procambarus* sp.	1	
10	*Etheostoma fonticola*	2	24,17
	Procambarus sp.	5	
11	*Gambusia* sp.	6	22,25,26,21,25,13
12	*Gambusia* sp.	1	15
	Procambarus sp.	7	
13	*Gambusia* sp.	1	18
	Etheostoma fonticola	1	33
14	*Etheostoma fonticola*	1	27
	Gambusia sp.	8	22,15
	Procambarus sp.	3	
15	*Lepomis miniatus*	1	50
	Etheostoma fonticola	1	21
	Gambusia sp.	3	
16	*Etheostoma fonticola*	2	17,20
17	No fish or crustaceans collected		

SAN MARCOS RIVER -SPRING 2015 SAMPLING			
Dip net sweep	**Species**	**Number**	**Length (mm)**
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		**Site:**
City Park		H2 - Site 1
Date:	**Time:**	**Observer(s):**
6/10/2015	857-916	TJ,JW,JH,JG

Overall	**Species**	**Number**	**Avg. Length (mm)**
8	*Gambusia sp.*		
1	*Ambloplites rupestris*		
4	*Procambarus* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	*Gambusia sp.*	2	24,25
	Procambarus sp.	1	
2	*Ambloplites rupestris*	1	235
3	*Gambusia* sp.	1	22
4	*Gambusia* sp.	1	20
	Procambarus sp.	1	
5	*Gambusia* sp.	2	29,25
6	No fish or crustaceans collected		
7	*Gambusia* sp.	1	35
8	No fish or crustaceans collected		
9	*Procambarus* sp.	1	
10	No fish or crustaceans collected		
11	No fish or crustaceans collected		
12	*Gambusia* sp.	1	30
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	*Procambarus* sp.	1	
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		**Site:**
City Park		PH1- Site 2
Date:	**Time:**	**Observer(s):**
6/10/2015	917-935	TJ,JW,JH,JG

Overall	**Species**	**Number**	**Avg. Length (mm)**
29	*Gambusia* sp.		
2	*Ambloplites rupestris*		
3	*Palaemonetes* sp.		
9	*Procambarus* sp.		
8	*Etheostoma fonticola*		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	*Gambusia* sp.	7	32,26,19,20,26,14,20
	Etheostoma fonticola	3	20,16,33
2	*Palaemonetes* sp.	1	
	Gambusia sp.	4	14,30,23,21
3	*Procambarus* sp.	2	
	Gambusia sp.	5	27,25,30,25,17
4	*Palaemonetes* sp.	1	
	Gambusia sp.	2	27,23
5	*Procambarus* sp.	1	
	Gambusia sp.	2	26,26
6	*Gambusia* sp.	2	24,22
7	*Procambarus* sp.	1	
	Etheostoma fonticola	2	19,23
	Gambusia sp.	1	30
8	*Gambusia* sp.	2	28,26
	Palaemonetes sp.	1	
9	*Procambarus* sp.	1	
10	*Gambusia* sp.	1	
11	No fish or crustaceans collected		
12	*Procambarus* sp.	2	
	Ambloplites rupestris	2	33,35
	Gambusia sp.	3	
	Etheostoma fonticola	1	27
13	*Etheostoma fonticola*	1	35
	Procambarus sp.	2	
14	*Etheostoma fonticola*	1	27
15	No fish or crustaceans collected		

***Tarebia granifera-slight*

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		**Site:**
City Park		O1 - Site 3
Date:	**Time:**	**Observer(s):**
6/10/2015	940-949	TJ,JW,JH,JG

Overall	**Species**	**Number**	**Avg. Length (mm)**
1	*Gambusia* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	*Gambusia* sp.	1	35
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	***Tarebia granifera-slight* **Melanoides - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:
City Park		HD2 - Site 4
Date:	**Time:**	**Observer(s):**
6/10/2015	950-1023	TJ,JW,JH,JG

Overall	Species	Number	Avg. Length (mm)
3	*Lepomis miniatus*		
54	*Etheostoma fonticola*		
180	*Gambusia* sp.		
100	*Palaemonetes* sp.		
25	*Procambarus* sp.		
1	*Micropterus salmoides*		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Lepomis miniatus*	1	52
	Etheostoma fonticola	11	26,27,17,22,17,16,21,23,18
	Gambusia sp.	63	16,18,21,16,21,17,20,22,18,19
	Palaemonetes sp.	46	
	Procambarus sp.	7	
2	*Gambusia* sp.	17	
	Palaemonetes sp.	17	
	Procambarus sp.	4	
3	*Lepomis miniatus*	1	60
	Etheostoma fonticola	9	22,20,16,23,12,21,18,30,19
	Palaemonetes sp.	13	
	Procambarus sp.	3	
	Gambusia sp.	38	
4	*Etheostoma fonticola*	8	21,27,16,13,22,16,19,15
	Procambarus sp.	5	
	Palaemonetes sp.	12	
	Gambusia sp.	9	
5	*Etheostoma fonticola*	5	19,28,21,22,17
	Palaemonetes sp.	7	
	Procambarus sp.	2	
	Gambusia sp.	15	
6	*Etheostoma fonticola*	1	17
	Gambusia sp.	5	
7	*Etheostoma fonticola*	5	26,27,23,24,18
	Micropterus salmoides	1	64
	Gambusia sp.	7	
	Palaemonetes sp.	2	
	Procambarus sp.	1	
8	*Procambarus* sp.	2	
	Gambusia sp.	1	
9	*Etheostoma fonticola*	3	20,33,18
	Lepomis miniatus	1	28
	Gambusia sp.	6	
10	*Etheostoma fonticola*	2	19,17
	Gambusia sp.	4	
	Palaemonetes sp.	1	
	Procambarus sp.	1	
11	*Etheostoma fonticola*	2	25,22
	Gambusia sp.	5	
	Palaemonetes sp.	2	
12	*Etheostoma fonticola*	1	26
	Gambusia sp.	5	
13	*Etheostoma fonticola*	2	13,13

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING			
Dip net sweep	**Species**	**Number**	**Length (mm)**
14	*Gambusia* sp.	2	
15	*Etheostoma fonticola*	5	21,29,24,29,13
	Gambusia sp.	3	
16	No fish or crustaceans collected		
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:
City Park		HD1 - Site 5
Date:	**Time:**	**Observer(s):**
6/10/2015	1024-1054	TJ,JW,JH,JG

Overall	Species	Number	Avg. Length (mm)
263	*Gambusia* sp.		
1	*Micropterus salmoides*		
41	*Etheostoma fonticola*		
1	*Lepomis miniatus*		
4	*Procambarus* sp.		
18	*Palaemonetes* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia* sp.	89	21,20,15,12,15,18,16,20,17,12,20,21,16,12,16,16,21,13,19,20,14,20,15,1
	Micropterus salmoides	1	55
	Etheostoma fonticola	12	36,17,22,26,27,26,22,20,22,17,22,13
	Lepomis miniatus	1	34
	Procambarus sp.	1	
	Palaemonetes sp.	11	
2	*Etheostoma fonticola*	2	19,24
	Gambusia sp.	27	
	Procambarus sp.	1	
	Palaemonetes sp.	4	
3	*Etheostoma fonticola*	3	19,20,15
	Gambusia sp.	46	
4	*Etheostoma fonticola*	1	15
	Gambusia sp.	22	
	Palaemonetes sp.	1	
5	*Etheostoma fonticola*	1	15
	Palaemonetes sp.	2	
	Gambusia sp.	31	
6	*Gambusia* sp.	15	
	Etheostoma fonticola	7	34,20,19,23,20,24,19
7	*Gambusia* sp.	8	
	Procambarus sp.	1	
8	*Gambusia* sp.	12	
	Etheostoma fonticola	3	22,19,14
	Procambarus sp.	1	
9	*Etheostoma fonticola*	6	20,22,25,15,23,17
	Gambusia sp.	8	
10	*Gambusia* sp.	1	
11	*Etheostoma fonticola*	2	17,15
	Gambusia sp.	1	
12	*Gambusia* sp.	1	
13	*Etheostoma fonticola*	1	22
	Gambusia sp.	1	
14	*Etheostoma fonticola*	2	22,20
	Gambusia sp.	1	
15	*Etheostoma fonticola*	1	17
16	No fish or crustaceans collected		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING			
Dip net sweep	**Species**	**Number**	**Length (mm)**
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		**Site:**
City Park		O2-Site 6
Date:	**Time:**	**Observer(s):**
6/10/2015	1057-1059	TJ,JW,JH,JG

Overall	**Species**	**Number**	**Avg. Length (mm)**

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		**Site:**
City Park		S1 - Site 7
Date:	**Time:**	**Observer(s):**
6/10/2015	1100-1115	TJ,JW,JH,JG

Overall	**Species**	**Number**	**Avg. Length (mm)**
3	*Etheostoma fonticola*		
4	*Gambusia* sp.		
2	*Ambloplites rupestris*		
4	*Procambarus* sp.		
1	*Lepomis miniatus*		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	*Gambusia* sp.	1	21
	Etheostoma fonticola	1	20
2	*Procambarus* sp.	1	
	Ambloplites rupestris	1	98
3	*Procambarus* sp.	1	
	Gambusia sp.	1	16
4	No fish or crustaceans collected		
5	*Procambarus* sp.	1	
6	*Ambloplites rupestris*	1	155
7	No fish or crustaceans collected		
8	*Procambarus* sp.	1	
9	No fish or crustaceans collected		
10	*Lepomis miniatus*	1	85
	Gambusia sp.	1	23
11	*Etheostoma fonticola*	1	17
12	No fish or crustaceans collected		
13	*Gambusia* sp.	1	20
	Etheostoma fonticola	1	15
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:	Site on Map:
City Park		S2- Site 8	S4
Date:	**Time:**	**Observer(s):**	
6/10/2015	1118-1131	TJ,JW,JH,JG	

Overall	Species	Number	Avg. Length (mm)
2	*Etheostoma fonticola*		
2	*Gambusia* sp.		
1	*Lepomis microlophus*		
3	*Procambarus* sp.		
1	*Palaemonetes* sp.		
2	*Ambloplites rupestris*		
2	*Lepomis miniatus*		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	*Procambarus* sp.	1	
	Ambloplites rupestris	1	55
	Etheostoma fonticola	1	22
3	*Lepomis miniatus*	1	60
	Etheostoma fonticola	1	22
4	*Ambloplites rupestris*	1	110
	Lepomis miniatus	1	23
	Gambusia sp.	1	20
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	*Gambusia* sp.	1	16
	Procambarus sp.	1	
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	*Palaemonetes* sp.	1	
11	*Procambarus* sp.	1	
12	*Lepomis microlophus*	1	92
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:
City Park		H1 - Site 9
Date:	**Time:**	**Observer(s):**
6/10/2015	1135-1157	TJ,JW,JH,JG

Overall	Species	Number	Avg. Length (mm)
18	*Etheostoma fonticola*		
1	*Ameiurus natalis*		
21	*Gambusia* sp.		
45	*Palaemonetes* sp.		
16	*Procambarus* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	2	24,21
	Gambusia sp.	4	27,24,23,15
	Palaemonetes sp.	10	
	Procambarus sp.	1	
2	*Etheostoma fonticola*	5	25,20,20,24,21
	Gambusia sp.	5	20,20,15,16,20
	Palaemonetes sp.	15	
3	*Gambusia* sp.	2	11,27
	Etheostoma fonticola	3	25,26,25
	Procambarus sp.	4	
	Palaemonetes sp.	7	
4	*Etheostoma fonticola*	3	26,26,25
	Palaemonetes sp.	7	
	Procambarus sp.	2	
	Gambusia sp.	1	22
5	*Etheostoma fonticola*	1	22
6	*Gambusia* sp.	3	30,18,20
	Palaemonetes sp.	2	
	Etheostoma fonticola	1	18
	Procambarus sp.	4	
7	*Gambusia* sp.	3	20,22,21
	Palaemonetes sp.	1	
8	*Procambarus* sp.	1	
9	*Procambarus* sp.	1	
	Palaemonetes sp.	1	
10	*Etheostoma fonticola*	2	25,21
	Gambusia sp.	1	20
11	*Palaemonetes* sp.	1	
	Gambusia sp.	1	15
	Etheostoma fonticola	1	18
	Ameiurus natalis	1	16
12	*Procambarus* sp.	3	
	Gambusia sp.	1	23
	Palaemonetes sp.	1	
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		

***Tarebia granifera-slight*
***Corbicula - slight*

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:
City Park		PH2- Site 10
Date:	**Time:**	**Observer(s):**
6/10/2015	1158-1221	TJ,JW,JH,JG

Overall	Species	Number	Avg. Length (mm)
12	*Gambusia* sp.		
13	*Etheostoma fonticola*		
7	*Procambarus* sp.		
2	*Lepomis miniatus*		
1	*Ambloplites rupestris*		
72	*Palaemonetes* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Procambarus* sp.	1	
	Lepomis miniatus	1	75
	Gambusia sp.	7	25,28,18,23,20,12,15
	Palaemonetes sp.	22	
2	*Gambusia* sp.	3	26,21,17
	Etheostoma fonticola	3	15,16,17
	Palaemonetes sp.	2	
3	*Etheostoma fonticola*	3	32,31,17
	Gambusia sp.	1	25
	Ambloplites rupestris	1	28
	Palaemonetes sp.	19	
4	*Lepomis miniatus*	1	42
	Procambarus sp.	1	
	Gambusia sp.	1	13
5	*Etheostoma fonticola*	1	26
	Palaemonetes sp.	7	
6	*Etheostoma fonticola*	2	32,15
	Palaemonetes sp.	6	
7	*Procambarus* sp.	4	
	Palaemonetes sp.	2	
	Etheostoma fonticola	1	14
8	*Etheostoma fonticola*	1	28
	Palaemonetes sp.	8	
9	*Procambarus* sp.	1	
10	*Etheostoma fonticola*	1	23
	Palaemonetes sp.	2	
11	*Palaemonetes* sp.	2	
12	No fish or crustaceans collected		
13	*Etheostoma fonticola*	1	16
	Palaemonetes sp.	1	
14	*Palaemonetes* sp.	1	
15	No fish or crustaceans collected		
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:
City Park		PH1- Site 1
Date:	**Time:**	**Observer(s):**
10/19/2015	1257-1312	TJ,JW,JH,ME

Overall	Species	Number	Avg. Length (mm)
4	*Gambusia* sp.		
1	*Ambloplites rupestris*		
3	*Procambarus* sp.		
2	*Etheostoma fonticola*		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia sp.*	2	26,32
	Procambarus sp.	1	
2	No fish or crustaceans collected		
3	*Ambloplites rupestris*	1	63
4	*Etheostoma fonticola*	1	30
5	No fish or crustaceans collected		
6	*Procambarus* sp.	1	
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	*Gambusia* sp.	1	20
10	*Gambusia* sp.	1	25
	Etheostoma fonticola	1	37
11	No fish or crustaceans collected		
12	*Procambarus* sp.	1	
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:
City Park		O2-Site 2
Date:	**Time:**	**Observer(s):**
10/19/2015	1317-1321	TJ,JW,JH,ME

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:
City Park		HD2 - Site 3
Date:	**Time:**	**Observer(s):**
10/19/2015	1322-1349	TJ,JW,JH,ME

Overall	Species	Number	Avg. Length (mm)
11	*Etheostoma fonticola*		
216	*Gambusia* sp.		
15	*Procambarus* sp.		
9	*Palaemonetes* sp.		
2	*Ambloplites rupestris*		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Procambarus* sp.	1	
	Etheostoma fonticola	2	20,28
	Gambusia sp.	32	9,15,17,16,18,12,12,15,15,18,10,12,12,12,10, 14,16,13,11,15,22,20,13,12,14
2	*Etheostoma fonticola*	1	28
	Gambusia sp.	8	
	Procambarus sp.	1	
	Palaemonetes sp.	2	
3	*Ambloplites rupestris*	1	174
	Gambusia sp.	29	
	Procambarus sp.	1	
4	*Gambusia* sp.	3	
	Procambarus sp.	1	
5	*Ambloplites rupestris*	1	134
	Gambusia sp.	25	
	Palaemonetes sp.	1	
6	*Etheostoma fonticola*	2	23,32
	Procambarus sp.	3	
	Gambusia sp.	14	
7	*Procambarus* sp.	2	
	Palaemonetes sp.	1	
	Gambusia sp.	8	
8	*Procambarus* sp.	1	
	Etheostoma fonticola	2	34,32
	Gambusia sp.	31	
9	*Gambusia* sp.	30	
	Palaemonetes sp.	3	
10	*Procambarus* sp.	1	
	Etheostoma fonticola	1	30
	Gambusia sp.	7	
11	*Palaemonetes* sp.	2	
	Procambarus sp.	1	
	Gambusia sp.	5	
12	*Procambarus* sp.	3	
	Etheostoma fonticola	2	25,16
	Gambusia sp.	12	
13	*Gambusia* sp.	7	
14	*Etheostoma fonticola*	1	30
	Gambusia sp.	4	
15	*Gambusia* sp.	1	
	***Tarebia granifera-slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:
City Park		O1 - Site 4
Date:	**Time:**	**Observer(s):**
10/19/2015	1351-1355	TJ,JW,JH,ME

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:
City Park		HD1 - Site 5
Date:	**Time:**	**Observer(s):**
10/19/2015	1356-1413	TJ,JW,JH,ME

Overall	Species	Number	Avg. Length (mm)
36	*Gambusia* sp.		
2	*Micropterus salmoides*		
3	*Etheostoma fonticola*		
5	*Procambarus* sp.		
7	*Palaemonetes* sp.		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia* sp.	8	35,15,23,30,10,10,9,9
2	*Etheostoma fonticola*	2	31,30
	Micropterus salmoides	1	145
	Gambusia sp.	6	35,20,12,13,10,9
	Palaemonetes sp.	2	
3	*Gambusia* sp.	9	31,18,16,10,10,12,12,10,11
	Palaemonetes sp.	1	
4	*Gambusia* sp.	6	12,13
5	*Gambusia* sp.	4	
6	*Procambarus* sp.	2	
	Etheostoma fonticola	1	32
	Palaemonetes sp.	1	
7	*Palaemonetes* sp.	1	
	Gambusia sp.	1	
8	No fish or crustaceans collected		
9	*Palaemonetes* sp.	1	
10	*Micropterus salmoides*	1	106
11	*Procambarus* sp.	1	
12	*Procambarus* sp.	2	
	Palaemonetes sp.	1	
	Gambusia sp.	1	
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	*Gambusia* sp.	1	

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		**Site:**	
City Park		S1 - Site 6	
Date:	**Time:**	**Observer(s):**	
10/19/2015	1416-1425	TJ,JW,JH,ME	
Overall	**Species**	**Number**	**Avg. Length (mm)**
3	*Procambarus* sp.		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	No fish or crustaceans collected		
2	*Procambarus* sp.	1	
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	*Procambarus* sp.	1	
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	*Procambarus* sp.	1	
10	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:	Site on Map:
City Park		S2- Site 7	S4
Date:	**Time:**	**Observer(s):**	
10/19/2015	1426-1438	TJ,JW,JH,ME	

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:
City Park		H1 - Site 8
Date:	**Time:**	**Observer(s):**
10/19/2015	1441-1508	TJ,JW,JH,ME

Overall	Species	Number	Avg. Length (mm)
14	*Etheostoma fonticola*		
1	*Ambloplites rupestris*		
1	*Micropterus salmoides*		
1	*Lepomis sp.*		
3	*Gambusia* sp.		
80	*Palaemonetes* sp.		
36	*Procambarus* sp.		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Ambloplites rupestris*	1	78
	Etheostoma fonticola	3	30,35,20
	Gambusia sp.	1	16
	Palaemonetes sp.	12	
2	*Gambusia* sp.	1	11
	Etheostoma fonticola	1	28
	Palaemonetes sp.	14	
3	*Etheostoma fonticola*	2	32,29
	Palaemonetes sp.	21	
	Procambarus sp.	3	
	Gambusia sp.	1	9
4	*Procambarus* sp.	7	
	Etheostoma fonticola	2	34,30
	Palaemonetes sp.	3	
5	*Procambarus* sp.	4	
	Palaemonetes sp.	2	
6	*Palaemonetes* sp.	4	
	Procambarus sp.	5	
7	*Etheostoma fonticola*	1	36
	Micropterus salmoides	1	68
	Palaemonetes sp.	15	
	Procambarus sp.	3	
8	*Procambarus* sp.	2	
	Palaemonetes sp.	2	
9	*Procambarus* sp.	4	
	Etheostoma fonticola	1	31
10	*Etheostoma fonticola*	1	36
	Procambarus sp.	3	
11	*Etheostoma fonticola*	3	32,36,30
	Lepomis sp.	1	25
	Palaemonetes sp.	2	
12	*Procambarus* sp.	1	
	Palaemonetes sp.	2	
13	*Procambarus* sp.	3	
14	*Palaemonetes* sp.	3	
15	*Procambarus* sp.	1	

***Tarebia granifera-slight*

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		**Site:**
City Park		PH2- Site 9
Date:	**Time:**	**Observer(s):**
10/19/2015	1511-1526	TJ,JW,JH,ME

Overall	**Species**	**Number**	**Avg. Length (mm)**
4	*Etheostoma fonticola*		
1	*Procambarus* sp.		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	No fish or crustaceans collected		
2	*Etheostoma fonticola*	1	32
3	*Etheostoma fonticola*	2	36,33
4	No fish or crustaceans collected		
5	*Procambarus* sp.	1	
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	*Etheostoma fonticola*	1	26
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:
City Park		H2 - Site 10
Date:	**Time:**	**Observer(s):**
10/19/2015	1530-1557	TJ,JW,JH,ME

Overall	Species	Number	Avg. Length (mm)
1	*Ambloplites rupestris*		
35	*Etheostoma fonticola*		
17	*Gambusia* sp.		
1	*Lepomis miniatus*		
1	*Lepomis gulosus*		
63	*Procambarus* sp.		
89	*Palaemonetes* sp.		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	2	20,26
	Gambusia sp.	6	10,13,10,9,12,8
	Procambarus sp.	3	
	Palaemonetes sp.	31	
2	*Ambloplites rupestris*	1	55
	Etheostoma fonticola	7	39,33,36,31,23,35,30
	Gambusia sp.	7	15,16,11,13,10,13,13
	Lepomis miniatus	1	57
	Procambarus sp.	7	
	Palaemonetes sp.	5	
3	*Etheostoma fonticola*	8	25,26,35,33,30,33,20,21
	Gambusia sp.	1	10
	Palaemonetes sp.	29	
	Procambarus sp.	7	
4	*Etheostoma fonticola*	4	33,33,28,30
	Palaemonetes sp.	8	
	Gambusia sp.	3	11,10,11
	Procambarus sp.	5	
5	*Etheostoma fonticola*	2	30,27
	Procambarus sp.	4	
	Palaemonetes sp.	6	
6	*Lepomis gulosus*	1	157
	Procambarus sp.	5	
	Etheostoma fonticola	2	30,31
	Palaemonetes sp.	4	
7	*Procambarus* sp.	4	
	Etheostoma fonticola	5	21,26,32,27,34
8	*Procambarus* sp.	5	
9	*Palaemonetes* sp.	2	
10	*Etheostoma fonticola*	3	23,33,27
	Palaemonetes sp.	3	
	Procambarus sp.	2	
11	*Etheostoma fonticola*	2	34,34
	Procambarus sp.	11	
12	*Palaemonetes* sp.	1	
	Procambarus sp.	3	
13	*Procambarus* sp.	6	
14	*Procambarus* sp.	1	
15	No fish or crustaceans collected		
	***Tarebia granifera-slight*		

SAN MARCOS RIVER -FALL 2015 SAMPLING			
Dip net sweep	Species	Number	Length (mm)

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Location (Reach):		Site:
IH-35		O1 - Site 1
Date:	**Time:**	**Observer(s):**
4/21/2015	1157-1201	JG,JW,JH,TJ

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Location (Reach):		Site:
IH-35		O2 - Site 2
Date:	**Time:**	**Observer(s):**
4/21/2015	1203-1205	JG,JW,JH,TJ

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER - SPRING 2015 SAMPLING

Location (Reach):		Site:
IH-35		HD1 - Site 3
Date:	**Time:**	**Observer(s):**
4/21/2015	1428-1451	JG,JW,JH,TJ

Overall	Species	Number	Avg. Length (mm)
1	*Lepomis auritus*		
2	*Ambloplites rupestris*		
20	*Etheostoma fonticola*		
2	*Lepomis miniatus*		
13	*Gambusia* sp.		
31	*Procambarus* sp.		

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Lepomis auritus*	1	82
	Ambloplites rupestris	1	52
	Etheostoma fonticola	3	24,19,20,101
	Lepomis miniatus	1	101
	Gambusia sp.	3	21,15,19
	Procambarus sp.	5	
2	*Etheostoma fonticola*	3	25,24,19
	Gambusia sp.	7	11,13,22,19,24,12,20
	Procambarus sp.	1	
3	*Etheostoma fonticola*	2	22,16
	Gambusia sp.	1	33
	Procambarus sp.	1	
4	*Procambarus* sp.	8	
	Gambusia sp.	2	12,20
	Ambloplites rupestris	1	11
5	*Etheostoma fonticola*	3	20,19,22
	Procambarus sp.	3	
6	*Etheostoma fonticola*	1	20
7	*Etheostoma fonticola*	1	32
8	*Lepomis miniatus*	1	53
	Procambarus sp.	5	
	Etheostoma fonticola	1	29
9	*Etheostoma fonticola*	2	23,22
10	No fish or crustaceans collected		
11	*Etheostoma fonticola*	3	25,25,22
	Procambarus sp.	2	
12	*Etheostoma fonticola*	1	31
	Procambarus sp.	3	
13	No fish or crustaceans collected		
14	*Procambarus* sp.	3	

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER - SPRING 2015 SAMPLING

15	No fish or crustaceans collected ***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Location (Reach):		Site:
IH-35		C2- Site 4
Date:	**Time:**	**Observer(s):**
4/21/2015	1208-1230	JG,JW,JH,TJ

Overall	Species	Number	Avg. Length (mm)
47	*Procambarus* sp.		
1	*Lepomis miniatus*		
20	*Etheostoma fonticola*		
1	*Lepomis sp.*		
1	*Palaemonetes* sp.		
3	*Gambusia* sp.		
1	*Lepomis auritus*		

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Procambarus* sp.	2	
2	*Procambarus* sp.	7	
	Lepomis miniatus	1	52
	Etheostoma fonticola	2	35,16
	Lepomis sp.	1	16
	Palaemonetes sp.	1	
	Gambusia sp.	1	15
3	*Etheostoma fonticola*	3	24,29,17
	Procambarus sp.	5	
4	*Lepomis auritus*	1	53
	Etheostoma fonticola	4	17,18,16,12
	Procambarus sp.	1	
5	*Etheostoma fonticola*	2	21,28
	Procambarus sp.	2	
6	*Etheostoma fonticola*	2	20,18
	Procambarus sp.	6	
7	*Etheostoma fonticola*	1	25
	Procambarus sp.	6	
8	*Etheostoma fonticola*	2	14,19
	Procambarus sp.	2	
9	*Procambarus* sp.	5	
10	*Etheostoma fonticola*	2	27,21
	Procambarus sp.	2	
11	*Procambarus* sp.	5	
12	No fish or crustaceans collected		
13	*Etheostoma fonticola*	1	22
	Gambusia sp.	1	22
	Procambarus sp.	3	
14	*Etheostoma fonticola*	1	26
15	*Procambarus* sp.	1	
	Gambusia sp.	1	10
	*** Melanoides - slight*		
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Location (Reach):		Site:
IH-35		C1 - Site 5
Date:	**Time:**	**Observer(s):**
4/21/2015	1234-1301	JG,JW,JH,TJ

Overall	Species	Number	Avg. Length (mm)
4	*Lepomis sp.*		
30	*Etheostoma fonticola*		
2	*Dionda nigrotaeniata*		
1	*Ameiurus natalis*		
4	*Gambusia* sp.		
4	*Ambloplites rupestris*		
45	*Procambarus* sp.		
1	*Lepomis miniatus*		

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Lepomis sp.*	3	13,11,12
	Etheostoma fonticola	7	19,15,19,20,17,17,18
	Dionda nigrotaeniata	1	19
	Ameiurus natalis	1	22
	Gambusia sp.	2	10,10,
	Ambloplites rupestris	2	13,12
	Procambarus sp.	23	
2	*Etheostoma fonticola*	4	34,19,19,15
	Gambusia sp.	1	15
	Lepomis sp.	1	12
3	*Etheostoma fonticola*	8	18,11,15,21,16,12,16,16
	Procambarus sp.	10	
	Gambusia sp.	1	13
4	*Lepomis miniatus*	1	50
	Etheostoma fonticola	3	18,11,19
	Dionda nigrotaeniata	1	18
	Ambloplites rupestris	1	13
5	*Procambarus* sp.	4	
6	*Etheostoma fonticola*	4	35,19,24,15
7	*Etheostoma fonticola*	2	20,16
	Ambloplites rupestris	1	11
	Procambarus sp.	2	
8	*Etheostoma fonticola*	1	35
9	No fish or crustaceans collected		
10	*Procambarus* sp.	3	
11	*Etheostoma fonticola*	1	16
	Procambarus sp.	2	
12	No fish or crustaceans collected		
13	*Procambarus* sp.	1	
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	*** Melanoides - slight*		
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Location (Reach):		Site:
IH-35		H1 - Site 6
Date:	**Time:**	**Observer(s):**
4/21/2015	1306-1321	JG,JW,JH,TJ

Overall	Species	Number	Avg. Length (mm)
1	*Ameiurus natalis*		
1	*Lepomis auritus*		
8	*Procambarus* sp.		
1	*Lepomis gulosus*		
10	*Gambusia* sp.		
2	*Lepomis miniatus*		
1	*Ambloplites rupestris*		
1	*Lepomis sp.*		

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia* sp.	6	34,14,22,27,15,20
	Lepomis auritus	1	59
2	*Procambarus* sp.	4	
	Lepomis gulosus	1	200
	Gambusia sp.	1	15
3	*Lepomis miniatus*	2	67,81
	Gambusia sp.	1	29
4	*Procambarus* sp.	2	
5	*Gambusia* sp.	1	28
6	*Procambarus* sp.	2	
7	*Ameiurus natalis*	1	16
8	*Gambusia* sp.	1	25
9	No fish or crustaceans collected		
10	*Ambloplites rupestris*	1	24
	Lepomis sp.	1	10
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		

*** Melanoides - slight*
***Tarebia granifera - slight*

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Location (Reach):		Site:
IH-35		H2 - Site 7
Date:	**Time:**	**Observer(s):**
4/21/2015	1326-1342	JG,JW,JH,TJ

Overall	Species	Number	Avg. Length (mm)
6	*Gambusia* sp.		
8	*Etheostoma fonticola*		
1	*Ambloplites rupestris*		
1	*Hypostomus plecostomus*		
6	*Procambarus* sp.		
1	*Lepomis miniatus*		

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia* sp.	1	26
	Etheostoma fonticola	1	20
2	*Ambloplites rupestris*	1	20
	Hypostomus plecostomus	1	21
3	*Procambarus* sp.	1	
4	*Procambarus* sp.	2	
	Etheostoma fonticola	3	34,31,12
	Gambusia sp.	2	22,23
5	No fish or crustaceans collected		
6	*Procambarus* sp.	1	
	Etheostoma fonticola	1	34
7	*Procambarus* sp.	1	
	Etheostoma fonticola	1	20
8	*Lepomis miniatus*	1	60
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
11	No fish or crustaceans collected		
12	*Gambusia* sp.	3	36,27,28
	Etheostoma fonticola	2	2019
	Procambarus sp.	1	
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	** *Melanoides - slight*		
	***Tarebia granifera - slight*		
	***Corbicula - slight*		

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER - SPRING 2015 SAMPLING

Location (Reach):		Site:
IH-35		HD2 - Site 8
Date:	**Time:**	**Observer(s):**
4/21/2015	1346-1404	JG,JW,JH,TJ

Overall	Species	Number	Avg. Length (mm)
21	*Etheostoma fonticola*		
14	*Gambusia* sp.		
3	*Herichthys cyanoguttatus*		
2	*Ambloplites rupestris*		
140	*Procambarus* sp.		

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	5	26,20,21,16,16
	Gambusia sp.	2	11,13
	Herichthys cyanoguttatus	3	41,16,16
	Ambloplites rupestris	1	22
	Procambarus sp.	61	
2	*Etheostoma fonticola*	4	24,23,22,16
	Gambusia sp.	1	12
	Procambarus sp.	25	
3	*Gambusia* sp.	5	28,15,15,22,12
	Etheostoma fonticola	1	17
	Procambarus sp.	10	
4	*Gambusia* sp.	4	20,20,12,11
	Etheostoma fonticola	2	20,16
	Procambarus sp.	11	
5	*Etheostoma fonticola*	3	21,20,16
	Gambusia sp.	2	23,13
	Procambarus sp.	7	
6	*Etheostoma fonticola*	2	20,24
	Procambarus sp.	1	
7	No fish or crustaceans collected		
8	*Procambarus* sp.	3	
9	*Procambarus* sp.	8	
10	*Ambloplites rupestris*	1	23
	Etheostoma fonticola	2	20,19
	Procambarus sp.	3	
11	No fish or crustaceans collected		
12	*Etheostoma fonticola*	2	26,27
	Procambarus sp.	4	
13	*Procambarus* sp.	5	
14	*Procambarus* sp.	1	
15	*Procambarus* sp.	1	

SAN MARCOS RIVER - SPRING 2015 SAMPLING			
Dip net sweep	**Species**	**Number**	**Length (mm)**
	***Tarebia granifera - slight* *** Melanoides - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Location (Reach):		Site:
IH-35		S2 - Site 9
Date:	**Time:**	**Observer(s):**
4/21/2015	1406-1425	JG,JW,JH,TJ

Overall	Species	Number	Avg. Length (mm)
12	*Etheostoma fonticola*		
2	*Gambusia* sp.		
1	*Lepomis miniatus*		
24	*Procambarus* sp.		
3	*Ambloplites rupestris*		
1	*Lepomis auritus*		

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	3	32,14,14
	Lepomis miniatus	1	76
	Procambarus sp.	6	
2	*Etheostoma fonticola*	1	31
	Gambusia sp.	1	26
	Procambarus sp.	6	
3	*Etheostoma fonticola*	2	21,20
	Procambarus sp.	5	
4	*Ambloplites rupestris*	1	17
	Etheostoma fonticola	1	18
5	*Procambarus* sp.	3	
6	*Procambarus* sp.	1	
7	*Etheostoma fonticola*	1	20
8	*Lepomis auritus*	1	55
	Etheostoma fonticola	1	22
	Ambloplites rupestris	1	15
9	*Etheostoma fonticola*	2	16,17
10	*Procambarus* sp.	2	
11	No fish or crustaceans collected		
12	*Ambloplites rupestris*	1	15
13	*Procambarus* sp.	1	
14	*Gambusia* sp.	1	25
	Etheostoma fonticola	1	34
15	No fish or crustaceans collected		
	***Tarebia granifera - slight*		
	*** Melanoides - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Location (Reach):		**Site:**
IH-35		S1 - Site 10
Date:	**Time:**	**Observer(s):**
4/21/2015	1454-1510	JG,JW,JH,TJ

Overall	**Species**	**Number**	**Avg. Length (mm)**
1	*Lepomis miniatus*		
10	*Procambarus* sp.		
1	*Lepomis auritus*		
1	*Etheostoma fonticola*		
1	*Herichthys cyanoguttatus*		

SAN MARCOS RIVER - SPRING 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	*Lepomis miniatus*	1	75
	Procambarus sp.	7	
2	*Herichthys cyanoguttatus*	1	182
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	*Procambarus* sp.	2	
6	*Etheostoma fonticola*	1	30
7	*Procambarus* sp.	1	
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
11	*Lepomis auritus*	1	82
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	***Tarebia granifera - slight*		
	*** Melanoides - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:
IH-35		C1 - Site 1
Date:	**Time:**	**Observer(s):**
6/11/2015	903-928	JG,JW,JJ,TJ

Overall	Species	Number	Avg. Length (mm)
7	*Lepomis miniatus*		
1	*Gambusia* sp.		
21	*Procambarus* sp.		
1	*Palaemonetes* sp.		
10	*Etheostoma fonticola*		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Lepomis miniatus*	3	76,62,58
	Etheostoma fonticola	3	17,27,23
	Procambarus sp.	8	
2	*Etheostoma fonticola*	2	25,22
	Procambarus sp.	3	
3	*Lepomis miniatus*	1	63
	Gambusia sp.	1	26
	Procambarus sp.	2	
	Etheostoma fonticola	1	20
4	*Lepomis miniatus*	1	50
5	*Lepomis miniatus*	1	84
	Procambarus sp.	2	
6	*Etheostoma fonticola*	3	32,26,19
7	*Procambarus* sp.	1	
8	No fish or crustaceans collected		
9	*Etheostoma fonticola*	1	16
10	*Procambarus* sp.	1	
11	*Procambarus* sp.	1	
12	No fish or crustaceans collected		
13	*Lepomis miniatus*	1	82
	Procambarus sp.	1	
14	*Procambarus* sp.	1	
	Palaemonetes sp.	1	
15	*Procambarus* sp.	1	
	*** Melanoides - moderate*		
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:
IH-35		H1 - Site 2
Date:	**Time:**	**Observer(s):**
6/11/2015	932-949	JG,JW,JJ,TJ

Overall	Species	Number	Avg. Length (mm)
10	*Etheostoma fonticola*		
2	*Ambloplites rupestris*		
5	*Palaemonetes* sp.		
13	*Procambarus* sp.		
1	*Gambusia* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	2	20,24
	Ambloplites rupestris	1	80
	Palaemonetes sp.	2	
	Procambarus sp.	3	
2	No fish or crustaceans collected		
3	*Procambarus* sp.	1	
	Etheostoma fonticola	3	28,30,24
	Palaemonetes sp.	1	
4	No fish or crustaceans collected		
5	*Etheostoma fonticola*	5	30,22,31,25,17
	Gambusia sp.	1	16
	Palaemonetes sp.	1	
6	No fish or crustaceans collected		
7	*Procambarus* sp.	4	
	Ambloplites rupestris	1	36
	Palaemonetes sp.	1	
8	*Procambarus* sp.	1	
9	*Procambarus* sp.	2	
10	No fish or crustaceans collected		
11	*Procambarus* sp.	2	
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	***Corbicula - slight*		
	*** Melanoides - slight*		
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:	Site on Map:
IH-35		H2 - Site 3	H3
Date:	**Time:**	**Observer(s):**	
6/11/2015	953-1018	JG,JW,JJ,TJ	

Overall	Species	Number	Avg. Length (mm)
1	*Ambloplites rupestris*		
1	*Plecostomus sp.*		
5	*Etheostoma fonticola*		
2	*Lepomis miniatus*		
1	*Lepomis sp.*		
7	*Gambusia* sp.		
21	*Procambarus* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Ambloplites rupestris*	1	28
	Plecostomus sp.	1	20
	Etheostoma fonticola	2	31,20
	Lepomis miniatus	1	27
	Gambusia sp.	2	26,15
	Procambarus sp.	8	
2	*Gambusia* sp.	1	22
	Procambarus sp.	1	
3	*Gambusia* sp.	1	25
4	No fish or crustaceans collected		
5	*Etheostoma fonticola*	1	21
	Gambusia sp.	1	23
	Procambarus sp.	3	
6	*Lepomis sp.*	1	19
	Procambarus sp.	1	
7	No fish or crustaceans collected		
8	*Gambusia* sp.	1	36
9	*Lepomis miniatus*	1	40
	Procambarus sp.	1	
10	No fish or crustaceans collected		
11	*Procambarus* sp.	1	
12	*Procambarus* sp.	1	
13	*Etheostoma fonticola*	2	26,33
	Gambusia sp.	1	18
	Procambarus sp.	2	
14	No fish or crustaceans collected		
15	*Procambarus* sp.	3	
	*** Melanoides - moderate*		
	***Tarebia granifera - slight*		
	***Corbicula - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		**Site:**
IH-35		S2 - Site 4
Date:	**Time:**	**Observer(s):**
6/11/2015	1022-1041	JG,JW,JJ,TJ

Overall	**Species**	**Number**	**Avg. Length (mm)**
2	*Ambloplites rupestris*		
3	*Etheostoma fonticola*		
33	*Procambarus* sp.		
2	*Lepomis miniatus*		
1	*Plecostomus sp.*		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	*Ambloplites rupestris*	1	82
	Etheostoma fonticola	1	22
	Procambarus sp.	5	
2	*Procambarus* sp.	4	
3	*Procambarus* sp.	3	
	Etheostoma fonticola	1	21
4	*Procambarus* sp.	3	
5	*Lepomis miniatus*	2	62,66
	Procambarus sp.	3	
6	*Procambarus* sp.	3	
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	*Procambarus* sp.	1	
	Etheostoma fonticola	1	26
10	*Procambarus* sp.	1	
11	*Procambarus* sp.	4	
	Plecostomus sp.	1	21
12	*Procambarus* sp.	1	
13	*Procambarus* sp.	5	
14	No fish or crustaceans collected		
15	*Ambloplites rupestris*	1	129
	***Tarebia granifera - slight*		
	*** Melanoides - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:
IH-35		S1 - Site 5
Date:	**Time:**	**Observer(s):**
6/11/2015	1043-1055	JG,JW,JJ,TJ

Overall	Species	Number	Avg. Length (mm)
2	*Ambloplites rupestris*		
1	*Lepomis miniatus*		
8	*Procambarus* sp.		
1	*Gambusia* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	*Procambarus* sp.	2	
	Ambloplites rupestris	1	27
3	*Ambloplites rupestris*	1	105
	Lepomis miniatus	1	60
	Procambarus sp.	1	
4	No fish or crustaceans collected		
5	*Gambusia* sp.	1	20
6	*Procambarus* sp.	1	
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
11	*Procambarus* sp.	1	
12	No fish or crustaceans collected		
13	*Procambarus* sp.	1	
14	*Procambarus* sp.	1	
15	*Procambarus* sp.	1	
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:	Site on Map:
IH-35		HD1 - Site 6	HD4
Date:	**Time:**	**Observer(s):**	
6/11/2015	1102-1113	JG,JW,JJ,TJ	

Overall	Species	Number	Avg. Length (mm)
1	*Etheostoma fonticola*		
1	*Gambusia* sp.		
28	*Procambarus* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Procambarus* sp.	8	
	Gambusia sp.	1	20
2	*Procambarus* sp.	1	
3	*Procambarus* sp.	6	
4	No fish or crustaceans collected		
5	*Procambarus* sp.	4	
6	*Procambarus* sp.	2	
7	No fish or crustaceans collected		
8	*Procambarus* sp.	1	
9	No fish or crustaceans collected		
10	*Etheostoma fonticola*	1	21
11	*Procambarus* sp.	1	
12	*Procambarus* sp.	2	
13	*Procambarus* sp.	1	
14	*Procambarus* sp.	1	
15	*Procambarus* sp.	1	
	***Tarebia granifera - slight*		
	*** Melanoides - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):	Site:	Site on Map:
IH-35	C2- Site 7	

Date:	Time:	Observer(s):
6/11/2015	1119-1142	JG,JW,JJ,TJ

Overall	Species	Number	Avg. Length (mm)
13	*Etheostoma fonticola*		
19	*Lepomis miniatus*		
1	*Micropterus salmoides*		
8	*Palaemonetes* sp.		
21	*Procambarus* sp.		
3	*Ambloplites rupestris*		
1	*Lepomis sp.*		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	2	24,31
	Lepomis miniatus	2	26,25
	Micropterus salmoides	1	41
	Palaemonetes sp.	4	
2	*Procambarus* sp.	2	
	Lepomis miniatus	1	22
	Palaemonetes sp.	1	
3	*Lepomis miniatus*	2	84,62
	Etheostoma fonticola	2	27,20
	Procambarus sp.	1	
	Palaemonetes sp.	1	
4	*Etheostoma fonticola*	1	36
	Lepomis miniatus	1	60
	Ambloplites rupestris	1	35
5	*Procambarus* sp.	2	
	Etheostoma fonticola	4	24,31,22,19
	Lepomis miniatus	2	30,71
	Palaemonetes sp.	1	
6	*Lepomis miniatus*	1	22
	Palaemonetes sp.	1	
7	*Procambarus* sp.	3	
	Ambloplites rupestris	1	45
	Lepomis sp.	1	12
8	*Lepomis miniatus*	4	40,37,24,57
	Ambloplites rupestris	1	23
	Procambarus sp.	4	
9	*Etheostoma fonticola*	1	26
	Procambarus sp.	1	
10	*Lepomis miniatus*	4	59,56,22,67
	Procambarus sp.	4	
11	*Etheostoma fonticola*	1	25
	Procambarus sp.	1	
12	*Procambarus* sp.	1	
13	*Lepomis miniatus*	1	73
14	*Procambarus* sp.	2	
15	*Etheostoma fonticola*	2	16,21
16	*Lepomis miniatus*	1	65

*** Melanoides - slight*
***Tarebia granifera - slight*

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:	Site on Map:
IH-35		O2 - Site 8	O3
Date:	**Time:**	**Observer(s):**	
6/11/2015	1144-1149	JG,JW,JJ,TJ	

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		Site:
IH-35		O1 - Site 9
Date:	**Time:**	**Observer(s):**
6/11/2015	1154-1157	JG,JW,JJ,TJ

Overall	Species	Number	Avg. Length (mm)

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Location (Reach):		**Site:**
IH-35		HD2 - Site 10
Date:	**Time:**	**Observer(s):**
6/11/2015	1159-1209	JG,JW,JJ,TJ

Overall	**Species**	**Number**	**Avg. Length (mm)**
1	*Etheostoma fonticola*		
1	*Gambusia* sp.		
3	*Percina apristis*		
2	*Palaemonetes* sp.		

SAN MARCOS RIVER -CRITICAL PERIOD (HIGH FLOW) 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	*Percina apristis*	2	75,76
	Palaemonetes sp.	2	
2	*Gambusia* sp.	1	17
	Percina apristis	1	25
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	*Etheostoma fonticola*	1	26
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	***Corbicula - slight*		
	***Tarebia granifera - slight*		
	*** Melanoides - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:
IH-35		HD2 - Site 1
Date:	**Time:**	**Observer(s):**
10/20/2015	1030-1045	ME,JW,JJ,TJ

Overall	Species	Number	Avg. Length (mm)
1	*Etheostoma fonticola*		
1	*Procambarus* sp.		
1	*Palaemonetes* sp.		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Palaemonetes* sp.	1	
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	*Procambarus* sp.	1	
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	*Etheostoma fonticola*	1	25
10	No fish or crustaceans collected		
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	***Corbicula - slight*		
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach): IH-35		**Site:** O1 - Site 2	
Date: 10/20/2015	**Time:** 1047-1051	**Observer(s):** ME,JW,JJ,TJ	
Overall	**Species**	**Number**	**Avg. Length (mm)**

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	**Species**	**Number**	**Length (mm)**
1	No fish or crustaceans collected		
2	No fish or crustaceans collected		
3	No fish or crustaceans collected		
4	No fish or crustaceans collected		
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):	Site:	Site on Map:
IH-35	C2- Site 3	

Date:	Time:	Observer(s):
10/20/2015	1056-1121	ME,JW,JJ,TJ

Overall	Species	Number	Avg. Length (mm)
2	*Lepomis miniatus*		
1	*Lepomis sp.*		
40	*Procambarus* sp.		
1	*Palaemonetes* sp.		
11	*Etheostoma fonticola*		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Procambarus* sp.	7	
	Palaemonetes sp.	1	
2	*Lepomis miniatus*	2	100,94
	Lepomis sp.	1	20
	Procambarus sp.	4	
3	*Etheostoma fonticola*	1	34
	Procambarus sp.	2	
4	*Etheostoma fonticola*	3	34,25,22
	Procambarus sp.	5	
5	*Procambarus* sp.	4	
6	*Etheostoma fonticola*	3	31,33,28
	Procambarus sp.	6	
7	*Etheostoma fonticola*	1	31
	Procambarus sp.	2	
8	*Etheostoma fonticola*	1	26
	Procambarus sp.	4	
9	*Etheostoma fonticola*	1	25
10	*Procambarus* sp.	1	
11	*Etheostoma fonticola*	1	22
	Procambarus sp.	2	
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	*Procambarus* sp.	2	
15	*Procambarus* sp.	1	
	***Corbicula - slight*		
	*** Melanoides - slight*		
	***Tarebia granifera - moderate*		

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:
IH-35		C1 - Site 4
Date:	**Time:**	**Observer(s):**
10/20/2015	1129-1159	ME,JW,JJ,TJ

Overall	Species	Number	Avg. Length (mm)
5	*Lepomis miniatus*		
37	*Gambusia* sp.		
1	*Ambloplites rupestris*		
1	*Lepomis auritus*		
2	*Lepomis sp.*		
9	*Procambarus* sp.		
3	*Palaemonetes* sp.		
3	*Etheostoma fonticola*		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Gambusia* sp.	20	18,15,11,13,18,22,10,10,10,14,12,10,11,12,10,11,12,10,10,10
	Etheostoma fonticola	3	24,20,25
	Lepomis miniatus	1	51
2	*Gambusia* sp.	7	20,17,15,14,14
	Procambarus sp.	2	
	Palaemonetes sp.	2	
3	*Lepomis miniatus*	1	38
	Lepomis sp.	1	15
	Gambusia sp.	10	
	Procambarus sp.	2	
4	*Procambarus* sp.	3	
5	*Lepomis auritus*	1	65
	Lepomis miniatus	1	41
6	No fish or crustaceans collected		
7	*Ambloplites rupestris*	1	65
8	*Procambarus* sp.	2	
9	*Lepomis miniatus*	1	38
	Palaemonetes sp.	1	
10	*Lepomis sp.*	1	25
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	*Lepomis miniatus*	1	53
	***Corbicula - slight*		
	*** Melanoides - slight*		
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:
IH-35		H1 - Site 5
Date:	**Time:**	**Observer(s):**
10/20/2015	1202-1227	ME,JW,JJ,TJ

Overall	Species	Number	Avg. Length (mm)
6	*Etheostoma fonticola*		
2	*Lepomis miniatus*		
1	*Plecostomus sp.*		
11	*Palaemonetes* sp.		
25	*Procambarus* sp.		
31	*Gambusia* sp.		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Lepomis miniatus*	1	120
	Procambarus sp.	7	
	Palaemonetes sp.	4	
	Gambusia sp.	15	24,23,22,17,12,13,19,18,23,20,13,15,12,11,10
2	*Procambarus* sp.	4	
	Gambusia sp.	6	22,19,24,18,12,15
	Palaemonetes sp.	1	
3	*Procambarus* sp.	1	
4	*Etheostoma fonticola*	1	31
5	*Procambarus* sp.	4	
	Gambusia sp.	7	28,16,25,16
	Etheostoma fonticola	1	28
	Palaemonetes sp.	3	
6	*Etheostoma fonticola*	1	31
	Procambarus sp.	2	
	Gambusia sp.	1	
7	*Etheostoma fonticola*	1	32
	Lepomis miniatus	1	81
	Palaemonetes sp.	1	
8	*Etheostoma fonticola*	1	31
	Procambarus sp.	2	
	Plecostomus sp.	1	20
9	*Procambarus* sp.	2	
10	*Palaemonetes* sp.	2	
	Procambarus sp.	1	
11	*Gambusia* sp.	1	
12	*Etheostoma fonticola*	1	30
	Gambusia sp.	1	
13	*Procambarus* sp.	2	
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	** *Melanoides - moderate*		
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS
SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:
IH-35		S1 - Site 6
Date:	**Time:**	**Observer(s):**
10/20/2015	1250-1302	ME,JW,JJ,TJ

Overall	Species	Number	Avg. Length (mm)
1	*Lepomis miniatus*		
1	*Etheostoma fonticola*		
14	*Procambarus* sp.		
1	*Herichthys cyanoguttatus*		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Procambarus* sp.	1	
	Herichthys cyanoguttatus	1	115
2	*Procambarus* sp.	1	
	Etheostoma fonticola	1	34
3	*Procambarus* sp.	1	
4	*Procambarus* sp.	1	
5	*Procambarus* sp.	1	
6	*Procambarus* sp.	3	
7	*Procambarus* sp.	2	
8	*Procambarus* sp.	2	
9	*Procambarus* sp.	1	
10	No fish or crustaceans collected		
11	*Lepomis miniatus*	1	82
12	*Procambarus* sp.	1	
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	***Tarebia granifera - slight*		
	*** Melanoides - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:
IH-35		S2 - Site 7
Date:	**Time:**	**Observer(s):**
10/20/2015	1304-1320	ME,JW,JJ,TJ

Overall	Species	Number	Avg. Length (mm)
1	*Ambloplites rupestris*		
17	*Gambusia* sp.		
3	*Procambarus* sp.		
4	*Lepomis miniatus*		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Lepomis miniatus*	2	65,64
	Gambusia sp.	5	8,15,32,12,13
2	*Lepomis miniatus*	1	76
	Gambusia sp.	7	21,30,24,20,22,26,16
3	*Procambarus* sp.	1	
	Gambusia sp.	2	11,15
4	*Gambusia* sp.	2	15,14
	Procambarus sp.	1	
5	*Procambarus* sp.	1	
	Gambusia sp.	1	20
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	*Ambloplites rupestris*	1	112
10	*Lepomis miniatus*	1	86
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	***Corbicula - slight*		
	***Tarebia granifera - slight*		
	*** Melanoides - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:	Site on Map:
IH-35		H2 - Site 8	
Date:	**Time:**	**Observer(s):**	
10/20/2015	1223-1343	ME,JW,JJ,TJ	

Overall	Species	Number	Avg. Length (mm)
1	*Plecostomus sp.*		
5	*Etheostoma fonticola*		
29	*Gambusia* sp.		
73	*Procambarus* sp.		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Etheostoma fonticola*	5	33,30,37,335,34
	Gambusia sp.	19	22,12,15,21,22,19,18,11,15,14,20, 15,14,11,13,15,14,12,10
	Procambarus sp.	22	
2	*Gambusia* sp.	5	20,20,13,14,20
	Procambarus sp.	17	
3	*Procambarus* sp.	8	
	Gambusia sp.	1	20
4	*Procambarus* sp.	9	
	Gambusia sp.	1	
5	*Procambarus* sp.	4	
6	*Procambarus* sp.	4	
7	*Plecostomus sp.*	1	
	Procambarus sp.	2	
8	*Procambarus* sp.	2	
	Gambusia sp.	3	
9	No fish or crustaceans collected		
10	*Procambarus* sp.	1	
11	*Procambarus* sp.	1	
12	No fish or crustaceans collected		
13	*Procambarus* sp.	3	
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	** *Melanoides - slight*		
	***Tarebia granifera - slight*		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:	Site on Map:
IH-35		O2 - Site 9	
Date:	**Time:**	**Observer(s):**	
10/20/2015	1344-1352	ME,JW,JJ,TJ	

Overall	Species	Number	Avg. Length (mm)
7	*Notropis amabilis*		
1	*Procambarus* sp.		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Notropis amabilis*	1	67
2	*Notropis amabilis*	4	56,61,65,50
	Procambarus sp.	1	
3	*Notropis amabilis*	1	65
4	*Notropis amabilis*	1	62
5	No fish or crustaceans collected		
6	No fish or crustaceans collected		
7	No fish or crustaceans collected		
8	No fish or crustaceans collected		
9	No fish or crustaceans collected		
10	No fish or crustaceans collected		
11	No fish or crustaceans collected		
12	No fish or crustaceans collected		
13	No fish or crustaceans collected		
14	No fish or crustaceans collected		
15	No fish or crustaceans collected		
	***Tarebia granifera* - slight**		

DROP NET - FIELD DATA SHEETS

SAN MARCOS RIVER -FALL 2015 SAMPLING

Location (Reach):		Site:	Site on Map:
IH-35		HD1 - Site 10	HD4
Date:	**Time:**	**Observer(s):**	
10/20/2015	1355-1412	ME,JW,JJ,TJ	

Overall	Species	Number	Avg. Length (mm)
2	*Ambloplites rupestris*		
1	*Herichthys cyanoguttatus*		
8	*Etheostoma fonticola*		
13	*Gambusia* sp.		
15	*Procambarus* sp.		

SAN MARCOS RIVER -FALL 2015 SAMPLING

Dip net sweep	Species	Number	Length (mm)
1	*Ambloplites rupestris*	1	75
	Gambusia sp.	4	19,28,17,17
2	*Etheostoma fonticola*	1	31
	Gambusia sp.	2	14,16
3	*Gambusia* sp.	2	40,15
	Etheostoma fonticola	1	35
4	*Etheostoma fonticola*	1	35
	Gambusia sp.	1	17
	Procambarus sp.	3	
5	*Etheostoma fonticola*	1	35
	Procambarus sp.	3	
6	*Etheostoma fonticola*	2	20,33
	Herichthys cyanoguttatus	1	31
	Gambusia sp.	2	20,18
7	*Procambarus* sp.	3	
8	*Gambusia* sp.	1	28
	Procambarus sp.	1	
9	No fish or crustaceans collected		
10	*Etheostoma fonticola*	1	35
	Ambloplites rupestris	1	74
11	*Procambarus* sp.	3	
12	*Gambusia* sp.	1	18
	Procambarus sp.	1	
13	*Procambarus* sp.	1	
14	No fish or crustaceans collected		
15	*Etheostoma fonticola*	1	25
		39	
16	No fish or crustaceans collected		
	***Corbicula - slight*		
	***Tarebia granifera - slight*		
	*** Melanoides - slight*		