



City of Austin

Founded by Congress, Republic of Texas, 1839
Watershed Protection Department
P.O. Box 1088. Austin. Texas 78767

December 15, 2014

Ms. Vanessa Martinez
U.S. Fish and Wildlife Service
Ecological Services
PO Box 1306
Albuquerque, New Mexico 87103
Ph: 505-248-6665
Vanessa_Martinez@fws.gov

Dear Ms. Martinez:

Enclosed is the City of Austin's 2014 annual report for the U.S. Fish and Wildlife Service 10(a)1(A) permit (TE-833851) covering scientific activities affecting *Eurycea sosorum*, *E. waterlooensis*, and *E. tonkawae*.

Please do not hesitate to contact me should you require additional information at 512-974-2652, or Nathan Bendik, Watershed Protection Department Environmental Scientist, at 512-974-2040.

Sincerely,

Mike Personett, Assistant Director
Watershed Protection Department

2014 Annual Report
U.S. Fish and Wildlife Service Scientific Permit (TE-833851)

Reporting period: December 2013- November 2014

This report documents the activities associated with the Barton Springs salamander (*Eurycea sosorum*) that are authorized under the above federal endangered species permit for 2014.

Tables and figures are numbered by section.

TE-833851, Section S., Permit Condition 6: General Annual Reporting Requirements for Barton Springs and Austin Blind Salamanders

1) Precise locations of previously undocumented surveyed areas

None.

2) Dates of surveys conducted- see 4 below.

3a) Survey methods

Surveys of abundance of *Eurycea sosorum* (Barton Springs Salamander) and *Eurycea waterlooensis* (Austin Blind Salamander) were conducted bi-monthly throughout the year at the three perennial spring sites, Parthenia Spring (= Barton Springs Pool), Eliza Spring, and Zenobia Spring (=Old Mill= Sunken Garden) and at one intermittent spring, Upper Barton Spring, when water was present.

For each survey the date, weather, type of flow (base flow or storm flow) and aquifer discharge are recorded by the U.S. Geological Survey station at Barton Springs. Each site was searched by the drive survey method, which consists of a moving line from downstream do upstream. All substrate was searched for salamanders, rocks are removed and replaced behind the survey line, and aquatic macrophytes and bryophytes are searched without dislodgement. Every individual salamander found was identified to species and categorized by total length, <0.5", 0.5–1", 1–1.5", 1.5–2", >2". The total number of salamanders of each species and size class found were recorded. Survey effort was quantified by the time spent searching for salamanders in each section. Dissolved CO₂ concentration was measuring using a LaMotte titration kit.

Physical and biological characteristics of habitat are assessed in each section by visual observation. The physical habitat condition is characterized by the percent of transect area composed of bedrock, rocks (boulder+cobble+gravel), and concrete. Biological habitat condition is represented by percentages of bryophytes, macrophytes, loosely attached nuisance algae (filamentous green algae and cyanobacteria), and tightly attached, periphytic algae. The relative abundance of adult (>1") and juvenile (<1") crayfish is rated according to the following scale: 1=low <20, 2=medium 21-50, 3=high ≥50. Abundance of amphipods is estimated to the nearest ten/square foot. Other fauna are noted as present or absent (water pennies (coleopterans), mayfly larvae (ephemeropterans), caddisfly larvae (trichopterans), midge and fly larvae (dipterans), damselflies, dragonflies (odonates), worms, planaria, leeches, snails and limpets (gastropods), and fishes).

Any injury or death of a salamander is noted. If a salamander is found dead, its body is preserved in 95-100% EtOH or DMSO salt solution for DNA analysis if possible. Other relevant observations are noted.

In addition to the drive-survey count method, we also conducted mark-recapture research at

Upper Barton Spring and Eliza Spring (see item 9).

3b) Salamander collection methods

Salamanders were captured using small dipnets or net bags and placed into containers with clean groundwater before photographing. Temperature was controlled by keeping containers in the shade or in the spring water. During the Eliza mark-recapture surveys, most individuals were kept in flow-through mesh boxes within the spring before releasing. Small juveniles were kept separately in rigid containers.

4) Survey results

The number of *E. sosorum* found in the Barton Springs complex during monthly surveys are presented in the table below.

Table 2. Barton Springs Salamander and Austin Blind Salamander Abundance December 2013–November 2014. Parthenia Spring is located within Barton Springs Pool. Old Mill Spring/Sunken Garden is represented by OMS/SG, and Upper Barton Spring, by UBS. Salamanders observed whose size was not estimated are listed under No Size and included in the total number.

Site	Date	<i>Eurycea sosorum</i>				Total
		Juveniles (<1" TL)	Young Adults (1-2" TL)	Adults (>2"TL)	No Size	
Eliza	2/13/2014	0	45	83	1	129
Eliza	4/10/2014	18	48	87	1	154
Eliza	6/12/2014	2	37	69	0	108
Eliza	8/14/2014	38	72	64	0	174
Eliza (MR survey)	10/14/2014	not yet measured	"	"	NA	110
Eliza (MR survey)	10/15/2014	not yet measured	"	"	NA	115
Eliza (MR survey)	10/16/2014	not yet measured	"	"	NA	95
Parthenia	2/27/2014	10	15	6	1	32
Parthenia	4/25/2014	35	40	1	1	77
Parthenia	6/26/2014	13	31	11	0	55
Parthenia	8/28/2014	18	24	8	0	50
Parthenia	10/30/2014	3	2	0	NA	5
OMS/SG	2/20/2014	0	1	0	0	1
OMS/SG	4/17/2014	0	0	0	0	0
OMS/SG	6/19/2014	0	0	0	0	0
OMS/SG	8/21/2014	0	0	1	0	1
OMS/SG	10/28/2014	0	0	0	0	0
UBS	1/9/2014					0
UBS	3/17/2014	0	1	3	0	4
UBS	5/15/2014	1	0	0	0	1
UBS	6/30/2014	5	4	0	15	24
UBS	10/1/2014	0	1	1	NA	2

Eurycea waterlooensis

Site	Date	Juveniles (<1" TL)	Young Adults (1- 2" TL)	Adults (>2"TL)	No Size	Total
Eliza	2/13/2014	0	0	0	0	0
Eliza	4/10/2014	0	0	0	0	0
Eliza	6/12/2014	0	0	0	0	0
Eliza	8/14/2014	0	0	0	0	0
Eliza (MR survey)	10/14/2014	0	0	1	0	1
Eliza (MR survey)	10/15/2014	0	0	1	0	1
Eliza (MR survey)	10/16/2014	0	0	0	0	0
Parthenia	2/27/2014	0	0	0	0	0
Parthenia	4/25/2014	0	0	0	0	0
Parthenia	6/26/2014	0	0	0	0	0
Parthenia	8/28/2014	2	0	0	0	2
Parthenia	10/30/2014					
OMS/SG	2/20/2014	0	0	0	0	0
OMS/SG	4/17/2014	0	0	0	0	0
OMS/SG	6/19/2014	0	0	0	0	0
OMS/SG	8/21/2014	0	0	0	0	0
OMS/SG	10/28/2014	0	0	0	0	0
UBS	1/9/2014	0	0	0	0	0
UBS	3/17/2014	0	0	0	0	0
UBS	5/15/2014	0	0	0	0	0
UBS	6/30/2014	0	0	0	0	0
UBS	10/1/2014	0	0	0	0	0

5) Results of species identifications

No new species found.

6) Number of salamanders collected from the wild

None.

7) Number of salamanders handled and marked with elastomers

None.

8) Observations of abnormal behavior or condition of salamanders handled/ marked;

None.

9) Results of any mark-recapture methods

We conducted robust-design mark-recapture sampling at Eliza Spring using photographic identification methods for three consecutive days in October 2014 (14–16th). Over the course of three days we observed 210 unique individuals of *E. sosorum* ($M t + 1$). Of these, 136 were seen only once, 62 were recaptured once, and 12 were recaptured twice. We observed one *E. waterlooensis* (not included in results below) that was captured on day 1 and 2, but not 3.

Table 3. Capture-recapture data summary for Eliza Spring. $R(i)$ is the number of individuals captured, photographed and released; j is the number recaptured of that cohort for a given survey; total represents a sum of the recaptures for that cohort¹.

Occasion	$R(i)$	$j = 2$	$j = 3$	Total
1	95	39	14	53
2	111		33	33
3	90			0

The average total number of salamanders encountered each day (including captures and missed-but-counted individuals) was 107 individuals. This is analogous to a count.

We performed a closed-population analysis in MARK (citation) using the Huggins likelihood formulation (model results shown in Table 4, parameter estimates are shown in Table 5). While complete closure within the confines of the concrete surface area of Eliza Spring were likely not achieved, we believe the assumption of closure to permanent migrants to be reasonable. Our future efforts will include additional measures to seal the entrances to Eliza Spring. Regardless of whether some temporary migration occurred during our 3-day survey or not, these results indicate that there were around 3 times the number of individuals inhabiting Eliza Spring (including both the surface and immediate subsurface) than we would have counted on a given day during the same time period (Table 5).

Table 4. Closed population model results. Detection probability = p ; recapture probability = c ; (t) indicates time variation and (.) indicates a constant value.

Model	AICc	Delta AICc	AICc Weights	Model Likelihood	Num. Par	Deviance
$p(.) = c(.)$	775.57	0	0.35	1	1	1838.60
$p(t) = c(t)$	776.00	0.44	0.29	0.80	3	1835.00
$p(t) c(t)$	776.45	0.88	0.23	0.64	4	1833.42
$p(.) c(.)$	777.5484	1.9805	0.13172	0.3715	2	1838.5652

Table 5. Parameter estimates from the $p(.) = c(.)$ model (constant detection probability, no behavioral response to capture). N is the population size estimate.

Parameter	Estimate	Standard Error	Lower 95% CI	Upper 95% CI
p	0.33	0.03	0.28	0.38
N^*	302.70	19.28	271.94	348.74

*derived parameter

We also photographed individuals at Upper Barton Springs during all surveys for the reporting year (Table 6), although this did not follow a robust-design. There were not many recaptures, and therefore we did not perform any statistical analyses on these data. We also compared these photographs to those at Eliza Spring to check for evidence of migration, which we did not find.

¹ For example, on the third survey, 90 individuals were captured and photographed, 33 of which were unique recaptures from the 2nd day and 14 were unique recaptures from the 1st day. The remaining individuals ($90 - 33 - 14 = 43$) were new captures.

Table 6. Capture-recapture data summary for Upper Barton Spring. $R(i)$ is the number of individuals captured, photographed and released; j is the number recaptured of that cohort for a given survey; total represents a sum of the recaptures for that cohort.

Occasion	$R(i)$	$j = 2$	$j = 3$	$j = 4$	Total
1	6	1	0	0	1
2	5		2	0	2
3	47			0	0
4	15				0

10) Results of genetic research conducted as a result of tail-clipping

None.

11) Results of any research of management activities authorized by this permit and approved through the submission of study plans to the CPI Branch of the Austin ESFO

a. City of Austin monitors water quality in the Barton Springs Complex under this permit to meet the requirements of the Habitat Conservation Plan contained in the USFWS IO(a)(1)(B) permit PRT-839031 and the Texas Pollutant Discharge Elimination System permit WQ0004705000 (EPA NPDES TXS000401). Permitted staff collect water samples from each perennial spring, and Upper Barton Spring when flowing. Samples are analyzed for the following parameters at designated frequencies (Table 3). Biweekly tested parameters are total suspended solids, volatile suspended solids, $\text{NO}_3 + \text{NO}_2 - \text{N}$, $\text{NH}_3 - \text{N}$, Ortho-P, chlorophyll-a, temperature, dissolved oxygen, pH, conductivity, and turbidity. Quarterly sampling includes biweekly parameters plus alkalinity, Ca, Na, K, Mg, Cl, SO_4 , F, As, Cu, Fe, Pb, Ni, Zn. TPDES annual sampling includes all of the above plus Hardness, Ag, Cd, Cr, Hg, TOC, oil & grease, total polycyclic aromatic hydrocarbons, bromacil, organophosphate pesticides, chlorinated herbicides, volatiles, and semi-volatiles.

Table 7. Water Quality Sampling Dates.

Date	Site
4-Dec-13	Upper Barton Spring
6-Dec-13	Upper Barton Spring
6-Dec-13	Old Mill (Sunken Gardens) Spring
12-Dec-13	Barton Spring
16-Dec-13	Upper Barton Spring
16-Dec-13	Old Mill (Sunken Gardens) Spring
16-Dec-13	Eliza Spring
14-Jan-14	Barton Spring
17-Jan-14	Old Mill (Sunken Gardens) Spring
3-Feb-14	Barton Spring
13-Feb-14	Barton Spring
14-Feb-14	Barton Spring
28-Mar-14	Old Mill (Sunken Gardens) Spring
1-Apr-14	Cold Spring
1-Apr-14	Barton Spring
1-Apr-14	Upper Barton Spring
1-Apr-14	Old Mill (Sunken Gardens) Spring
1-Apr-14	Eliza Spring
24-Apr-14	Barton Spring
24-Apr-14	Old Mill (Sunken Gardens) Spring
24-Apr-14	Eliza Spring
7-May-14	Barton Spring
22-May-14	Upper Barton Spring
22-May-14	Old Mill (Sunken Gardens) Spring
22-May-14	Eliza Spring
30-May-14	Old Mill (Sunken Gardens) Spring
3-Jun-14	Old Mill (Sunken Gardens) Spring
4-Jun-14	Barton Spring
11-Jun-14	Cold Spring
11-Jun-14	Barton Spring
11-Jun-14	Upper Barton Spring
11-Jun-14	Old Mill (Sunken Gardens) Spring
11-Jun-14	Eliza Spring
19-Jun-14	Barton Spring
30-Jun-14	Upper Barton Spring
3-Jul-14	Old Mill (Sunken Gardens) Spring
8-Jul-14	Barton Spring
23-Jul-14	Barton Spring
5-Aug-14	Barton Spring
5-Aug-14	Old Mill (Sunken Gardens) Spring
20-Aug-14	Barton Spring
27-Aug-14	Old Mill (Sunken Gardens) Spring
3-Sep-14	Barton Spring
1-Oct-14	Barton Spring
22-Oct-14	Cold Spring
22-Oct-14	Barton Spring
22-Oct-14	Eliza Spring

- b. U.S. Geological Survey deploys and maintains water quality sampling equipment in Parthenia Spring. Equipment was serviced on a monthly basis by USGS dive teams.
- c. The USGS also collected water samples to examine concentrations of glyphosphate and atrazine. The dates for this collection are in the following table. Results are not yet available.

Date	Sampling Site(s)
4/1/2014	Main Barton, Eliza, Old Mill, Upper Barton
4/24/2014	Main Barton, Eliza and Old Mill with USGS for TPDES sample split
5/12/2014	Main Barton, Eliza and Old Mill with USGS
5/19/2014	Main Barton, Eliza and Old Mill with USGS
5/27/2014	Main Barton, Eliza and Old Mill with USGS
6/2/2014	Main Barton, Eliza and Old Mill with USGS
6/4/2014	Main Barton, Eliza and Old Mill with BSEACD
6/7/2014	Main Barton, Eliza and Old Mill with USGS
6/16/2014	Main Barton, Eliza and Old Mill with USGS
6/23/2014	Main Barton, Eliza and Old Mill with USGS
6/30/2014	Main Barton, Eliza and Old Mill with USGS

- d. City of Austin staff collect sediment samples for testing to meet requirements of the City's TPDES permit. These samples were collected 02/14/2014, 5/22/2014, 10/30/2014 and (planned) 12/16/2014.
- e. CORT study by Texas State University. The Gabor lab was awarded a grant through the Barton Springs Salamander Conservation Fund to study water-borne corticosterone in wild and captive *E. sosorum*. Sampling of wild *E. sosorum* from Eliza Spring was conducted under the supervision of City biologists. On 7/24/2014, 15 *E. sosorum* were captured by City staff, their CORT was sampled by allowing them in sit in a small beaker with water (see attached proposal); they were photographed, and then released.

TE-833851 Permit Condition: Captive Breeding Annual Reporting Requirements

1) The number of *Eurycea sosorum*, *Eurycea waterlooensis*, and *Eurycea tonkawae* held at the captive breeding facility (including the number of wild-caught and captive-bred individuals from each spring site collected).

Table 1. Inventory of Salamanders in Captive Breeding Program

Species	Spring of Origin	No. Wild-Caught	No. Captive-Bred > 6 Months of Age	No. Captive-Bred < 6 Months of Age
<i>Eurycea sosorum</i>	Barton Springs Pool	15	54	4
	Sunken Garden Spring	10	218	7
	Eliza Spring	37	127	1
	Upper Barton Spring	1	18	0
	Dallas Aquarium lineage and other ^{*1}	0	5	0
Total		63	422	12
<i>Eurycea waterlooensis</i>	Barton Springs Pool	1	NA ^{*2}	NA ^{*2}
	Sunken Garden Spring	9	NA ^{*2}	NA ^{*2}
	Eliza Spring	2	NA ^{*2}	NA ^{*2}
	Upper Barton Spring	0	NA ^{*2}	NA ^{*2}
	Total		12	34
<i>Eurycea tonkawae</i>	Bull Creek	12	5	0
	MacDonald Well	1	6	0
	SAS Canyon	8	0	0
	Testudo Tube	2	0	0
	Wheless	5	0	0
	Total		28	11

^{*1} Founder salamanders for the Dallas Aquarium captive population were collected from more than one spring site (Barton Springs Pool and Sunken Gardens) and mixed together. COA has F2's from Dallas F1's that were used for educational purposes at the Splash! Into the Edwards Aquifer exhibit at Barton Springs in Zilker Park. In addition, COA has 1 captive-raised *E. sosorum* from unknown origin of spring site.

^{*2} *E. waterlooensis* are not separated and bred according to spring site of origin due to the fact that the species is primarily aquifer-dwelling.

Note: One salamander of unknown origin was accidentally collected as a very small juvenile along with invertebrates which were collected for the purpose of a culture project in 2007. The spring site of origin was not definitive.

2) Number of observations of courtship behavior, spermatophores, spermatophore depositions, sperm transfers, and ovipositions.

In 2014, courtship behavior was observed in both wild-caught and captive-bred salamanders. In general, salamanders are not disturbed by City staff during courtship. Because salamanders can store sperm, observed courtship behavior does not necessarily result in immediate egg-laying. Each oviposition with viable offspring represents at least one sperm transfer, and possibly multiple transfers. Oviposition data are presented in Table 2.

Table 2. Ovipositions in Captivity 12/1/13-11/20/14. Tank I.D. indicates spring site of origin, reproductive group, and wild-caught or captive-bred status. Individuals in reproductive groups are recorded in order to follow actual or potential dams and sires. BSP denotes groups from Parthenia Spring, E, groups from Eliza Spring, SG, groups from Sunken Garden Spring, UBS, groups from Upper Barton Spring, and F, captive-bred salamanders.

Oviposition Date	Tank ID	Clutch Size	No. Hatched
<i>Eurycea sosorum</i>			
1/1/14	BSPF1 (Splash tank)	13	1
2/6/14	UBSF2 (C155)	3	0
2/14/14	SGF1 (C187)	3	NA ^{*3}
2/15/14	SGF1 (C159)	12	12
3/14/14	SGF1 (C86)	8	NA ^{*3}
5/9/14	SGF1 (C99)	8	NA ^{*3} 2 juveniles found in tank
6/17/14	SGF1 (C176)	11	NA ^{*3} 1 juvenile found in tank
7/23/14	BSP (C01B)	8	4
7/20/14	EF1 (C100)	NA	NA ^{*3} , 1 juvenile found in tank
9/11/14	SGF1 (C52)	2	Did not develop (not fertilized)
9/26/14	SGF1 (Splash tank#2)	2	Combined with 10/5 eggs
10/5/14	SGF1 (Splash tank#2)	7	5 (Combined with 9/26 eggs)
10/9/14	BSP (C01B)	6	Did not develop
11/6/14	SGF1 (C146B)	4	NA ^{*3}
11/14/14	SGF1 (C159)	13	NA ^{*3}
<i>Eurycea tonkawae</i>			
1/25/14	MacDonald Well	17	7
1/27/14	Bull Creek	12	6

^{*3} Some or all eggs of a clutch preserved to manage the population size and genetic diversity (prevent a disproportionate number of offspring produced from a single reproductive group, or to minimize inbreeding)

3, 4) Information on clutch sizes (range, mean, and standard deviation) and hatching success (range, mean, and standard deviation)

Table 3. Salamander Clutch Size and Hatching Success – 12/1/13-11/20/14

	Range	Mean	Standard Deviation
<i>E. sosorum</i>			
Clutch Size	2-13	7.1	4.0
No. Hatched	0-12	3.7	4.6
% Hatching	0-100	35.6	40.2
<i>E. tonkawae</i>			
Clutch Size	12-17	14.5	3.5
No. Hatched	6-7	6.5	0.7
% Hatching	41-50	45.6	6.2

5) Salamander Mortalities (including age and cause of death, if known)

Table 4. Salamander Mortalities 12/1/13–11/20/14

Species	Wild-Caught or Captive-Bred	Age (years)	No. Mortalities	Cause of Death (health condition observed)
<i>Eurycea sosorum</i>	WC	6-7	4	Unknown (1 with scoliosis)
	WC	8-11 ^{*4}	3	Senescence (scoliosis, gular displacement)
	WC	12-14 ^{*4}	5	Senescence
	CB	1-3	18	Unknown
	CB	3-5	9	Unknown
	CB	5-7	5	Unknown (2 with scoliosis)
	CB	7-8 ^{*4}	1	Senescence
	CB	12-13	1	Senescence (gular displacement)
	CB	17	1	Senescence
<i>Eurycea waterlooensis</i>	WC	NA	0	NA
	CB	3-7	3	Unknown
	CB	11	1	Senescence
<i>Eurycea tonkawae</i>	WC	8-9	7	Senescence
	CB	NA	0	NA

^{*4} Age of wild-caught salamanders is estimated based on size at collection, with a maximum estimated age of 1.5 years for salamanders > 2 inches total length at collection.

6) Information on Obvious Health Conditions or Behavioral Aberrations

No new health issues were observed in 2014.

7) Special Projects and Research

The captive breeding program provides support and salamanders for the public display tank at the Splash! Into the Edwards Aquifer Educational Exhibit. In 2014, six captive-raised Barton Springs salamanders were transferred to a second and larger display tank established at the Splash exhibit.

TE-833851, Section T., Permit Condition 6: General Annual Reporting Requirements for Jollyville Plateau Salamanders

Personnel

Names of all persons involved in the salamander surveys and their duties

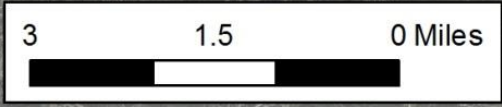
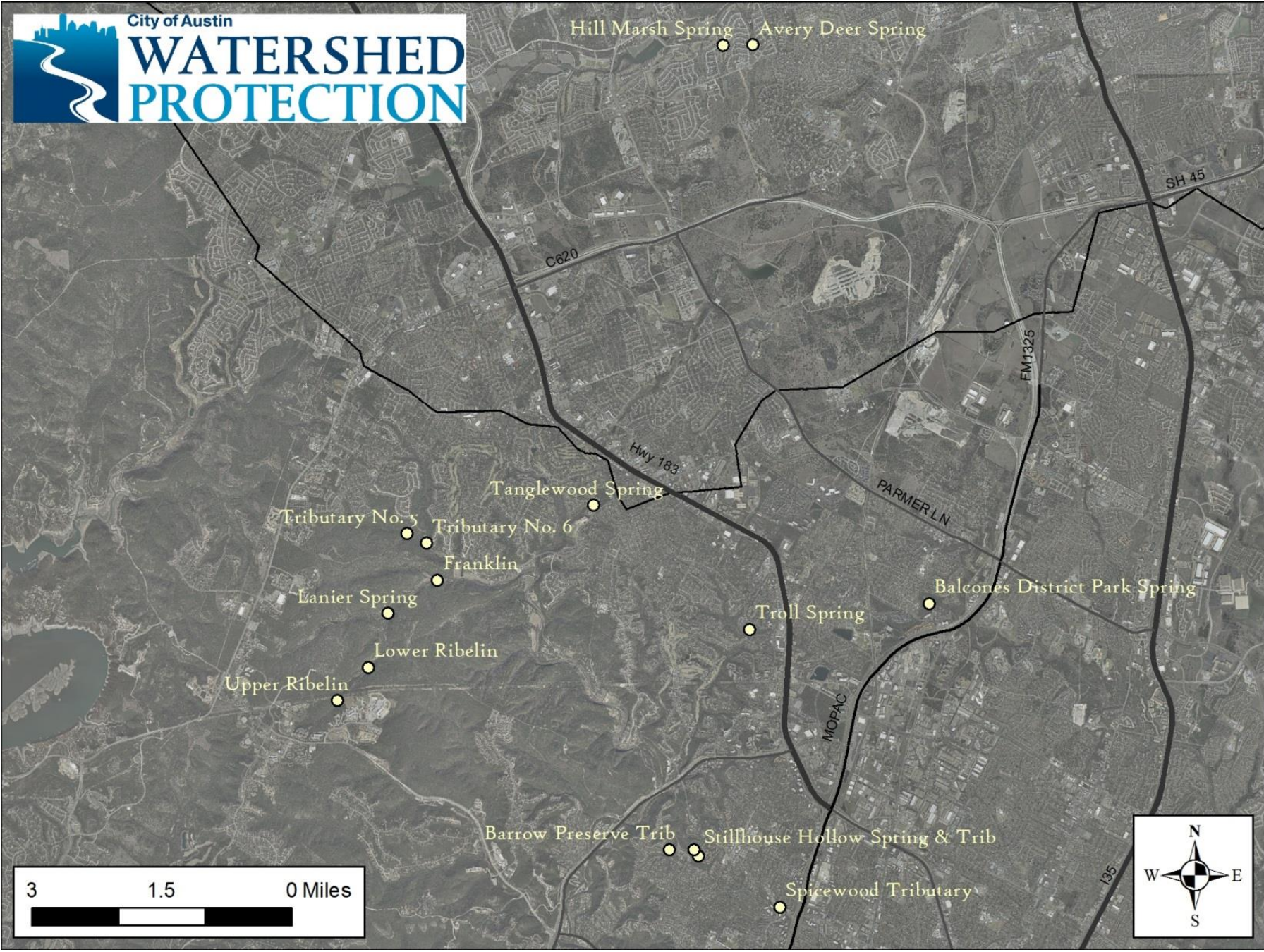
1. Nathan Bendik: study design, analysis, field work supervision
2. Blake Sissel: field assistance, data recording and entry
3. Tom Devitt: field assistance
4. Dee Ann Chamberlain: field assistance
5. Liza Colucci: field assistance
6. Laurie Dries: field assistance
7. Stephen Davis: field assistance
8. Mark Sanders: field assistance
9. Jonny Scalise: field assistance
10. Donelle Robinson: field assistance
11. Renee Fields: field assistance
12. Caitlin Gabor: CORT project study design, field assistance
13. Megan Mondelli: CORT project field assistance
14. Chelsea Blake: CORT project field assistance
15. Diana Kim: CORT project field assistance
16. Kristina Zabierek: CORT project field assistance
17. Thomas Marshall: CORT project field assistance
18. Kim Ort: CORT project field assistance
19. Laura Alberici Da Barbiano: CORT project field assistance

Person(s) directly responsible for writing the report

Nathan Bendik

Location

The first map depicts locations of all CMR study sites while the second map depicts the locations of all occupancy survey sites.





Specimens collected and their disposition.

Species	Site	County	Date	LONG	LAT	Collector	Current Disposition	Notes
<i>Eurycea sosorum</i>	Eliza Spring	Travis	6/3/2013	-97.769868	30.264506	Laurie Dries	TNHC 92288	
<i>Eurycea sosorum</i>	Eliza Spring	Travis	6/3/2013	-97.769868	30.264506	Laurie Dries	TNHC 92289	
<i>Eurycea sosorum</i>	Parthenia Spring (Barton Springs Pool)	Travis	2/20/2014	-97.770876	30.263719	Chris Herrington	TNHC 92290	found dead in shallow fissures during a pool draw-down
<i>Eurycea sosorum</i>	Upper Barton Spring	Travis	3/17/2014	-97.774116	30.263598	Nathan F. Bendik	TNHC 92291	found dead, likely squished under foot by trespasser
<i>Eurycea tonkawae</i>	Bull Creek, Tributary 6	Travis	5/4/2012	-97.814679	30.425238	Nathan F. Bendik	TNHC 92285	found dead
<i>Eurycea tonkawae</i>	Bull Creek, Tributary 4	Travis	3/20/2013	-97.791887	30.423579	Nathan F. Bendik	TNHC 92284	found dead
<i>Eurycea tonkawae</i>	Hill Marsh Spring	Williamson	2/24/2014	-97.755275	30.507772	Nathan F. Bendik	TNHC 92293	found dead
<i>Eurycea tonkawae</i>	MacDonald Well spring	Travis	5/2/2014	-97.853571	30.449783	Nathan F. Bendik	TNHC 92286	series of 7, found dead after spring flow ceased
<i>Eurycea tonkawae</i>	Barrow Hollow tributary	Travis	5/30/2014	-97.769084	30.372939	Nathan F. Bendik	TNHC 92287	found dead, likely injured by recent storm flows
<i>Eurycea tonkawae</i>	Lower Ribelin Spring	Travis	6/2/2014	-97.826397	30.404656	Nathan F. Bendik	TNHC 92294	found dead
<i>Eurycea sosorum</i>	Parthenia Spring (Barton Springs Pool)	Travis	9/18/2014	-97.770876	30.263719	Tom Devitt	TNHC 92673	found dead after flood and drawdown event. Tissue taken and preserved and deposited in TNHC
<i>Eurycea tonkawae</i>	Hill Marsh Spring	Williamson	8/20/2014	-97.755275	30.507772	Nathan F. Bendik	TNHC 92948	found dead; due to some prior disturbance
<i>Eurycea tonkawae</i>	Bull Creek, Tributary 6	Travis	6/17/2014	-97.814679	30.425238	Nathan F. Bendik	COA	Mortality due to stress from CORT experiment
<i>Eurycea tonkawae</i>	Bull Creek, Tributary 4	Travis	6/18/2014	-97.791887	30.423579	Nathan F. Bendik	COA	Mortality due to stress from CORT experiment

Capture-Mark-Recapture Survey Results

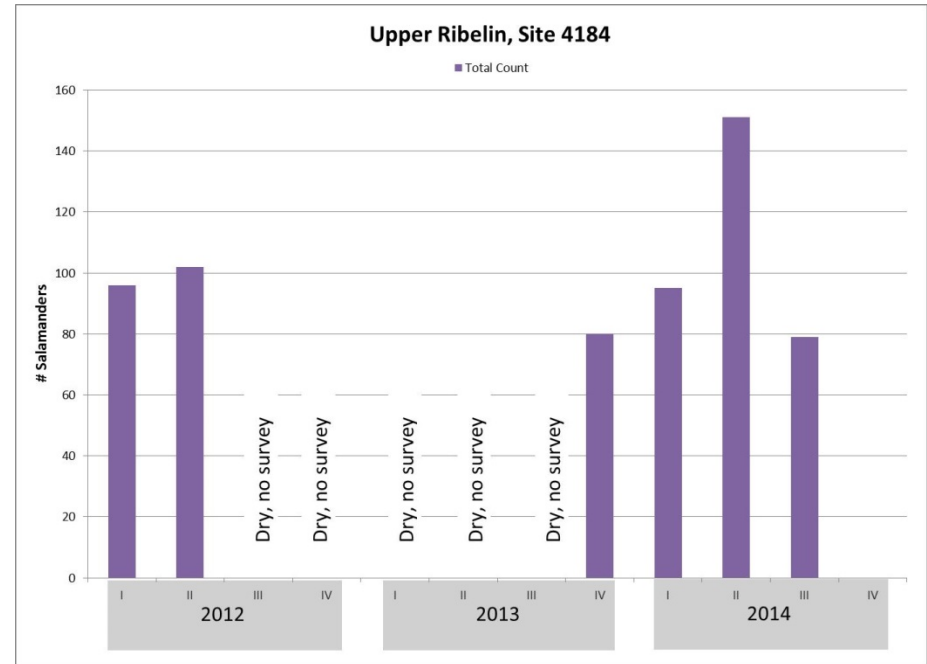
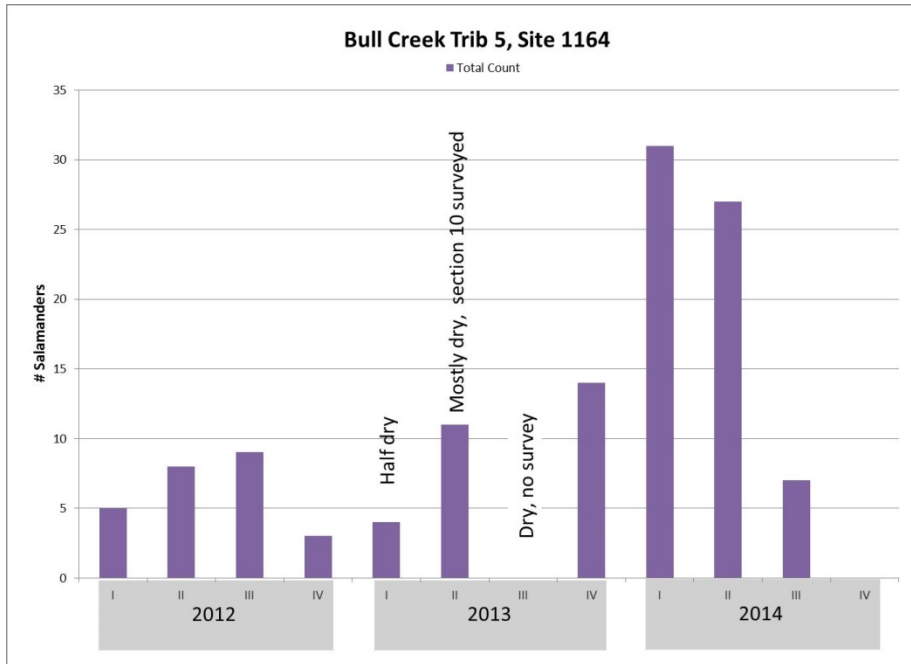
Survey methodologies and descriptions for the CORT study, die-tracing study, capture-mark-recapture, and occupancy surveys are provided in separate reports at the end of this document. The following tables and graphs summarize capture-mark-recapture survey results for 2014.

Date	Time	Site	Man-hours
2014-02-19	1137	Avery Deer Spring	0.78
2014-06-09	1233	Avery Deer Spring	1.57
2014-08-13	1104	Avery Deer Spring	0.53
2014-11-12	1100	Avery Deer Spring	0.55
2014-02-19	1041	Balcones District Park Spring	0.22
2014-06-06	1425	Balcones District Park Spring	0.23
2014-08-13	1258	Balcones District Park Spring	0.13
2014-11-12	1227	Balcones District Park Spring	0.10
2014-01-29	1110	Barrow Preserve Tributary ds Barrow Spring	1.80
2014-05-30	955	Barrow Preserve Tributary ds Barrow Spring	3.07
2014-08-06	1015	Barrow Preserve Tributary ds Barrow Spring	0.07
2014-11-25	1047	Barrow Preserve Tributary ds Barrow Spring	3.07
2014-03-18	937	Bull Creek Upstream of Tributary 7 (Franklin)	
2014-06-23	945	Bull Creek Upstream of Tributary 7 (Franklin)	13.92
2014-08-12	933	Bull Creek Upstream of Tributary 7 (Franklin)	26.15
2014-11-13	1004	Bull Creek Upstream of Tributary 7 (Franklin)	10.58
2014-02-24	1016	Hill Marsh Spring	7.73
2014-06-11	1017	Hill Marsh Spring	7.90
2014-08-20	1022	Hill Marsh Spring	7.53
2014-11-14	1017	Hill Marsh Spring	7.73
2014-03-18	1321	Lanier Spring	10.60
2014-06-04	1000	Lanier Spring	9.20
2014-08-19	1004	Lanier Spring	16.13
2014-11-21	940	Lanier Spring	
2014-02-12	1100	Ribelin Spring 2 (Lower Ribelin)	6
2014-06-02	1004	Ribelin Spring 2 (Lower Ribelin)	6.97
2014-08-15	1000	Ribelin Spring 2 (Lower Ribelin)	10.10
2014-11-10	1005	Ribelin Spring 2 (Lower Ribelin)	7.60
2014-06-10	1522	Spicewood Tributary Downstream of Spicewood Spring	1.52
2014-06-10	1115	Stillhouse Hollow ds of Stillhouse Hollow Spring	2.17
2014-06-27	1050	Tanglewood Tributary ds Tanglewood Spring	1.88
2014-02-18	1027	Tributary 5 ds Hanks Tract Property Line	
2014-07-03	1000	Tributary 5 ds Hanks Tract Property Line	
2014-08-11	1111	Tributary 5 ds Hanks Tract Property Line	
2014-12-02	1044	Tributary 5 ds Hanks Tract Property Line	9.12
2014-02-14	1057	Tributary 6 @ Bull Creek (EG)	9.90
2014-06-17	1010	Tributary 6 @ Bull Creek (EG)	11.83
2014-08-11	936	Tributary 6 @ Bull Creek (EG)	6.33
2014-11-07	1010	Tributary 6 @ Bull Creek (EG)	11.92
2014-02-03	1237	Troll Spring	12.30
2014-06-16	1002	Troll Spring	4.40
2014-08-06	1050	Troll Spring	4.90
2014-11-19	956	Troll Spring	9.10
2014-02-12	1355	Upper Ribelin Spring	4.48
2014-06-24	1005	Upper Ribelin Spring	5.92
2014-08-15	1007	Upper Ribelin Spring	10.37
2014-11-10	1020	Upper Ribelin Spring	11.78

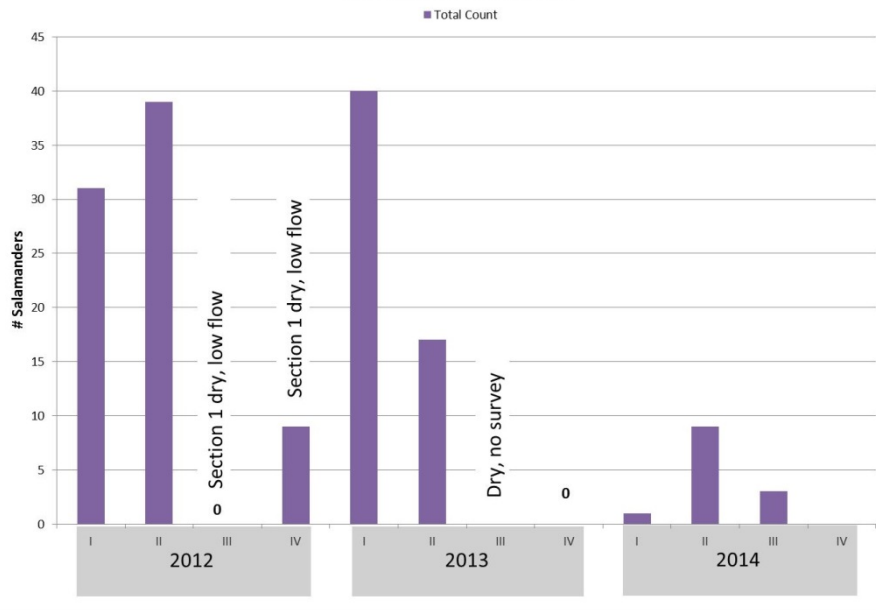
Table 1: Capture-Mark-Recapture Field Site Visits

Quarterly Count Summaries

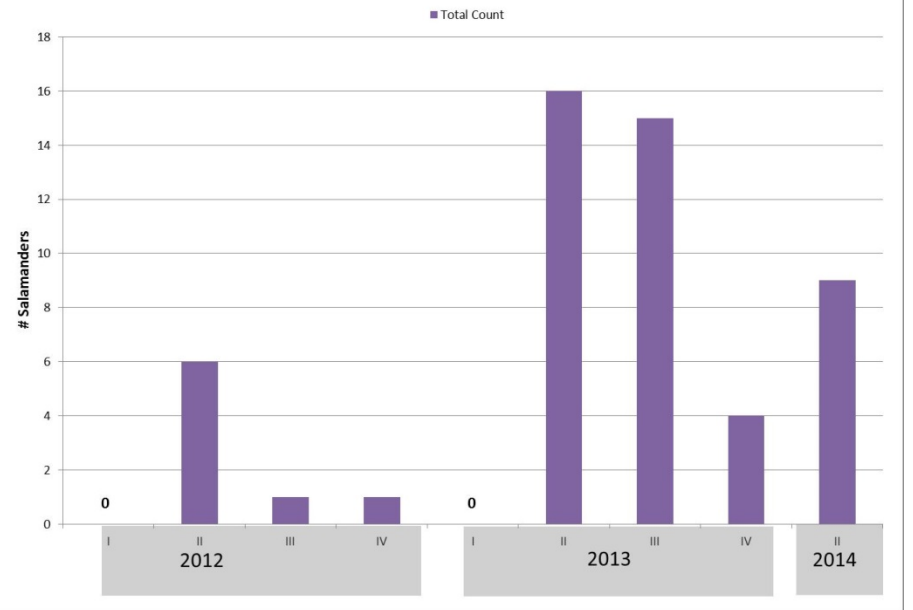
Below are the quarterly results of surveys conducted at 14 sites between 2012 and 2014. Total salamander counts include the total of all size classes: ≤ 1 inch, 1-2 inches, and ≥ 2 inches. Each graph has the same x -axis, but a different y -axis. Missing data are noted on each graph as “no survey” which were (typically) due to dry conditions. Zeroes indicate a survey which resulted in no salamander observations. Each quarter is three months long, starting in January, for quarter I. Quarter IV in 2014 is blank in all plots where raw data have yet to be tabulated.



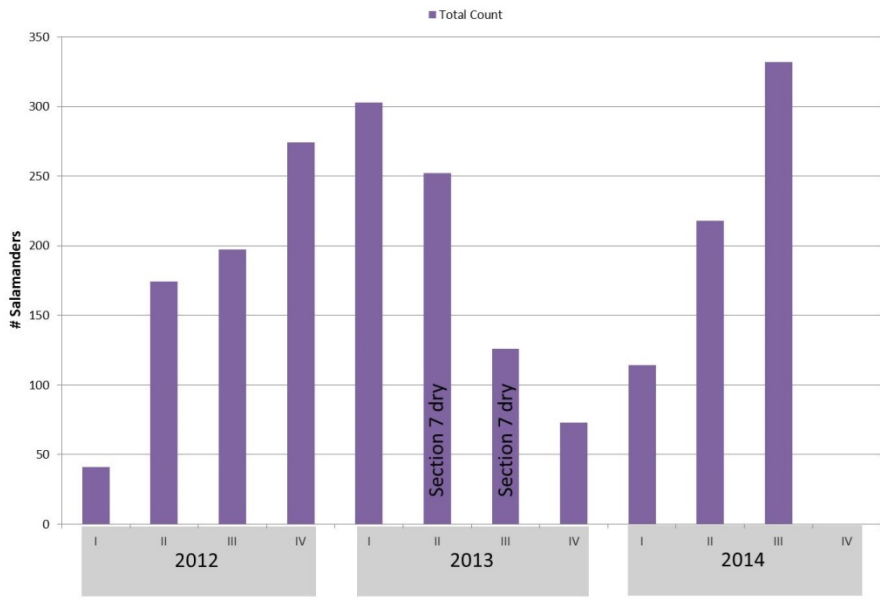
Barrow Hollow, Site 929



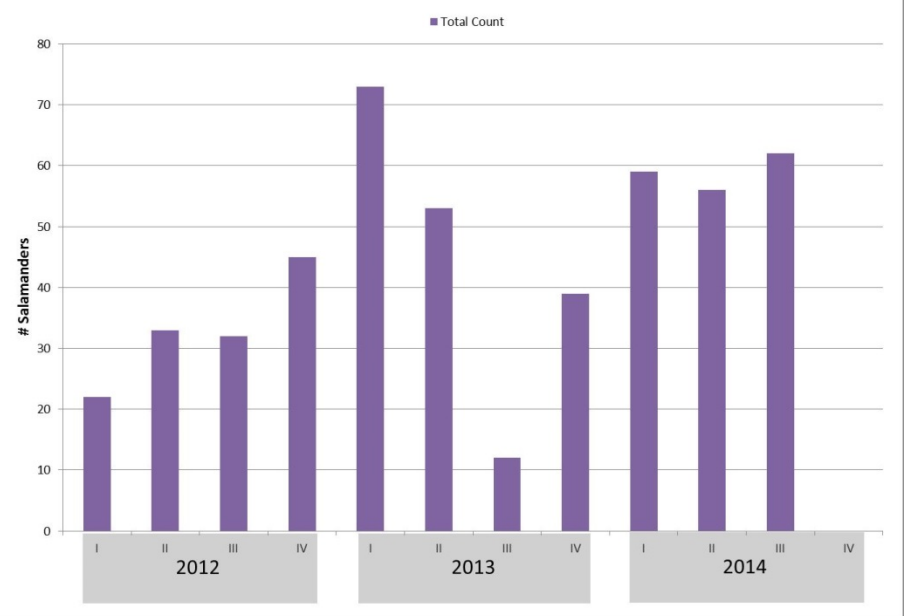
Stillhouse Hollow, Site 927



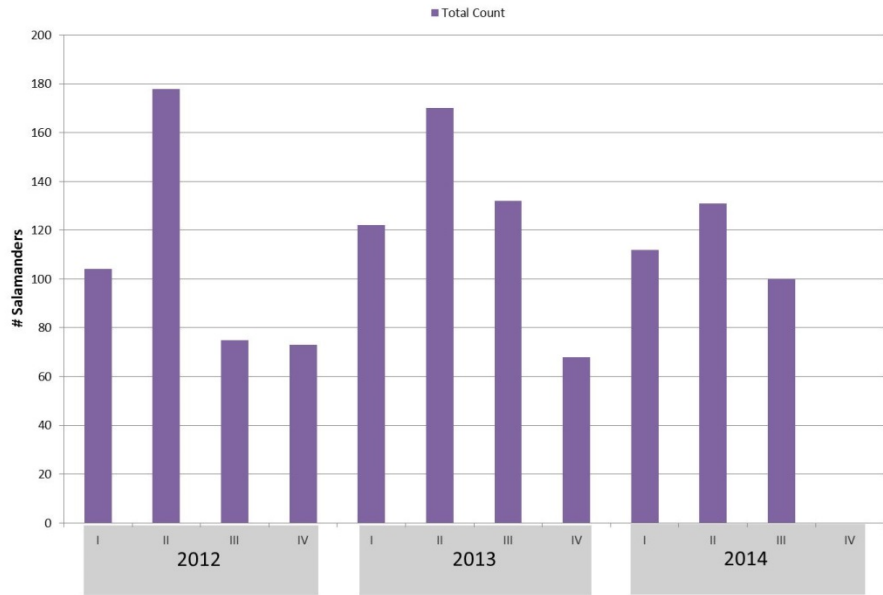
Franklin, Site 349



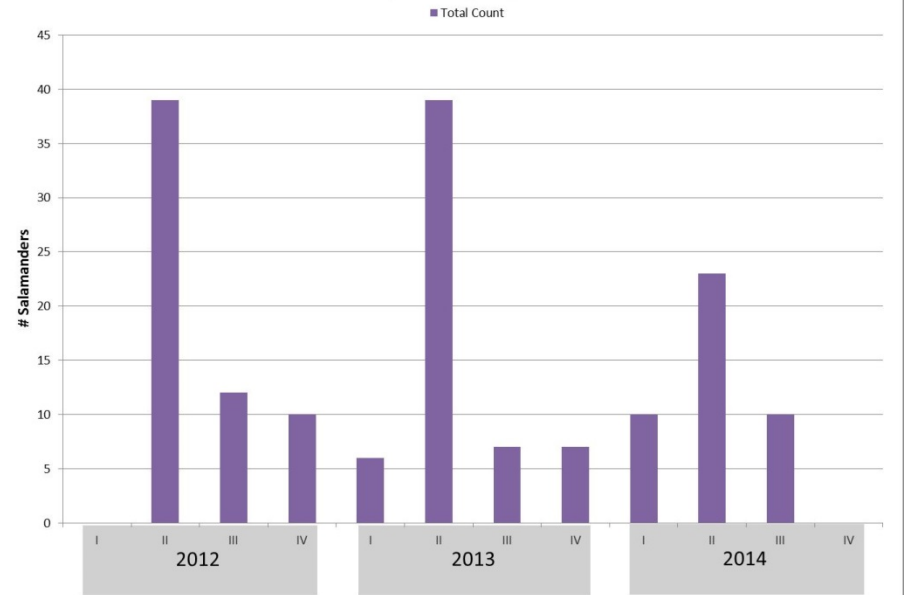
Bull Creek Trib 6, Site 151



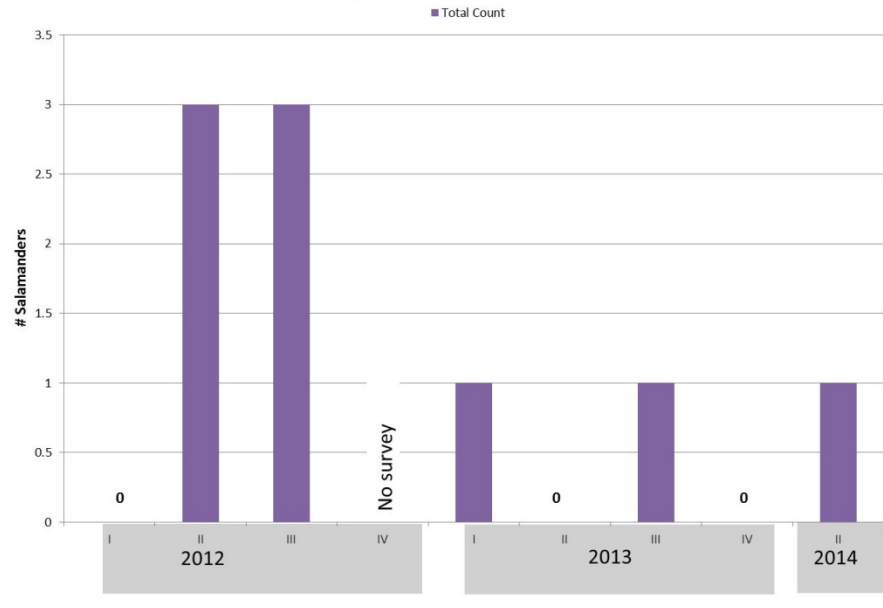
Hill Marsh Spring, Site 1353



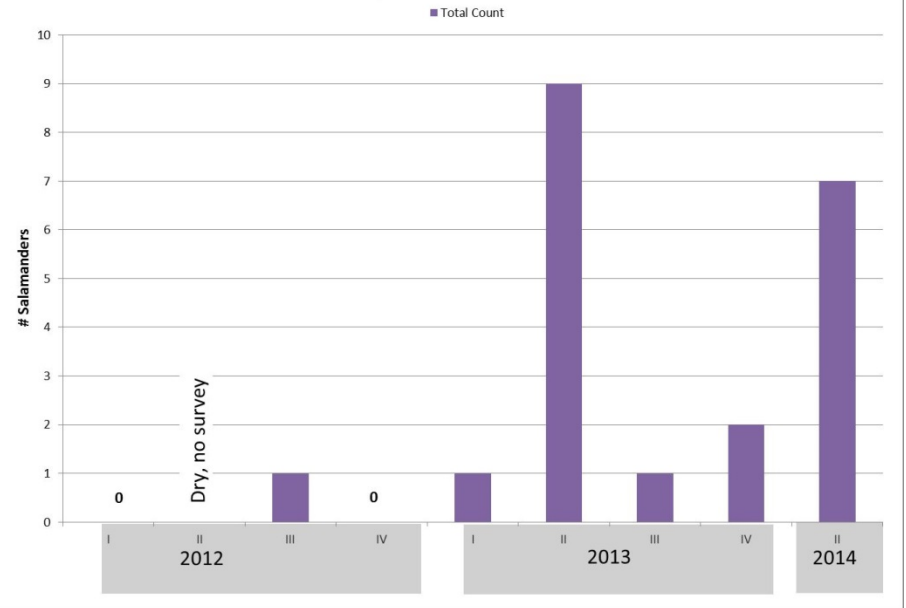
Avery Deer Spring, Site 1355



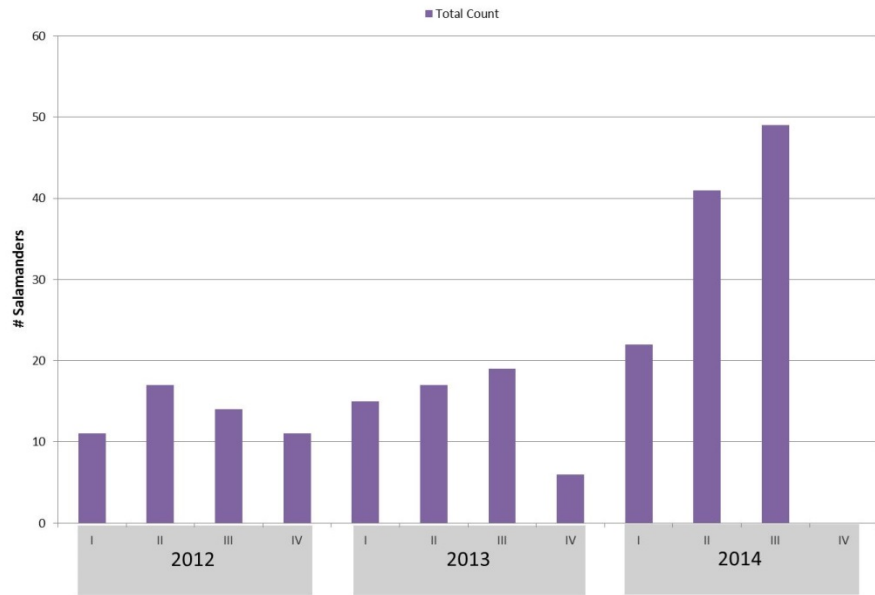
Spicewood, Site 930



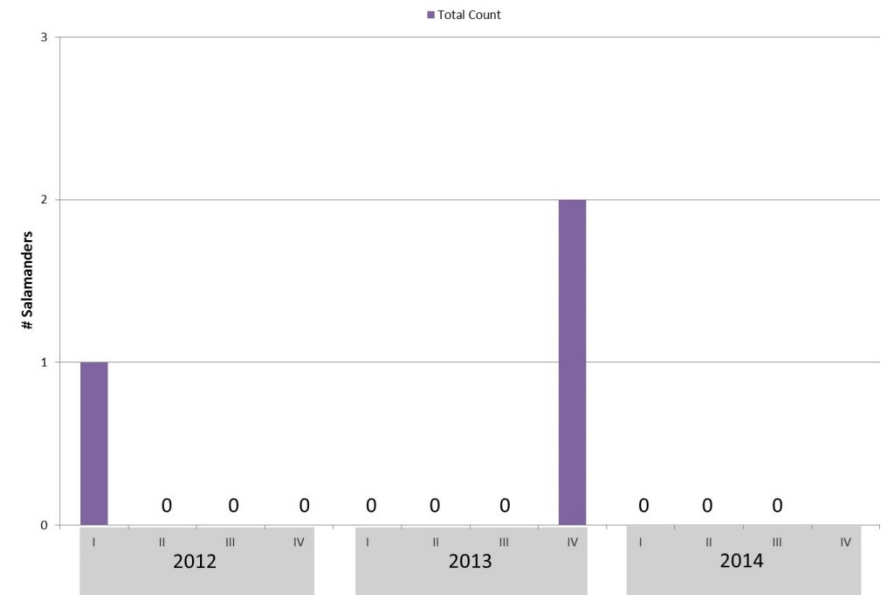
Tanglewood, Site 928



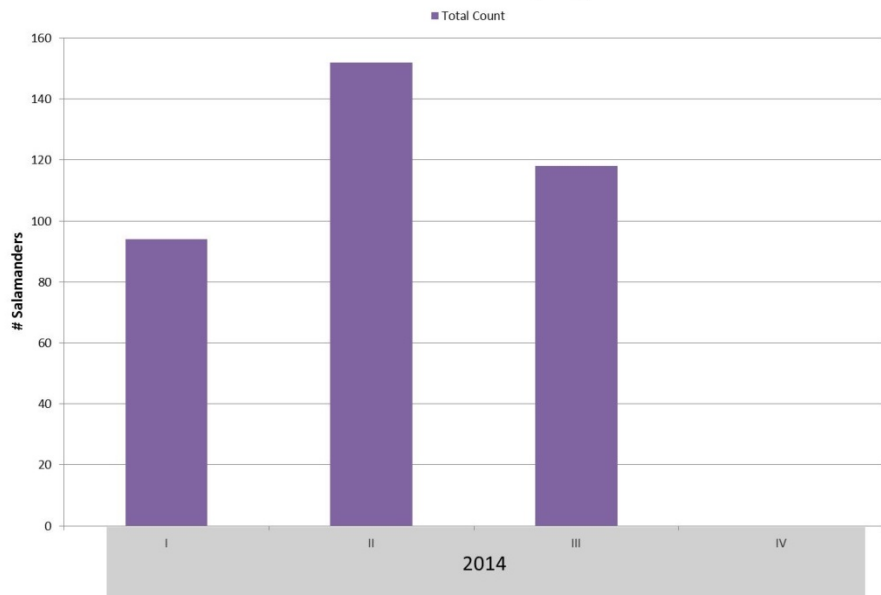
Troll Spring, Site 4457



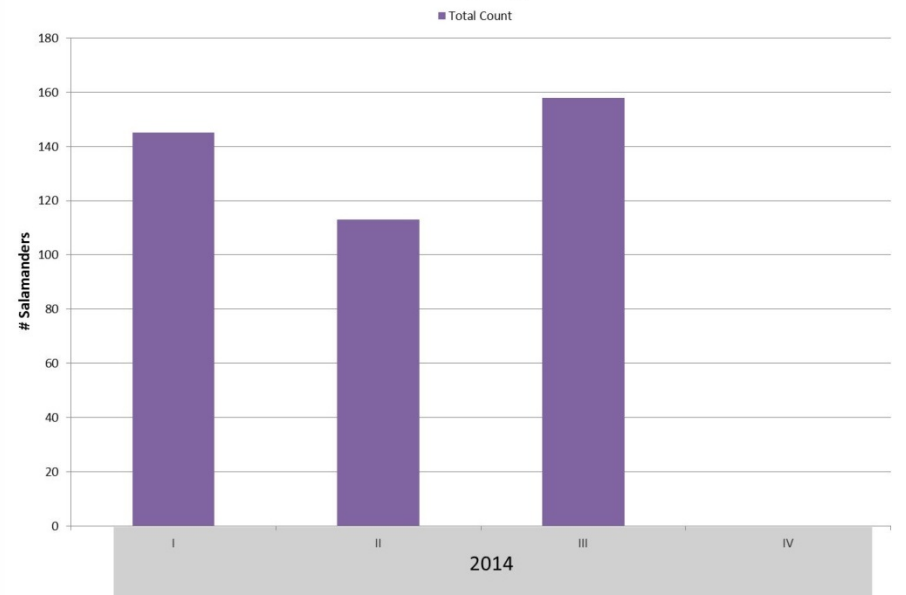
Balcones District Park Spring, Site 445



Lower Ribelin Spring, Site 4035

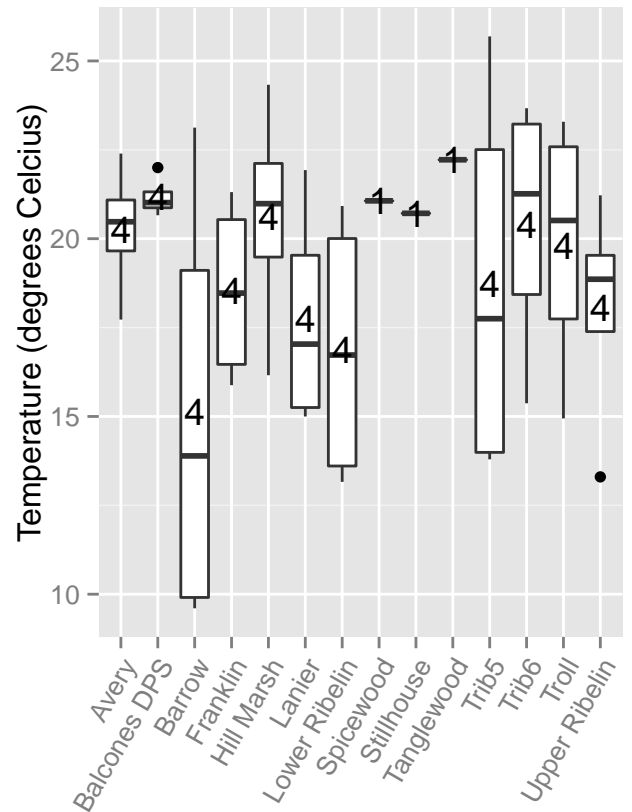
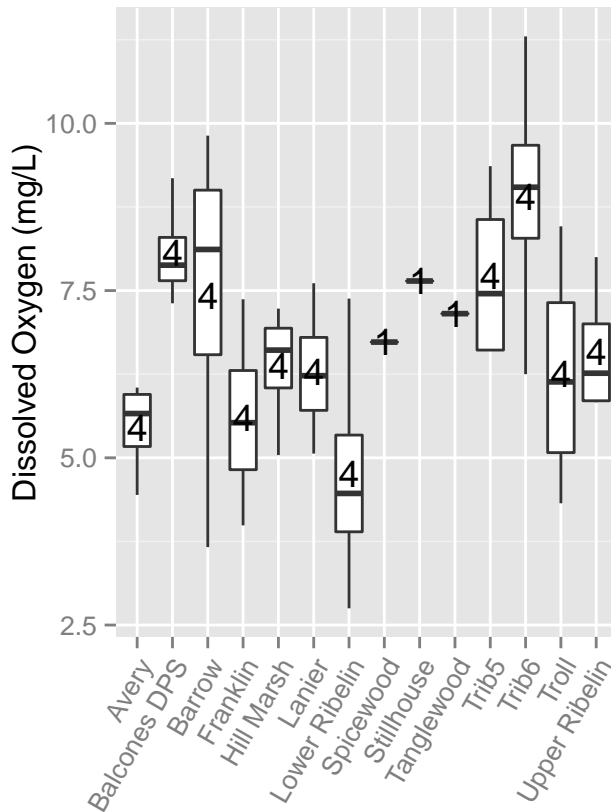


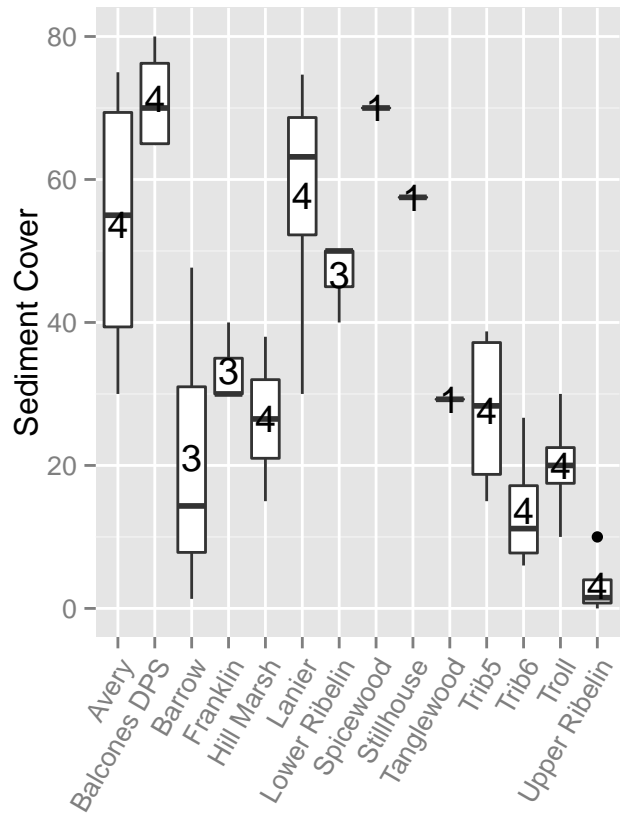
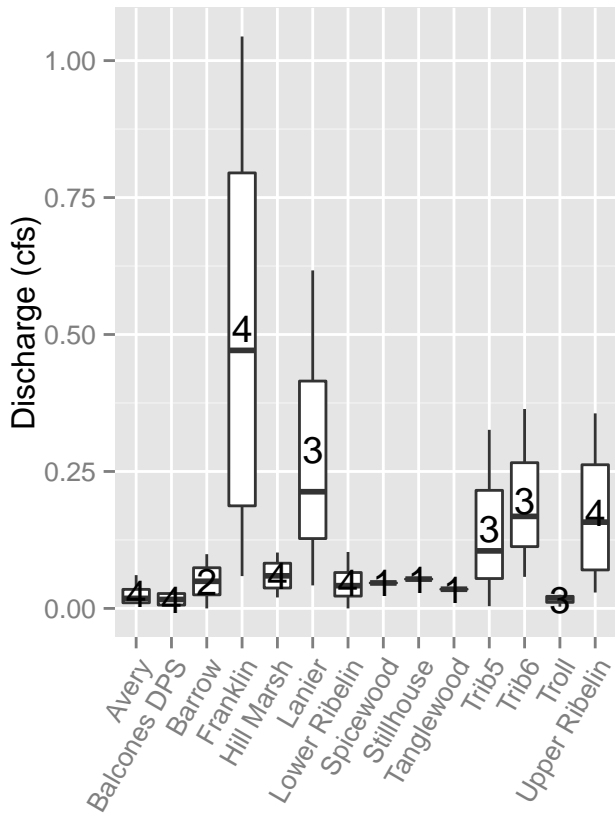
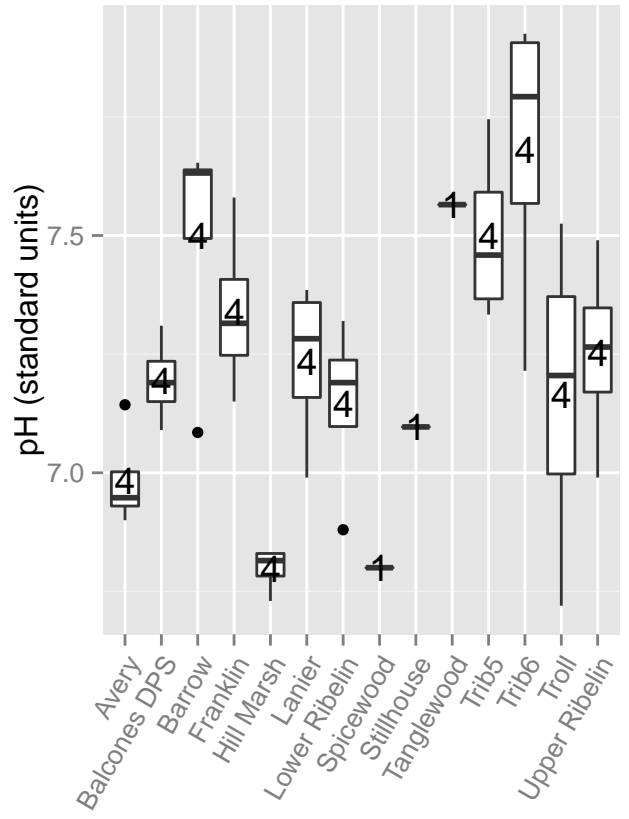
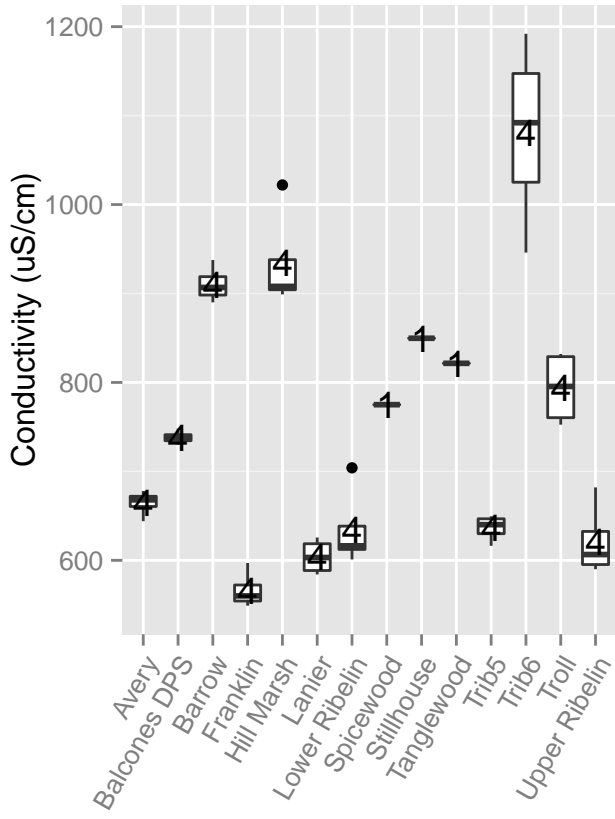
Lanier Spring, Site 3963

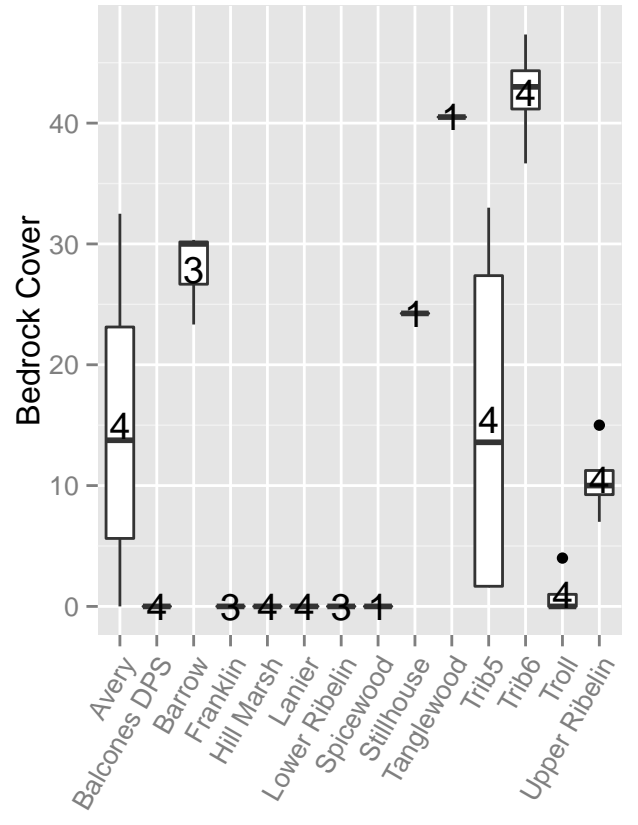
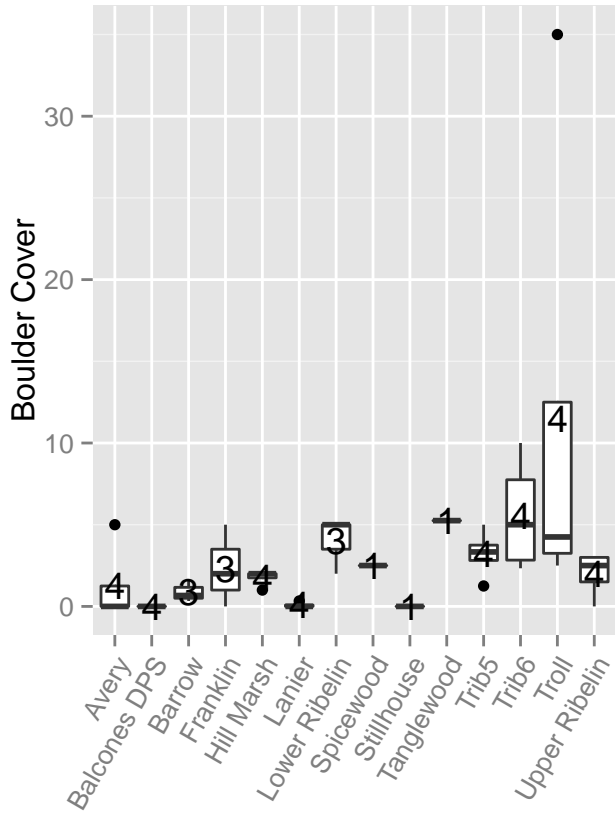
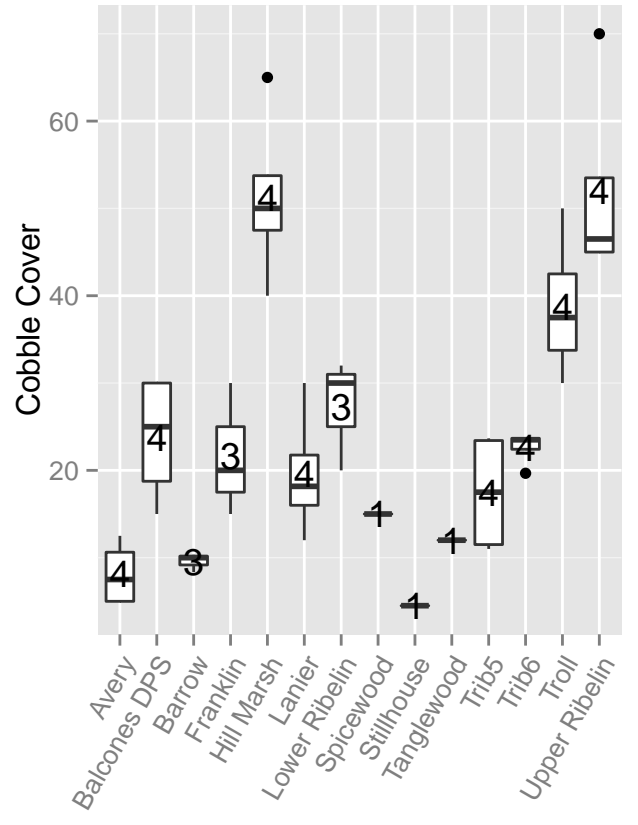
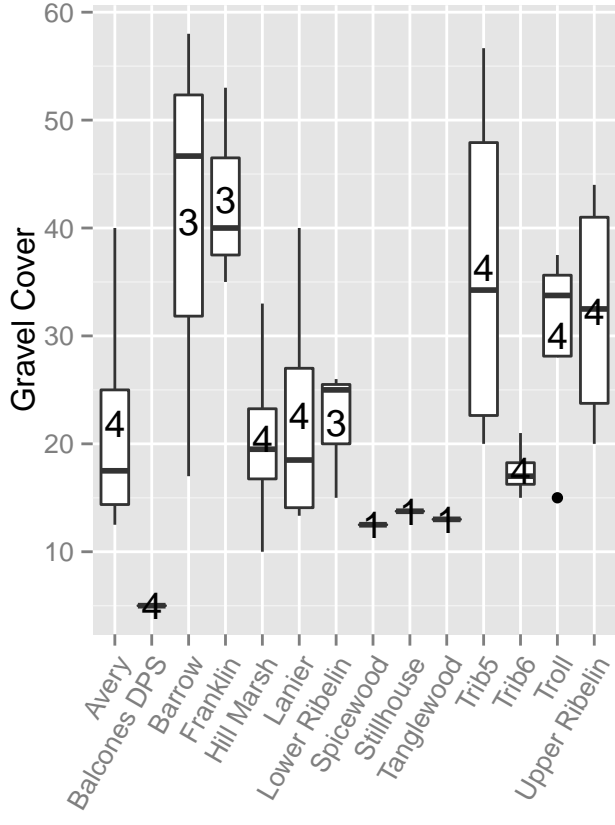


Habitat Characteristics

The following figures summarize the habitat and water quality parameters for the capture-mark-recapture surveys of Jollyville Plateau salamanders in 2014. Each graph is a box and whisker plot with the sample size displayed at the value of the mean. Where sites included more than one section with relevant data (e.g., if water quality data was collected at the spring orifice as well as the creek channel), these data were averaged by site, field visit and parameter. Additionally, we include a digital file (*.csv) of all raw survey and habitat data currently available in the City of Austin's Field Sample Database (there is too much information to reasonably provide in tables within this document). Note that not all survey data is up to date as of this writing and not all information is included in this file (e.g., individual capture histories are not included, nor are photographs, or individual measurements). Also note that these data have not completed quality checks for accuracy or completeness and are subject to change.







Release Tables

Below are the release tables for each site. Sites with fewer than 10 individuals captured on average were excluded. Each row contains the number of individuals that were photographed and released for each recapture occasion. The first column is the total number released, including those initially released and those released after recapture from a previous cohort. The remaining columns are the number first recaptured in each of the following occasions. Once re-caught they become part of the following rows.

We do not include an open-population mark-recapture analysis of these data at this time. The City captured and photographed over 2500 Jollyville Plateau salamanders in 2014. Because each individual is measured from their photograph, data processing takes a long time and often lags regular data entry. Photographic identification for these species is only reliable after an individual is large enough to be recognizable between sampling intervals. For 3-month and larger intervals, this tends to be around 25mm total length. For this reason, small individuals need to be culled from our databases before analysis commences. We do this programatically once we have a record of all measurements. Including these smaller individuals would result in a data set with recapture rates biased low (because recapture rates for small individuals would be very low), and would therefore produce unreliable open-population parameter estimates.

	Released	Jun 2012	Aug 2012	Nov 2012	Feb 2013	Jun 2013	Sep 2013	Dec 2013	Apr 2014	Jul 2014	Sep 2014	Total
Feb 2012	36	5	0	1	4	0	1	0	1	0	0	12
Jun 2012	111	0	2	4	6	1	1	0	4	0	1	19
Aug 2012	162	0	0	30	12	2	0	0	0	0	0	44
Nov 2012	245	0	0	0	74	11	0	1	1	0	0	87
Feb 2013	251	0	0	0	0	30	1	2	11	5	0	49
Jun 2013	107	0	0	0	0	0	1	2	2	2	0	7
Sep 2013	106	0	0	0	0	0	0	4	1	0	0	5
Dec 2013	57	0	0	0	0	0	0	0	10	0	0	10
Apr 2014	99	0	0	0	0	0	0	0	0	4	0	4
Jul 2014	181	0	0	0	0	0	0	0	0	0	59	59

Table 2: Franklin/Pit Spring site 349

	Released	May 2012	Jul 2012	Oct 2012	Feb 2013	May 2013	Aug 2013	Nov 2013	Feb 2014	Jun 2014	Aug 2014	Total
Feb 2012	102	33	3	1	3	0	0	0	0	0	0	40
May 2012	167	0	16	15	31	10	1	2	3	0	0	78
Jul 2012	64	0	0	7	10	8	1	1	1	0	0	28
Oct 2012	63	0	0	0	17	7	2	0	4	2	0	32
Feb 2013	111	0	0	0	0	43	7	5	3	0	0	58
May 2013	162	0	0	0	0	0	33	8	27	10	0	78
Aug 2013	118	0	0	0	0	0	0	14	21	12	0	47
Nov 2013	62	0	0	0	0	0	0	0	19	1	0	20
Feb 2014	110	0	0	0	0	0	0	0	0	34	2	36
Jun 2014	118	0	0	0	0	0	0	0	0	0	19	19

Table 3: Hill Marsh Spring site 1353

	Released	Apr 2012	Oct 2012	Feb 2013	May 2013	Aug 2013	Nov 2013	Jun 2014	Aug 2014	Total
Jan 2012	11	0	0	2	0	0	1	0	0	3
Apr 2012	9	0	0	2	0	0	0	0	0	2
Oct 2012	17	0	0	2	2	0	0	0	0	4
Feb 2013	20	0	0	0	0	0	0	0	0	0
May 2013	12	0	0	0	0	1	0	0	0	1
Aug 2013	17	0	0	0	0	0	0	0	0	0
Nov 2013	4	0	0	0	0	0	0	0	0	0
Jun 2014	30	0	0	0	0	0	0	0	6	6

Table 4: Troll Spring site 4457

	Released	Nov 2012	Feb 2013	May 2013	Nov 2013	Feb 2014	Jun 2014	Aug 2014	Total
Aug 2012	5	0	0	0	0	0	0	0	0
Nov 2012	2	0	0	0	0	0	0	0	0
Feb 2013	2	0	0	0	0	0	1	0	1
May 2013	11	0	0	0	0	1	1	0	2
Nov 2013	11	0	0	0	0	3	0	0	3
Feb 2014	28	0	0	0	0	0	3	0	3
Jun 2014	24	0	0	0	0	0	0	1	1

Table 5: Trib 5 site 1164

	Released	Jan 2014	May 2014	Aug 2014	Total
Nov 2013	35	18	1	0	19
Jan 2014	88	0	9	0	9
May 2014	108	0	0	5	5

Table 6: Lower Ribelin site 4035

	Released	Apr 2012	Aug 2012	Nov 2012	Jan 2013	May 2013	Aug 2013	Nov 2013	Feb 2014	Jun 2014	Aug 2014	Total
Jan 2012	22	0	0	0	1	0	0	2	0	0	0	3
Apr 2012	18	0	0	0	2	0	0	0	0	0	0	2
Aug 2012	29	0	0	4	1	0	0	0	0	0	0	5
Nov 2012	34	0	0	0	7	2	0	1	0	1	0	11
Jan 2013	69	0	0	0	0	6	0	0	3	0	0	9
May 2013	47	0	0	0	0	0	1	0	2	1	0	4
Aug 2013	11	0	0	0	0	0	0	1	0	0	0	1
Nov 2013	30	0	0	0	0	0	0	0	4	0	0	4
Feb 2014	52	0	0	0	0	0	0	0	0	0	0	0
Jun 2014	46	0	0	0	0	0	0	0	0	0	9	9

Table 7: Trib 6 site 151

	Released	May 2012	Nov 2013	Feb 2014	Jun 2014	Aug 2014	Total
Feb 2012	96	2	4	5	0	0	11
May 2012	76	0	1	0	0	0	1
Nov 2013	71	0	0	28	0	0	28
Feb 2014	79	0	0	0	0	0	0
Jun 2014	120	0	0	0	0	13	13

Table 8: Upper Ribelin site 4184

	Released	Aug 2012	Oct 2012	Feb 2013	Apr 2013	Aug 2013	Nov 2013	Feb 2014	Jun 2014	Aug 2014	Total
May 2012	30	0	0	0	1	0	0	0	0	0	1
Aug 2012	5	0	0	0	0	0	0	0	0	0	0
Oct 2012	8	0	0	2	0	0	0	0	0	0	2
Feb 2013	5	0	0	0	1	0	0	0	0	0	1
Apr 2013	19	0	0	0	0	0	0	1	1	0	2
Aug 2013	6	0	0	0	0	0	1	0	0	0	1
Nov 2013	8	0	0	0	0	0	0	0	0	1	1
Feb 2014	10	0	0	0	0	0	0	0	1	0	1
Jun 2014	21	0	0	0	0	0	0	0	0	1	1

Table 9: Avery Deer Spring site 1355

	Released	Mar 2014	May 2014	Aug 2014	Total
Nov 2013	28	6	1	0	7
Mar 2014	128	0	4	2	6
May 2014	94	0	0	5	5

Table 10: Lanier Spring site 3963

	Released	May 2012	Oct 2012	Feb 2013	May 2013	Jan 2014	May 2014	Jul 2014	Total
Jan 2012	27	1	0	8	0	0	0	0	9
May 2012	33	0	3	5	1	0	0	0	9
Oct 2012	7	0	0	5	0	0	0	0	5
Feb 2013	38	0	0	0	3	0	0	0	3
May 2013	24	0	0	0	0	0	0	0	0
Jan 2014	1	0	0	0	0	0	0	0	0
May 2014	9	0	0	0	0	0	0	0	0

Table 11: Barrow Hollow 929

Occupancy Survey Results

Date	Time	Site
2014-04-08	943	Barrow Trib @ JPS Occupancy Site 029
2014-05-09	1520	Barrow Trib @ JPS Occupancy Site 029
2014-04-18	1040	Barrow Trib @ JPS Occupancy Site 029
2014-04-08	958	Barrow Trib @ JPS Occupancy Site 030
2014-05-09	1533	Barrow Trib @ JPS Occupancy Site 030
2014-04-18	1054	Barrow Trib @ JPS Occupancy Site 030
2014-04-08	1011	Barrow Trib @ JPS Occupancy Site 031
2014-05-09	1549	Barrow Trib @ JPS Occupancy Site 031
2014-04-18	1108	Barrow Trib @ JPS Occupancy Site 031
2014-04-08	1033	Barrow Trib @ JPS Occupancy Site 032
2014-05-09	1631	Barrow Trib @ JPS Occupancy Site 032
2014-04-18	1130	Barrow Trib @ JPS Occupancy Site 032
2014-04-08	1043	Barrow Trib @ JPS Occupancy Site 033
2014-05-09	1609	Barrow Trib @ JPS Occupancy Site 033
2014-04-18	1143	Barrow Trib @ JPS Occupancy Site 033
2014-04-08	1055	Barrow Trib @ JPS Occupancy Site 034
2014-05-09	1616	Barrow Trib @ JPS Occupancy Site 034
2014-04-18	1153	Barrow Trib @ JPS Occupancy Site 034
2014-04-08	1110	Barrow Trib @ JPS Occupancy Site 035
2014-05-09	1628	Barrow Trib @ JPS Occupancy Site 035
2014-04-18	1206	Barrow Trib @ JPS Occupancy Site 035
2014-04-08	1121	Barrow Trib @ JPS Occupancy Site 036
2014-05-09	1638	Barrow Trib @ JPS Occupancy Site 036
2014-04-18	1218	Barrow Trib @ JPS Occupancy Site 036
2014-04-08	1132	Barrow Trib @ JPS Occupancy Site 037
2014-05-09	1648	Barrow Trib @ JPS Occupancy Site 037
2014-04-18	1235	Barrow Trib @ JPS Occupancy Site 037
2014-04-08	1143	Barrow Trib @ JPS Occupancy Site 038
2014-05-09	1720	Barrow Trib @ JPS Occupancy Site 038
2014-04-18	1244	Barrow Trib @ JPS Occupancy Site 038
2014-04-08	1221	Barrow Trib @ JPS Occupancy Site 039
2014-05-09	1726	Barrow Trib @ JPS Occupancy Site 039
2014-04-18	1309	Barrow Trib @ JPS Occupancy Site 039
2014-04-08	1233	Barrow Trib @ JPS Occupancy Site 040
2014-05-09	1737	Barrow Trib @ JPS Occupancy Site 040
2014-04-25	1035	Barrow Trib @ JPS Occupancy Site 040
2014-04-08	1247	Barrow Trib @ JPS Occupancy Site 041
2014-05-09	1746	Barrow Trib @ JPS Occupancy Site 041
2014-04-25	1043	Barrow Trib @ JPS Occupancy Site 041
2014-04-08	1258	Barrow Trib @ JPS Occupancy Site 043
2014-04-08	1308	Barrow Trib @ JPS Occupancy Site 044
2014-05-09	1808	Barrow Trib @ JPS Occupancy Site 044
2014-04-25	1056	Barrow Trib @ JPS Occupancy Site 044
2014-04-08	1318	Barrow Trib @ JPS Occupancy Site 045
2014-05-09	1815	Barrow Trib @ JPS Occupancy Site 045
2014-04-25	1100	Barrow Trib @ JPS Occupancy Site 045
2014-04-08	1326	Barrow Trib @ JPS Occupancy Site 046

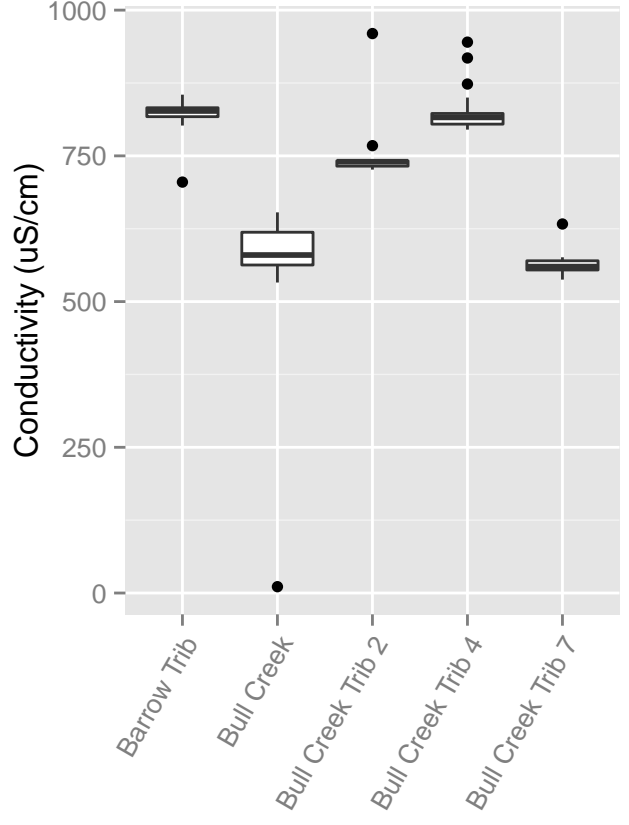
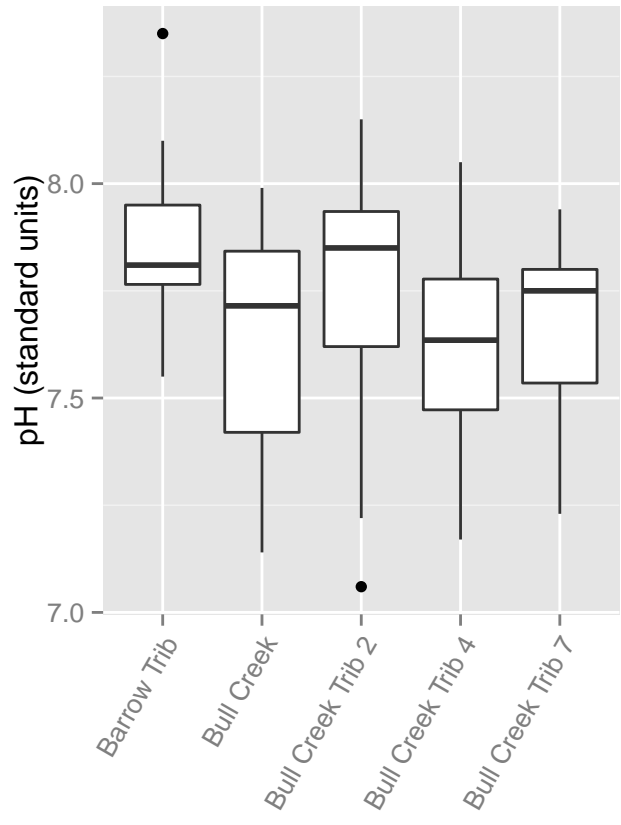
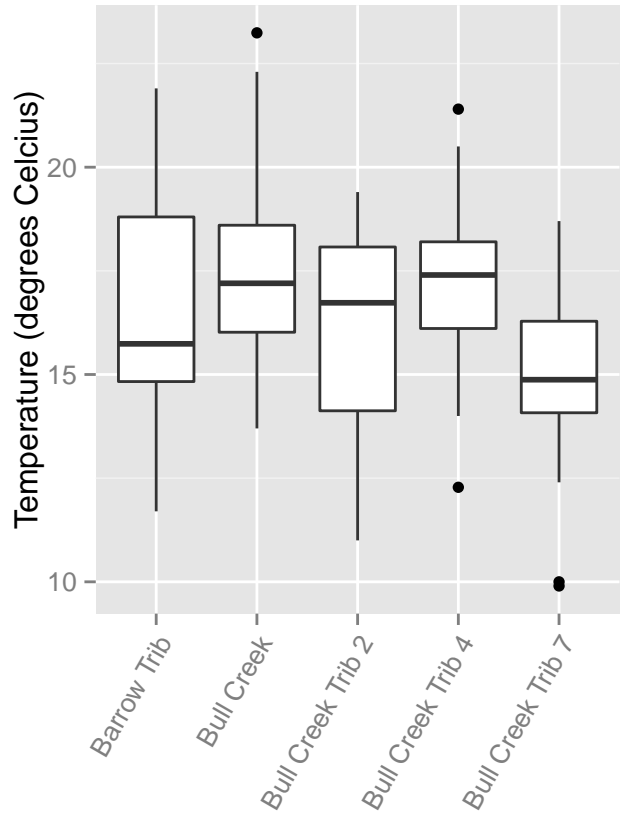
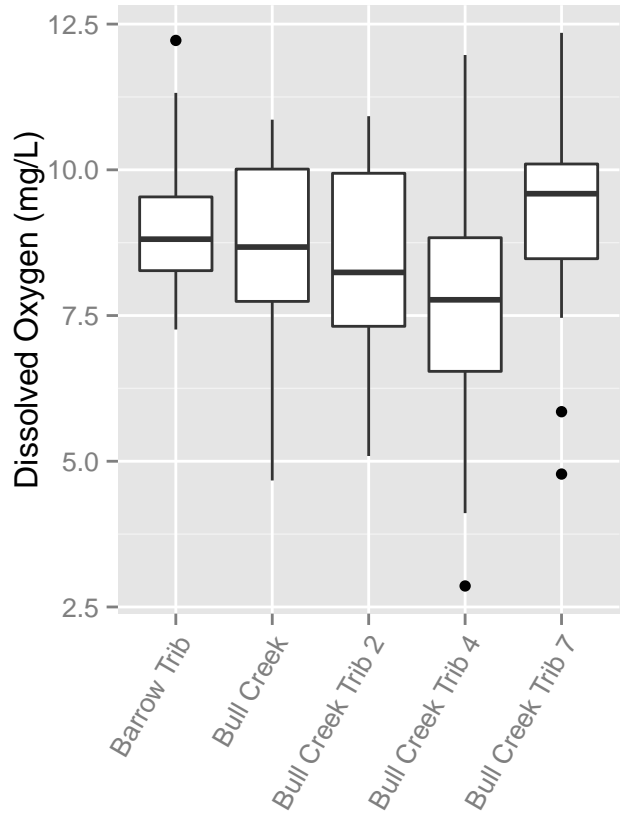
2014-05-09	1823	Barrow Trib @ JPS Occupancy Site 046
2014-04-25	1106	Barrow Trib @ JPS Occupancy Site 046
2014-04-08	1337	Barrow Trib @ JPS Occupancy Site 048
2014-04-01	1047	Bull Creek @ JPS Occupancy Site 057
2014-04-21	1058	Bull Creek @ JPS Occupancy Site 057
2014-04-11	1544	Bull Creek @ JPS Occupancy Site 057
2014-04-01	1112	Bull Creek @ JPS Occupancy Site 060
2014-04-11	1531	Bull Creek @ JPS Occupancy Site 060
2014-04-01	1132	Bull Creek @ JPS Occupancy Site 061
2014-04-21	1115	Bull Creek @ JPS Occupancy Site 061
2014-04-01	1147	Bull Creek @ JPS Occupancy Site 062
2014-04-21	0	Bull Creek @ JPS Occupancy Site 062
2014-04-01	1204	Bull Creek @ JPS Occupancy Site 063
2014-04-21	1	Bull Creek @ JPS Occupancy Site 063
2014-04-11	1504	Bull Creek @ JPS Occupancy Site 063
2014-04-01	1215	Bull Creek @ JPS Occupancy Site 064
2014-04-11	1452	Bull Creek @ JPS Occupancy Site 064
2014-04-01	1912	Bull Creek @ JPS Occupancy Site 065
2014-04-11	1201	Bull Creek @ JPS Occupancy Site 065
2014-04-01	1256	Bull Creek @ JPS Occupancy Site 066
2014-04-21	1	Bull Creek @ JPS Occupancy Site 066
2014-04-11	1212	Bull Creek @ JPS Occupancy Site 066
2014-04-01	1304	Bull Creek @ JPS Occupancy Site 067
2014-04-21	1	Bull Creek @ JPS Occupancy Site 067
2014-04-11	1225	Bull Creek @ JPS Occupancy Site 067
2014-04-01	1317	Bull Creek @ JPS Occupancy Site 068
2014-04-21	1	Bull Creek @ JPS Occupancy Site 068
2014-04-11	1238	Bull Creek @ JPS Occupancy Site 068
2014-04-01	1330	Bull Creek @ JPS Occupancy Site 069
2014-04-21	1	Bull Creek @ JPS Occupancy Site 069
2014-04-11	1241	Bull Creek @ JPS Occupancy Site 069
2014-04-01	1343	Bull Creek @ JPS Occupancy Site 070
2014-04-21	1	Bull Creek @ JPS Occupancy Site 070
2014-04-11	1255	Bull Creek @ JPS Occupancy Site 070
2014-04-01	1353	Bull Creek @ JPS Occupancy Site 071
2014-04-21	1	Bull Creek @ JPS Occupancy Site 071
2014-04-11	1301	Bull Creek @ JPS Occupancy Site 071
2014-04-01	1417	Bull Creek @ JPS Occupancy Site 072
2014-04-21	1	Bull Creek @ JPS Occupancy Site 072
2014-04-11	1313	Bull Creek @ JPS Occupancy Site 072
2014-04-01	1437	Bull Creek @ JPS Occupancy Site 073
2014-04-21	1	Bull Creek @ JPS Occupancy Site 073
2014-04-11	1325	Bull Creek @ JPS Occupancy Site 073
2014-04-01	1449	Bull Creek @ JPS Occupancy Site 074
2014-04-21	1	Bull Creek @ JPS Occupancy Site 074
2014-04-11	1339	Bull Creek @ JPS Occupancy Site 074
2014-04-01	1502	Bull Creek @ JPS Occupancy Site 076
2014-04-21	1	Bull Creek @ JPS Occupancy Site 076
2014-04-11	1353	Bull Creek @ JPS Occupancy Site 076
2014-04-01	1512	Bull Creek @ JPS Occupancy Site 077
2014-04-21	1	Bull Creek @ JPS Occupancy Site 077

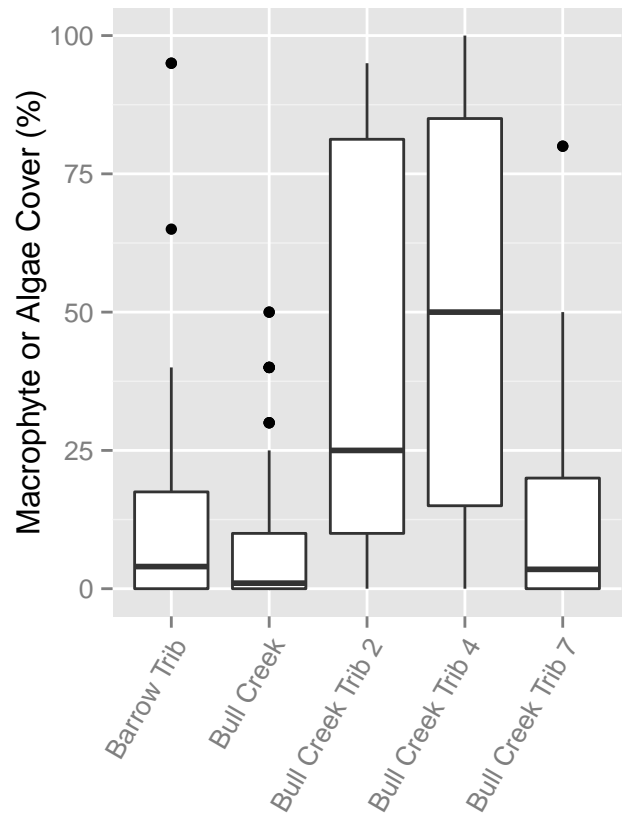
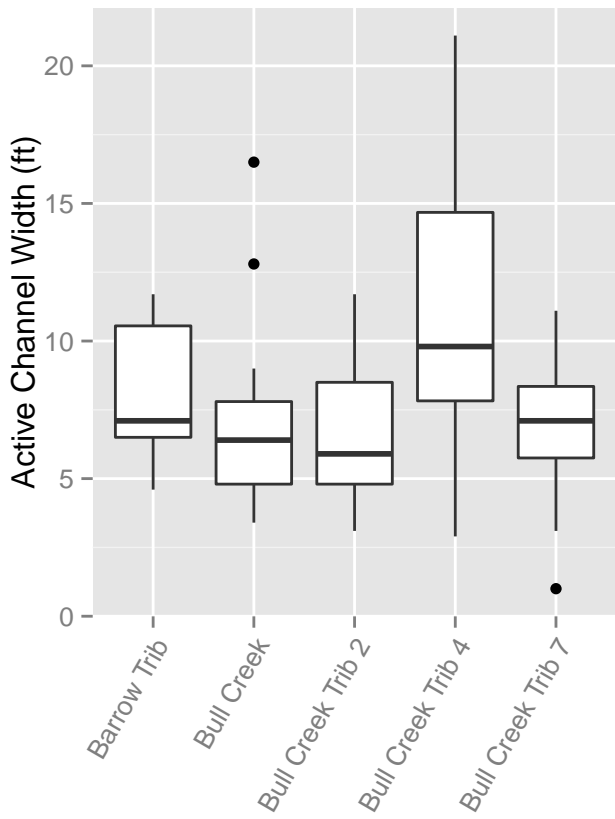
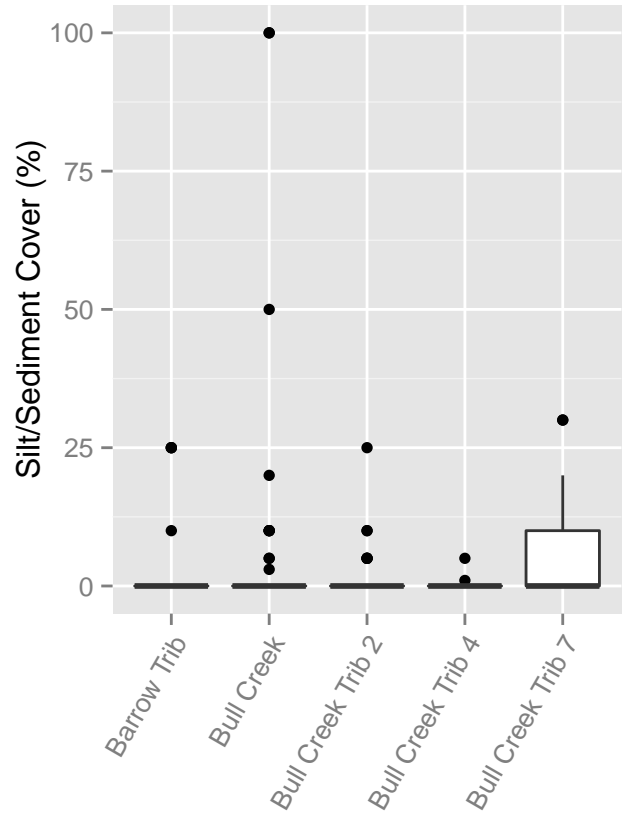
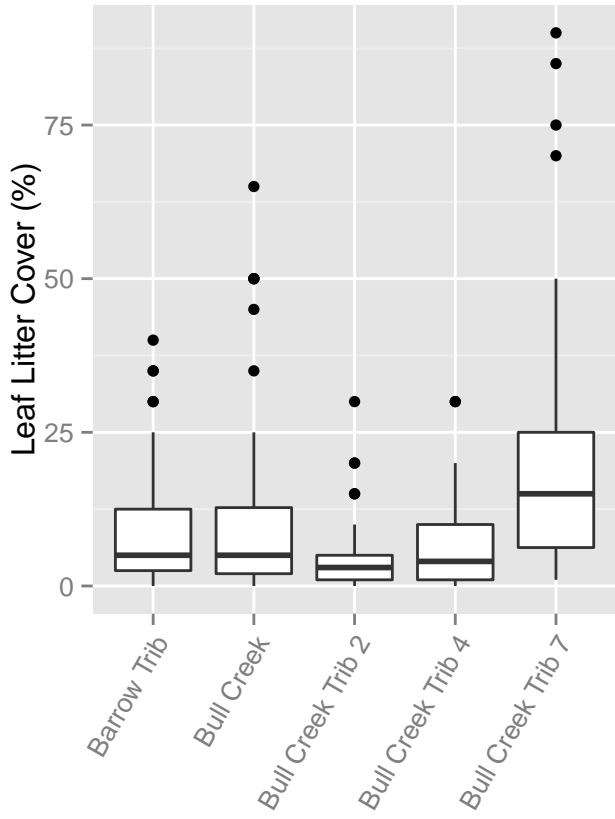
2014-04-11	1404	Bull Creek @ JPS Occupancy Site 077
2014-04-01	1245	Bull Creek @ JPS Occupancy Site 126
2014-04-21	1	Bull Creek @ JPS Occupancy Site 126
2014-04-11	1151	Bull Creek @ JPS Occupancy Site 126
2014-04-01	1620	Bull Creek @ JPS Occupancy Site 127
2014-04-21	1	Bull Creek @ JPS Occupancy Site 127
2014-04-11	1136	Bull Creek @ JPS Occupancy Site 127
2014-04-01	1642	Bull Creek @ JPS Occupancy Site 128
2014-04-21	1	Bull Creek @ JPS Occupancy Site 128
2014-04-11	1123	Bull Creek @ JPS Occupancy Site 128
2014-04-01	1703	Bull Creek @ JPS Occupancy Site 129
2014-04-21	1	Bull Creek @ JPS Occupancy Site 129
2014-04-11	1106	Bull Creek @ JPS Occupancy Site 129
2014-04-11	1044	Bull Creek @ JPS Occupancy Site 131
2014-04-01	1724	Bull Creek @ JPS Occupancy Site 131
2014-04-21	1	Bull Creek @ JPS Occupancy Site 131
2014-04-11	1031	Bull Creek @ JPS Occupancy Site 132
2014-04-01	1743	Bull Creek @ JPS Occupancy Site 132
2014-04-21	1	Bull Creek @ JPS Occupancy Site 132
2014-04-11	1010	Bull Creek @ JPS Occupancy Site 133
2014-04-01	1805	Bull Creek @ JPS Occupancy Site 133
2014-04-21	1	Bull Creek @ JPS Occupancy Site 133
2014-04-04	953	Bull Creek Trib 2 @ JPS Occupancy Site 108
2014-04-28	1522	Bull Creek Trib 2 @ JPS Occupancy Site 108
2014-04-15	1037	Bull Creek Trib 2 @ JPS Occupancy Site 108
2014-04-04	1009	Bull Creek Trib 2 @ JPS Occupancy Site 110
2014-04-28	1532	Bull Creek Trib 2 @ JPS Occupancy Site 110
2014-04-15	1049	Bull Creek Trib 2 @ JPS Occupancy Site 110
2014-04-04	1021	Bull Creek Trib 2 @ JPS Occupancy Site 111
2014-04-28	1605	Bull Creek Trib 2 @ JPS Occupancy Site 111
2014-04-15	1059	Bull Creek Trib 2 @ JPS Occupancy Site 111
2014-04-04	1046	Bull Creek Trib 2 @ JPS Occupancy Site 112
2014-04-28	1615	Bull Creek Trib 2 @ JPS Occupancy Site 112
2014-04-15	1113	Bull Creek Trib 2 @ JPS Occupancy Site 112
2014-04-04	1057	Bull Creek Trib 2 @ JPS Occupancy Site 113
2014-04-28	1625	Bull Creek Trib 2 @ JPS Occupancy Site 113
2014-04-15	1125	Bull Creek Trib 2 @ JPS Occupancy Site 113
2014-04-04	1111	Bull Creek Trib 2 @ JPS Occupancy Site 114
2014-04-28	1635	Bull Creek Trib 2 @ JPS Occupancy Site 114
2014-04-15	1134	Bull Creek Trib 2 @ JPS Occupancy Site 114
2014-04-04	1128	Bull Creek Trib 2 @ JPS Occupancy Site 115
2014-04-28	1650	Bull Creek Trib 2 @ JPS Occupancy Site 115
2014-04-15	1148	Bull Creek Trib 2 @ JPS Occupancy Site 115
2014-04-04	1143	Bull Creek Trib 2 @ JPS Occupancy Site 116
2014-04-28	1717	Bull Creek Trib 2 @ JPS Occupancy Site 116
2014-04-15	1202	Bull Creek Trib 2 @ JPS Occupancy Site 116
2014-04-04	1200	Bull Creek Trib 2 @ JPS Occupancy Site 117
2014-04-28	1727	Bull Creek Trib 2 @ JPS Occupancy Site 117
2014-04-15	1312	Bull Creek Trib 2 @ JPS Occupancy Site 117
2014-04-04	1216	Bull Creek Trib 2 @ JPS Occupancy Site 118
2014-04-15	1312	Bull Creek Trib 2 @ JPS Occupancy Site 118

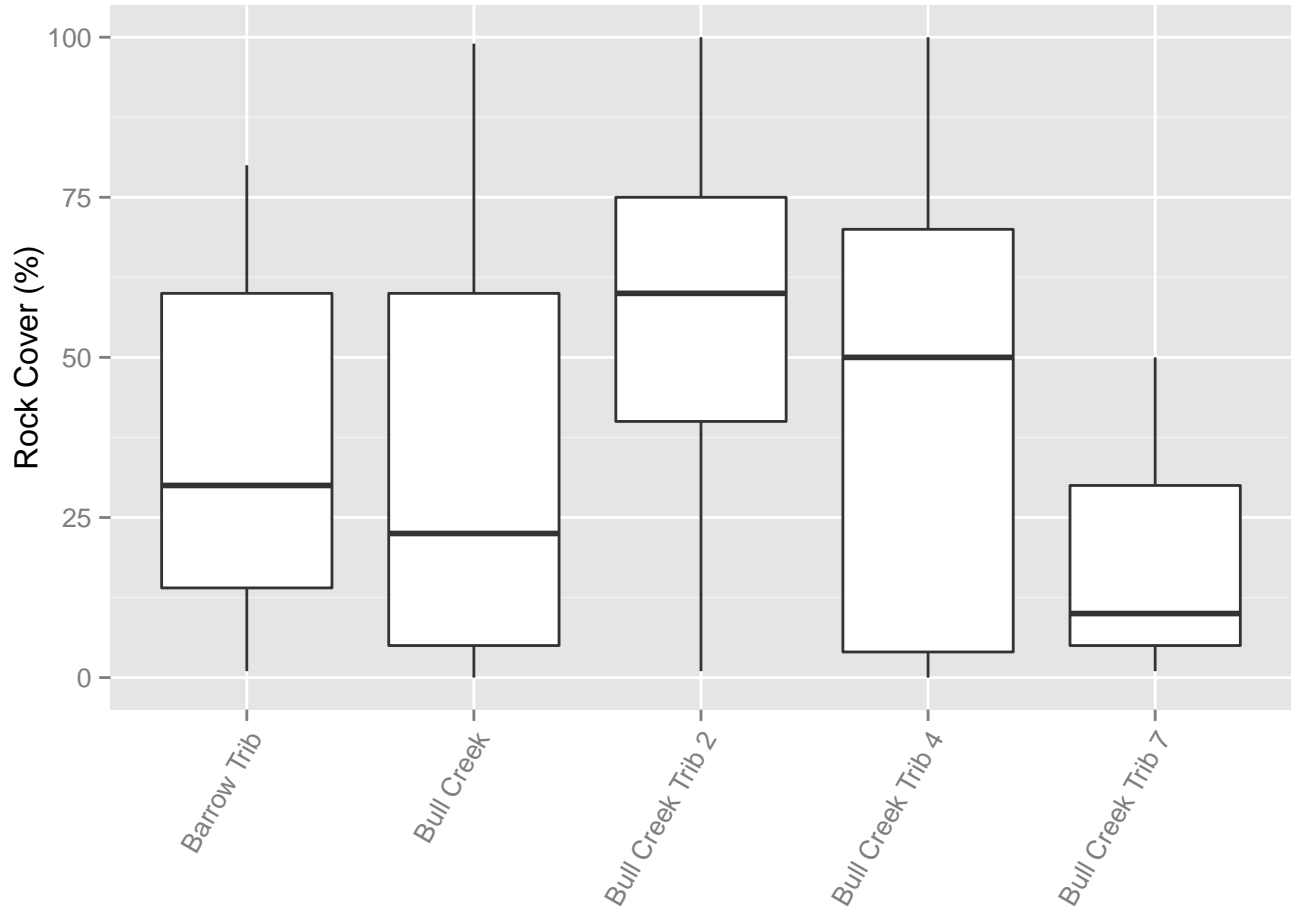
2014-04-15	1251	Bull Creek Trib 2 @ JPS Occupancy Site 121
2014-04-15	1304	Bull Creek Trib 2 @ JPS Occupancy Site 122
2014-04-04	1314	Bull Creek Trib 2 @ JPS Occupancy Site 123
2014-04-28	1548	Bull Creek Trib 2 @ JPS Occupancy Site 123
2014-04-15	1321	Bull Creek Trib 2 @ JPS Occupancy Site 123
2014-04-09	1055	Bull Creek Trib 4 @ JPS Occupancy Site 001
2014-04-03	1017	Bull Creek Trib 4 @ JPS Occupancy Site 001
2014-04-25	1501	Bull Creek Trib 4 @ JPS Occupancy Site 001
2014-04-09	1106	Bull Creek Trib 4 @ JPS Occupancy Site 002
2014-04-03	1033	Bull Creek Trib 4 @ JPS Occupancy Site 002
2014-04-25	1455	Bull Creek Trib 4 @ JPS Occupancy Site 002
2014-04-09	1120	Bull Creek Trib 4 @ JPS Occupancy Site 003
2014-04-03	1050	Bull Creek Trib 4 @ JPS Occupancy Site 003
2014-04-25	1437	Bull Creek Trib 4 @ JPS Occupancy Site 003
2014-04-09	1134	Bull Creek Trib 4 @ JPS Occupancy Site 004
2014-04-03	1104	Bull Creek Trib 4 @ JPS Occupancy Site 004
2014-04-25	1431	Bull Creek Trib 4 @ JPS Occupancy Site 004
2014-04-09	1142	Bull Creek Trib 4 @ JPS Occupancy Site 005
2014-04-03	1116	Bull Creek Trib 4 @ JPS Occupancy Site 005
2014-04-25	1423	Bull Creek Trib 4 @ JPS Occupancy Site 005
2014-04-09	1149	Bull Creek Trib 4 @ JPS Occupancy Site 006
2014-04-03	1126	Bull Creek Trib 4 @ JPS Occupancy Site 006
2014-04-25	1414	Bull Creek Trib 4 @ JPS Occupancy Site 006
2014-04-09	1201	Bull Creek Trib 4 @ JPS Occupancy Site 008
2014-04-03	1139	Bull Creek Trib 4 @ JPS Occupancy Site 008
2014-04-25	1401	Bull Creek Trib 4 @ JPS Occupancy Site 008
2014-04-09	1225	Bull Creek Trib 4 @ JPS Occupancy Site 009
2014-04-03	1150	Bull Creek Trib 4 @ JPS Occupancy Site 009
2014-04-25	1352	Bull Creek Trib 4 @ JPS Occupancy Site 009
2014-04-09	1240	Bull Creek Trib 4 @ JPS Occupancy Site 010
2014-04-03	1203	Bull Creek Trib 4 @ JPS Occupancy Site 010
2014-04-25	1339	Bull Creek Trib 4 @ JPS Occupancy Site 010
2014-04-09	1255	Bull Creek Trib 4 @ JPS Occupancy Site 011
2014-04-03	1234	Bull Creek Trib 4 @ JPS Occupancy Site 011
2014-04-25	1300	Bull Creek Trib 4 @ JPS Occupancy Site 011
2014-04-03	1441	Bull Creek Trib 4 @ JPS Occupancy Site 014
2014-04-23	1153	Bull Creek Trib 4 @ JPS Occupancy Site 014
2014-04-09	1659	Bull Creek Trib 4 @ JPS Occupancy Site 014
2014-04-03	1450	Bull Creek Trib 4 @ JPS Occupancy Site 015
2014-04-23	1143	Bull Creek Trib 4 @ JPS Occupancy Site 015
2014-04-09	1659	Bull Creek Trib 4 @ JPS Occupancy Site 015
2014-04-03	1502	Bull Creek Trib 4 @ JPS Occupancy Site 016
2014-04-23	1127	Bull Creek Trib 4 @ JPS Occupancy Site 016
2014-04-09	1659	Bull Creek Trib 4 @ JPS Occupancy Site 016
2014-04-03	1513	Bull Creek Trib 4 @ JPS Occupancy Site 017
2014-04-23	1126	Bull Creek Trib 4 @ JPS Occupancy Site 017
2014-04-09	1700	Bull Creek Trib 4 @ JPS Occupancy Site 017
2014-04-09	1259	Bull Creek Trib 4 @ JPS Occupancy Site 019
2014-04-03	1239	Bull Creek Trib 4 @ JPS Occupancy Site 019
2014-04-25	1305	Bull Creek Trib 4 @ JPS Occupancy Site 019
2014-04-09	1305	Bull Creek Trib 4 @ JPS Occupancy Site 020

2014-04-03	1247	Bull Creek Trib 4 @ JPS Occupancy Site 020
2014-04-25	1310	Bull Creek Trib 4 @ JPS Occupancy Site 020
2014-04-09	1317	Bull Creek Trib 4 @ JPS Occupancy Site 021
2014-04-03	1257	Bull Creek Trib 4 @ JPS Occupancy Site 021
2014-04-25	1320	Bull Creek Trib 4 @ JPS Occupancy Site 021
2014-04-09	1327	Bull Creek Trib 4 @ JPS Occupancy Site 022
2014-04-03	1307	Bull Creek Trib 4 @ JPS Occupancy Site 022
2014-04-25	1323	Bull Creek Trib 4 @ JPS Occupancy Site 022
2014-04-09	1339	Bull Creek Trib 4 @ JPS Occupancy Site 023
2014-04-03	1331	Bull Creek Trib 4 @ JPS Occupancy Site 023
2014-04-23	1325	Bull Creek Trib 4 @ JPS Occupancy Site 023
2014-04-09	1355	Bull Creek Trib 4 @ JPS Occupancy Site 024
2014-04-03	1347	Bull Creek Trib 4 @ JPS Occupancy Site 024
2014-04-23	1239	Bull Creek Trib 4 @ JPS Occupancy Site 024
2014-04-03	1356	Bull Creek Trib 4 @ JPS Occupancy Site 025
2014-04-23	1229	Bull Creek Trib 4 @ JPS Occupancy Site 025
2014-04-09	1658	Bull Creek Trib 4 @ JPS Occupancy Site 025
2014-04-03	1408	Bull Creek Trib 4 @ JPS Occupancy Site 026
2014-04-09	1658	Bull Creek Trib 4 @ JPS Occupancy Site 026
2014-04-07	1024	Bull Creek Trib 7 @ JPS Occupancy Site 081
2014-04-29	1621	Bull Creek Trib 7 @ JPS Occupancy Site 081
2014-04-16	1103	Bull Creek Trib 7 @ JPS Occupancy Site 081
2014-04-07	1039	Bull Creek Trib 7 @ JPS Occupancy Site 082
2014-04-29	1620	Bull Creek Trib 7 @ JPS Occupancy Site 082
2014-04-16	1116	Bull Creek Trib 7 @ JPS Occupancy Site 082
2014-04-07	1117	Bull Creek Trib 7 @ JPS Occupancy Site 088
2014-04-16	1134	Bull Creek Trib 7 @ JPS Occupancy Site 088
2014-04-07	1142	Bull Creek Trib 7 @ JPS Occupancy Site 089
2014-04-29	1649	Bull Creek Trib 7 @ JPS Occupancy Site 089
2014-04-16	1146	Bull Creek Trib 7 @ JPS Occupancy Site 089
2014-04-07	1155	Bull Creek Trib 7 @ JPS Occupancy Site 090
2014-04-29	1705	Bull Creek Trib 7 @ JPS Occupancy Site 090
2014-04-16	1156	Bull Creek Trib 7 @ JPS Occupancy Site 090
2014-04-07	1210	Bull Creek Trib 7 @ JPS Occupancy Site 091
2014-04-29	1715	Bull Creek Trib 7 @ JPS Occupancy Site 091
2014-04-16	1202	Bull Creek Trib 7 @ JPS Occupancy Site 091
2014-04-07	1221	Bull Creek Trib 7 @ JPS Occupancy Site 092
2014-04-07	1235	Bull Creek Trib 7 @ JPS Occupancy Site 093
2014-04-16	1216	Bull Creek Trib 7 @ JPS Occupancy Site 093
2014-04-07	1253	Bull Creek Trib 7 @ JPS Occupancy Site 094
2014-04-29	1736	Bull Creek Trib 7 @ JPS Occupancy Site 094
2014-04-16	1226	Bull Creek Trib 7 @ JPS Occupancy Site 094
2014-04-07	1306	Bull Creek Trib 7 @ JPS Occupancy Site 095
2014-04-16	1234	Bull Creek Trib 7 @ JPS Occupancy Site 095
2014-04-07	1407	Bull Creek Trib 7 @ JPS Occupancy Site 096
2014-04-29	1749	Bull Creek Trib 7 @ JPS Occupancy Site 096
2014-04-16	1248	Bull Creek Trib 7 @ JPS Occupancy Site 096
2014-04-07	1407	Bull Creek Trib 7 @ JPS Occupancy Site 097
2014-04-29	1825	Bull Creek Trib 7 @ JPS Occupancy Site 097
2014-04-16	1314	Bull Creek Trib 7 @ JPS Occupancy Site 097
2014-04-07	1421	Bull Creek Trib 7 @ JPS Occupancy Site 098

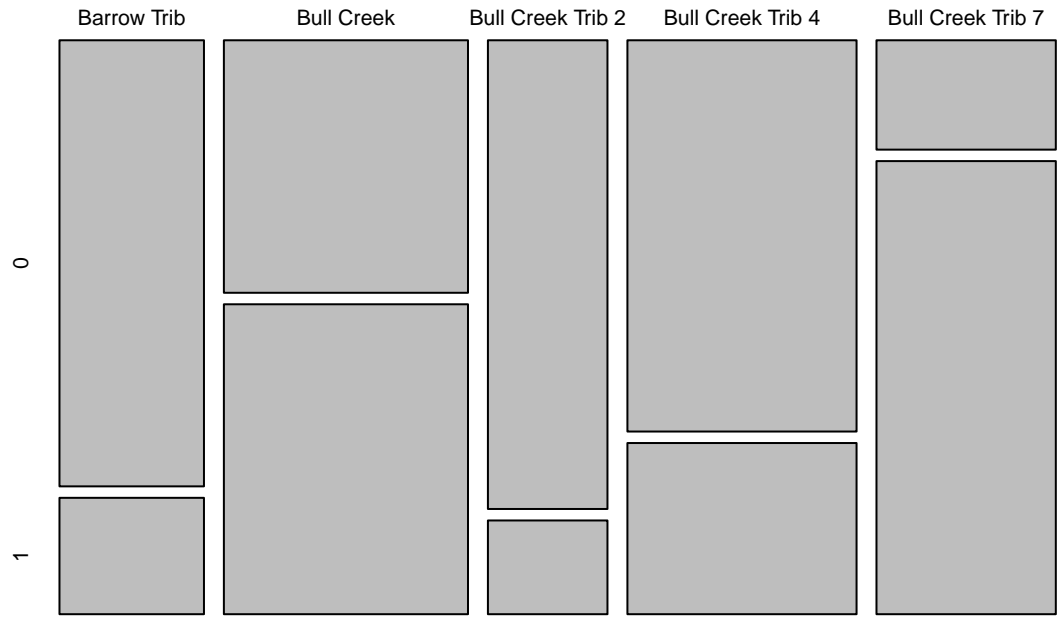
2014-04-29	1833	Bull Creek Trib 7 @ JPS Occupancy Site 098
2014-04-16	1325	Bull Creek Trib 7 @ JPS Occupancy Site 098
2014-04-07	1435	Bull Creek Trib 7 @ JPS Occupancy Site 099
2014-04-29	1841	Bull Creek Trib 7 @ JPS Occupancy Site 099
2014-04-16	1335	Bull Creek Trib 7 @ JPS Occupancy Site 099
2014-04-07	1449	Bull Creek Trib 7 @ JPS Occupancy Site 100
2014-04-29	1851	Bull Creek Trib 7 @ JPS Occupancy Site 100
2014-04-16	1346	Bull Creek Trib 7 @ JPS Occupancy Site 100
2014-04-07	1502	Bull Creek Trib 7 @ JPS Occupancy Site 101
2014-04-29	1859	Bull Creek Trib 7 @ JPS Occupancy Site 101
2014-04-16	1356	Bull Creek Trib 7 @ JPS Occupancy Site 101
2014-04-07	1512	Bull Creek Trib 7 @ JPS Occupancy Site 102
2014-04-29	1907	Bull Creek Trib 7 @ JPS Occupancy Site 102
2014-04-16	1411	Bull Creek Trib 7 @ JPS Occupancy Site 102
2014-04-07	1521	Bull Creek Trib 7 @ JPS Occupancy Site 103
2014-04-07	1536	Bull Creek Trib 7 @ JPS Occupancy Site 105
2014-04-29	1922	Bull Creek Trib 7 @ JPS Occupancy Site 105
2014-04-16	1427	Bull Creek Trib 7 @ JPS Occupancy Site 105



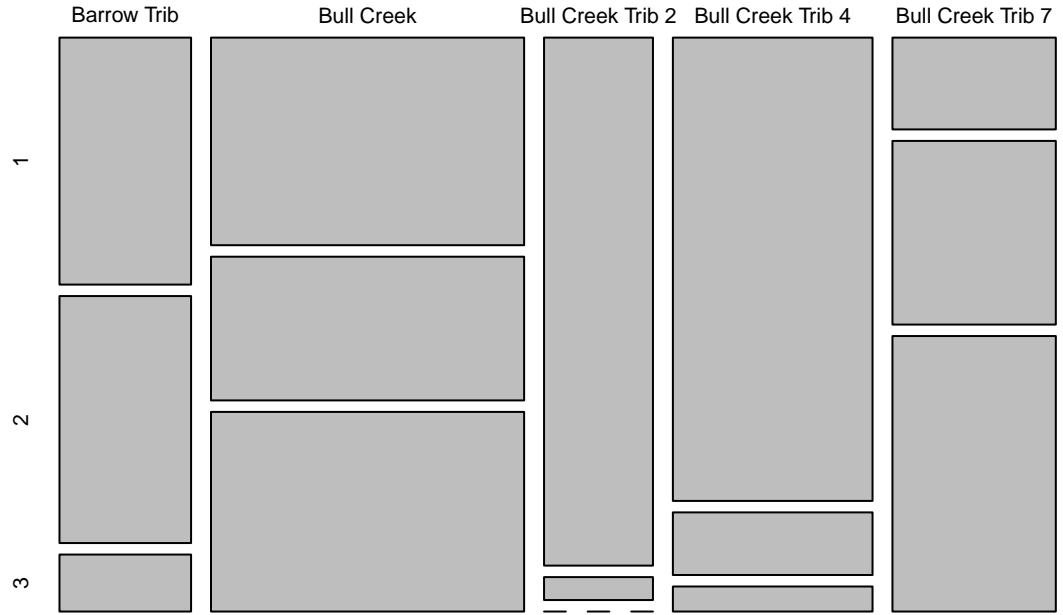




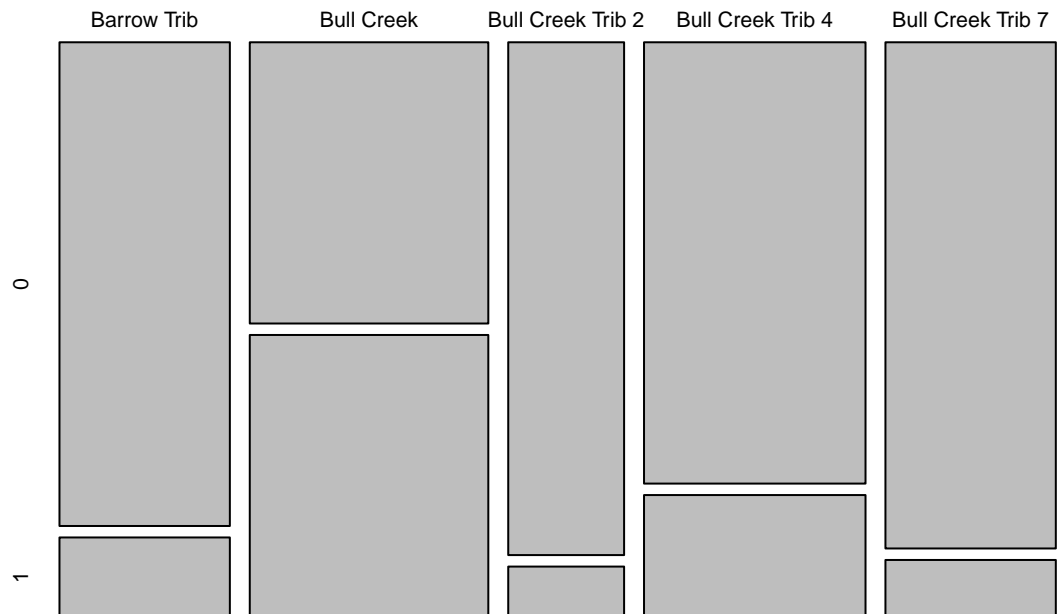
Maidenhair Fern Presence



Calcium Carbonate



Salamander Presence



For comparison, we repeat the same analysis for 2013 and 2014. See Bendik 2014 for a detailed analysis of the 2013 occupancy data http://www.austintexas.gov/watershed_protection/publications/document.cfm?id=206340.

```
##2013
occu(~1 ~ WATER.TEMPERATURE_sd + WATER.TEMPERATURE_mean + DISSOLVED.OXYGEN_mean + WATER.

##
## Call:
## occu(formula = ~1 ~ WATER.TEMPERATURE_sd + WATER.TEMPERATURE_mean +
##       DISSOLVED.OXYGEN_mean + WATER.DEPTH_mean + VELOCITY_mean +
##       ROCK.COVER_mean, data = ocdat13)
##
## Occupancy:
##               Estimate      SE      z P(>|z|)
## (Intercept)    16.2044 10.6277  1.5247 0.12733
## WATER.TEMPERATURE_sd  -1.7310  0.6190 -2.7965 0.00517
## WATER.TEMPERATURE_mean -0.2926  0.5452 -0.5367 0.59148
## DISSOLVED.OXYGEN_mean  -0.4784  0.2996 -1.5965 0.11038
## WATER.DEPTH_mean      -9.3649  3.1207 -3.0009 0.00269
## VELOCITY_mean         -0.0715  2.8346 -0.0252 0.97987
## ROCK.COVER_mean       -0.0155  0.0126 -1.2341 0.21717
##
## Detection:
##      Estimate      SE      z  P(>|z|)
##      0.974 0.28 3.47 0.000517
##
## AIC: 146.5816

##2014
occu(~1 ~ WATER.TEMPERATURE_sd + WATER.TEMPERATURE_mean + DISSOLVED.OXYGEN_mean + WATER.

##
## Call:
## occu(formula = ~1 ~ WATER.TEMPERATURE_sd + WATER.TEMPERATURE_mean +
##       DISSOLVED.OXYGEN_mean + WATER.DEPTH_mean + VELOCITY_mean +
##       ROCK.COVER_mean, data = ocdat14)
##
## Occupancy:
##               Estimate      SE      z P(>|z|)
## (Intercept)    -3.3346  3.55266 -0.939 0.34793
## WATER.TEMPERATURE_sd  -0.6764  0.24874 -2.719 0.00654
## WATER.TEMPERATURE_mean  0.1781  0.19301  0.923 0.35620
## DISSOLVED.OXYGEN_mean  -0.0484  0.15594 -0.311 0.75617
## WATER.DEPTH_mean      0.7282  1.12192  0.649 0.51632
## VELOCITY_mean         1.8192  1.82568  0.996 0.31902
## ROCK.COVER_mean       0.0156  0.00974  1.598 0.11001
##
## Detection:
##      Estimate      SE      z  P(>|z|)
##      0.898 0.264 3.4 0.000686
##
## AIC: 213.72
```

TE-833851, Section U., Permit Condition 6: General Annual Reporting Requirements for San Marcos Salamanders

No research activities were performed on San Marcos Salamanders or within San Marcos Salamander habitat.

TE-833851, Section V., Permit Condition 6: General Annual Reporting Requirements for Karst Invertebrates

During hydrogeological investigations, City of Austin permitted staff entered several caves that may harbor protected karst invertebrates. These caves, the dates of entry, City personnel, purpose of visit, and relevant observations are presented in the table below.

Date	#Entrants	Cave	Purpose	Staff
10/14/2010	2	Blowing Sink	examine drips, change dye receptors	Mark Sanders, Nico Hauwert
4/28/2011	3	Blowing Sink	examine drips	Nico Hauwert, Brian Cowan, Saj Zap
6/25/2011	3	Blowing Sink	cave gate cut found on upper level trip to top of first drop	Nico Hauwert, David Papke, Justin Camp
8/21/2011	7	Blowing Sink	dive team for lower Eileens River sump	Jean Krejca, Mark Sanders, Nico Hauwert
9/21/2010	2	Goat	examine drips during major rain	Nico Hauwert, Mark Sanders
9/21/2010	2	Maple Run	examine drips during major rain	Nico Hauwert, Mark Sanders
5/3/2011	4	Maple run	examine drips	Nico Hauwert, Brian Cowan, David papke, mike Sledge
5/3/2011	20?	Goat	cave rescue AFD	
5/3/2011	3	Tooth Cave	examine drips	Mark Sanders, Nico Hauwert
11/10/2011	3	Flint Ridge	examine drips	Mark Sanders, Rick Hudson, Hunter Denham
5/12/2011	2	Jester Estates	did not enter cave as flash flood poured in entrance	Mark Sanders, Nico Hauwert
6/9/2011	2	Jester Estates	faunal survey, map cave, map drips, water sample	Mark Sanders, Nico Hauwert
11/22/2011	3	Jester Estates	faunal survey, inst drip gauge, geology, verify map, remove rock hazard	Mark Sanders, Nico Hauwert, Amanda Aurora
11/22/2011	3	Pickle pit	faunal survey, map cave, map drips, geology	Mark Sanders, Amanda Aurora, Nico Hauwert
10/21/2011	TCMA report	Whirlpool cave	education trip with ACC	Nico Hauwert
9/14/2011	TCMA report	Whirlpool cave	education trip with Girls school of Austin	Nico Hauwert
8/4/2011	TCMA report	Whirlpool cave	P&R Ranger volunteers	Nico Hauwert, David papke
7/7/2011	TCMA report	Whirlpool cave	P&R Ranger volunteers	
11/12/2011	20	Goat/Get Down entrances	UT Env Law class (did not enter caves)	Nico Hauwert
8/9/2011	60	public education	Imagine Austin: Citizens Advisory Task Force on Flint Ridge challenges	
9/1/2011	100	public education	BCP annual training talk pickle Res ctr	Nico Hauwert
6/30/2011	15	staff education	Cave Skills at Dunvegan	Nico Hauwert, Mark Sanders, Todd Bayless
5/10/2011	2	McNeil Bat cave	drip sampling, drip rate, faunal survey	Nico Hauwert, Todd Bayless
5/10/2011	2	Fossil Garden	drip rate, faunal survey	Nico Hauwert, Todd Bayless
11/4/2010	3	McNeil	map cave, faunal survey	Nico Hauwert, Mark Sanders, Justin Camp
10/1/2010	3	McNeil Bat/Fossil Garden/No Rent/Weldon	surveyed cave entrances (did not enter)	Nico Hauwert

9/18/2011		Flint Ridge	surface geophysics over Quad border sink	
10/16/2011		Flint Ridge	surface geophysics over Quad border sink	
1/16/2013	2	Pennies Cave		Nico Hauwert, Scott Hiers
2/16/2013	12	Goat Cave	AustinExplorers, cave mapping	Nico Hauwert, Cait McCann
5/28/2013	5	Spanish Wells	cave mapping	Nico Hauwert, Mark Sanders, Todd Bayless, Renee Fields
6/7/2013	12	Whirlpool cave	Nature Center staff training	
9/10/2013	3	Starks Mine	cave mapping	Nico Hauwert, Todd Bayless, Paul Fuscille
9/12/2013	5	Goat cave	Community Impact Newsletter interview	Nico hauwert, Justin Shaw, Steven Shields
9/16/2013	22	District Park	Explore Austin - Education	Justin Shaw and others.
9/20-23/2013	5	Maple Run	hydrogeologic study	multiple trips with Nico Hauwert, Justin Shaw, Vivian Loftin, David Comer, Christopher Francke
9/21/2014	21	District Park	explore Austin - Education	Justin Shaw and others.
10/18/2013	1	Starks Mine	cave mapping	
10/5/2014	6	District Park	download tipper gauges	Justin Shaw, Lee Jay Graves, Davey Siddons, Karen Masters, Matt Rasler, Lydia Hernandez
1/8/2014	4	Blowing Sink	rerig bolts, check post flood damage	Bev Shade, David Ochel, Heather Tucek and myself Justin Shaw
1/18/2014	22	District Park	Explore Austin led by rangers	
2/15/2014	22	Goat	Explore Austin led by rangers	
2/22/2014	10	Maple Run	baylor U Rec sports to Rainbow room	Kelli McMahan, Mark Cody
2/24/2014	5	Maple Run	pulled out monitoring equipment to GED	Heather Tucek, Guin McDaid, Yaz Avila, Justin Shaw, and Don Broussard
2/24/2014	4	Goat Cave	ranger led adult tour	Steven Shields
3/5/2014		Blowing Sink		
3/12/2014	4	Blowing Sink	reopening below Kirschberg Hall	Justin Shaw, Don Broussard, David Comer, and Yazmin Avila
3/16/2014	7	Midnight Cave	Clean Trash off ledge, education / U.T. Grotto vertical training	Justin Shaw, Eric Flint, Galen Falgout, Lydia Hernandez, David Comer, Stefan Hubner, Ellie Watson
3/21/2014	6	Flint Ridge	pre-hydro study evaluation	Drew Thompson, Justin Shaw, heather Tucek, Lee jay Graves, and DJ Walker (AFD)
4/4/2014	5	Flint Ridge	Hydrostudy prep, opening blocked	Guin McDaid, Heather Tucek, Drew Thompson, Justin Shaw, Lee Jay Graves
4/8/2014	2	Blowing Sink	reopening below Kirschberg Hall	Guin McDaid, Heather Tucek, Don Broussard, Justin Shaw, Drew Thompson, Lee Jay Graves
4/13/2014		Midnight Cave	education / U.T. Grotto Vertical Training	Justin Shaw, Lydia Hernandez, Christine Weirich, Elizabeth Herren, Laura Robertson
4/17/2014	2	Blowing Sink	set up drip gauge, attempt reopen passage	Heather Tucek and Justin Shaw
5/7/2014	5	Blowing Sink	attempted to reopen Kirschberg Hall drain and reinstalled autosampler	Drew Thompson, Justin Shaw, heather Tucek, Don Broussard, David Comer
5/8/2014	2	Goat	water sampling	Yazmin Avila and Justin Shaw
5/9/2014	2	Goat	water sampling	Yazmin Avila and Drew Thompson
5/12/2014	2	Blowing Sink	program autosampler for rain	Yazmin Avila, Justin Shaw
5/14/2014	6	Blowing Sink	collect samples, reprogram autosampler	Heather Tuček, Yazmin Avila, Lee Jay Graves, David Comer, Justin Shaw and volunteer Jeff Nichols
5/25/2014	2	Blowing Sink	collect samples	Heather Tuček and David Comer
5/26/2014	3	Goat	sampling	David Comer, Jeff Nichols and Heather Tucek
6/3/2014	7	Flint Ridge	passage enlargement, equipment	Justin Shaw, Heather Tucek, Don Broussard, Yaz Avila, Lee jay Graves,

			hauling, tarp hanging	Drew Thompson, Jeff Nichols
6/10/2014	6	Flint Ridge	Breakdown bypass dig	Lee Jay Graves, Jeff Nichols, Fernando Hernandez, Drew Thompson, Yaz Avila
6/11/2014	6	Flint Ridge	haul autosampler to Balcony Room, reopen Headfirst hole	Don Broussard, Fernando Hernandez, Heather Tucek, Jeff Nichols, Justin Shaw, Yazmine Avila entered Flint Ridge Cave
6/12/2014		Flint Ridge	equipment transport / equipment installation, passage enlargement	Justin Shaw, Drew Thompson, Yaz Avila, Fernando Hernandez
6/30/2014	2	Flint Ridge	push lower leads	Justin Shaw and Fernando Hernandez
7/6/2014	3	Flint Ridge	scout equipment locations and plan installations	Justin Shaw, Davey Siddons, Heather Tucek
7/25/2014	6	Flint Ridge	install autosampler	Heather Tucek, Leslie Ward, Heather Tucek, Davey Siddons, Yaz Avila, Justin Shaw
7/28/2014	6	Flint Ridge	haul autosampler to Cheese & Chocolate	Heather Tucek, Drew Thompson, Jeff Nichols, Justin Shaw, LJ Graves, Fernando Hernandez, Yazmin Avila and Volunteer Davey Siddons
7/29/2014	6	Flint Ridge	haul autosampler to Drip Pit	Fernando Hernandez, Davey Siddons, Justin Shaw, Drew Thompson, Yaz Avila, Jeff Nichols
7/31/2014	5	Flint Ridge	equipment / supply transport and equipment setup	Yaz Avila, Fernando Hernandez, Lee Jay Graves, Justin Shaw, Drew Thompson
8/7/2014	3	Flint Ridge	equipment setup	Heather Tucek, Davey Siddons, Justin Shaw
8/12/2014	5	Flint Ridge	HydroLab Sonde transport and installation	Justin Shaw, Heather Tucek, Lee Jay Graves, Fernando Hernandez, Yaz Avila
8/27/2014	5	Flint Ridge	equipment installation and maintenance	Jeff, Nichols, Heather Tucek, Justin Shaw
9/1/2014	3	Flint Ridge	push rear leads	Yaz Avila, Lee Jay Graves, Jeff nichols
9/3/2014	2	Flint Ridge	push leads	Yaz Avila, Viv Loftin
9/11/2014	2	Flint Ridge	activate autosampler	Justin Shaw, Yaz Avila
9/15/2014	3	Flint Ridge	HydroLab Sonde calibration	Justin Shaw, Heather Tucek, Jeff Nichols
9/16/2014	3	Flint Ridge	HydroLab Sonde calibration	Justin Shaw, Heather Tucek, Jeff Nichols
9/18/2014	2	Flint Ridge	equipment maintenance	Justin Shaw, Davey Siddons
9/22/2014	4	Flint Ridge	equipment maintenance, supply transport	Justin Shaw, Don Broussard, Elizabeth Herrer, Jeff Nichols
10/1/2014	3	Flint Ridge	equipment maintenance	Justin Shaw, Jeff Nichols, Davey Siddons
10/4/2014	2	Flint Ridge	haul battery and autosampler computer controller	Justin Shaw, Lydia Hernandez
10/7/2014	2	Flint Ridge	equipment maintenance	Justin Shaw, Jeff Nichols
10/9/2014	2	Flint Ridge	equipment maintenance	Justin Shaw, Jeff Nichols
10/15/2014	2	Flint Ridge	HydroLab Sonde calibration	Justin Shaw, Jeff Nichols
10/16/2014	3	Flint Ridge	equipment maintenance	Justin Shaw, Jeff Nichols, Heather Tucek
10/17/2014	4	Flint Ridge	HydroLab Sonde calibration, battery and supply haul	Justin Shaw, Davey Siddons, Heather Tucek, Jeff Nichols
10/18/2014	22	Maple Run	Explore Austin	
10/20/2014	4	Flint Ridge	retrieve water samples	Justin Shaw, Davey Siddons, Heather Tucek, Jeff Nichols,
10/28/2014	2	Flint Ridge	equipment maintenance	Justin Shaw, Davey Siddons
10/30/2014	2	Flint Ridge	equipment maintenance	Justin Shaw, Davey Siddons
10/31/2014	2	Flint Ridge	equipment maintenance	Justin Shaw, Davey Siddons
11/1/2014	4	Flint Ridge	Study Audit by Dr. Cowan	Justin Shaw, Brian Cowan, Justin Camp, Yaz Avila
11/3/2014	2	Flint Ridge	HydroLab Sonde calibration	Justin Shaw, Davey Siddons
11/4/2014	2	Flint Ridge	receptor placement	Justin Shaw, Davey Siddons
11/6/2014	6	Flint Ridge	retrieve water samples	Justin Shaw, Jeff Nichols, Lee Jay Graves, Heather Tucek, Davey Siddons
11/8/2014	2	Flint Ridge	haul batteries	Justin Shaw, Davey Siddons
11/11/2014	7	Flint Ridge	retrieve water samples	Justin Shaw, Patrick Chaiker, Julie Webber, Davey Siddons, Heather Tucek, Jeff Nichols, Lee Jay Graves
11/18/2014	3	Flint Ridge	haul battery, equipment	Justin Shaw, Heather Tucek, Jeff Nichols

			maintenance	
11/17/2014	2	Flint Ridge	haul battery, equipment maintenance	Justin Shaw, Davey Siddons
11/24/2014	5	Flint Ridge	retrieve water samples	Justin Shaw, Heather Tucek, Jeff Nichols, Lee Jay Graves, Don Broussard
12/2/2014	6	Flint Ridge	retrieve water samples	Justin Shaw, Heather Tucek, Jeff Nichols, Yaz Avila, Don Broussard, Elizabeth Herr