



Jollyville Plateau Salamander Interim Report, 2014, for the Balcones Canyonlands Preserve

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Introduction

This document is a summary of research activity for the Jollyville Plateau Salamander (*E. tonkawae*) conducted and/or supervised by the City of Austin Watershed Protection Department. We conducted salamander surveys on the following Balcones Canyonland Preserve (BCP) tracts: Hanks, Franklin, Lanier, managed by the City of Austin Wildlands Division; Stillhouse Hollow and Barrow Preserve tracts, jointly managed by the City of Austin Parks and Recreation Department and Wildlands; Sam Hamilton East, and Concordia, managed by Travis County. Surveys were also done at several other sites on public or privately owned property. Here, we provide a brief synopsis of each monitoring or research project and summarize the data collected.

We continued long-term monitoring on a quarterly basis at 14 sites, and all salamanders captured at each site were photographed for the purposes of mark-recapture so that population demographic analyses could be conducted in the future. Included in this report is a summary of the total number of salamanders counted at each site for each quarter (including those not captured and photographed) and capture-recapture summary tables..

We continued occupancy surveys in Trib 7, Bull mainstem/Trib 8, Trib 4, and Barrow Hollow Trib with the addition of Trib 2 and additional sites along Bull Creek mainstem in the spring. We include a brief summary of our findings in this report.

In addition to population and occupancy surveys, Pete Diaz et al. (USFWS) in collaboration with the USGS and WPD continued the toxicology study on central Texas Eurycea, which included water sampling and salamander tissue sampling. His report is attached.

We collected water-borne stress hormones from salamanders at Lanier, Franklin/Pit Spring, Barrow, Sam Hamilton West, Lower Ribelin Spring, and Trib 4 of Bull Creek, in collaboration with the Gabor lab at Texas State University. Preliminary analyses are provided in a separate report (attached).

Additional details about these projects including background and methods are available in the project QAPPs (listed below) and referenced reports therein. For your reference, we also include the City's federal scientific permit report, which contains additional information such as environmental variable summaries and a specimen log.

Population Monitoring

We conducted population surveys using a drive survey technique at 14 sites in 2014 (Figure 1). We searched under rocks and other cover objects, sweeping leaf litter and algae with pool nets. We captured salamanders

with nets and photographed each one on a standardized grid background. Individuals observed, but not captured were recorded as one of three size classes, $\leq 1''$, $1-2''$ and $\geq 2''$. Surveys were primarily conducted on a quarterly basis (every three months) with the exception of Tanglewood Spring, Stillhouse Hollow and Spicewood Spring, which are now being surveyed on an annual basis. Total counts (includes all size classes) are reported from 14 sites.

Conditions during the winter of 2013 through the fall of 2014 were wetter than the previous year, allowing us to complete all of our planned surveys (Figure 2).

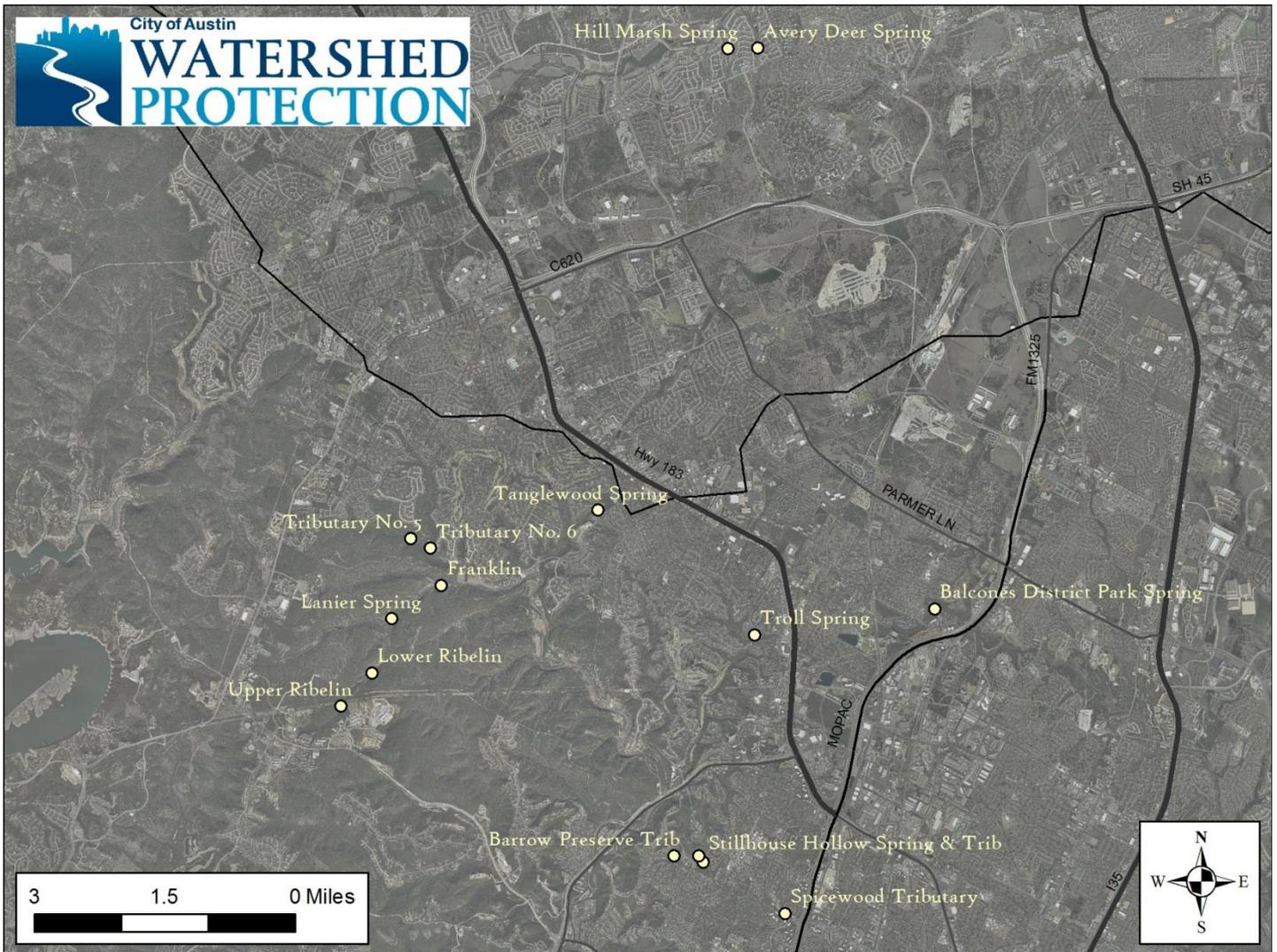
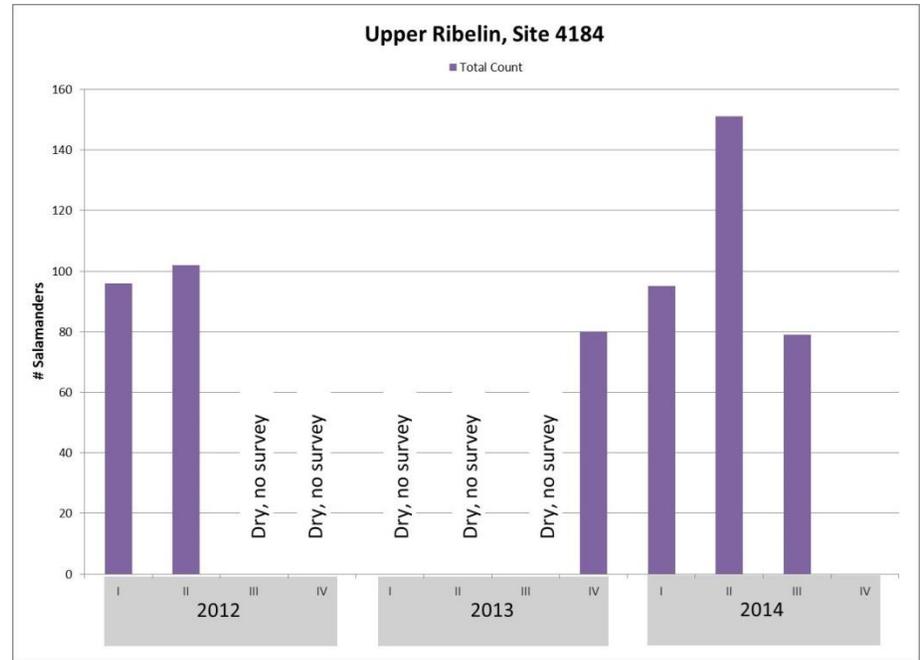
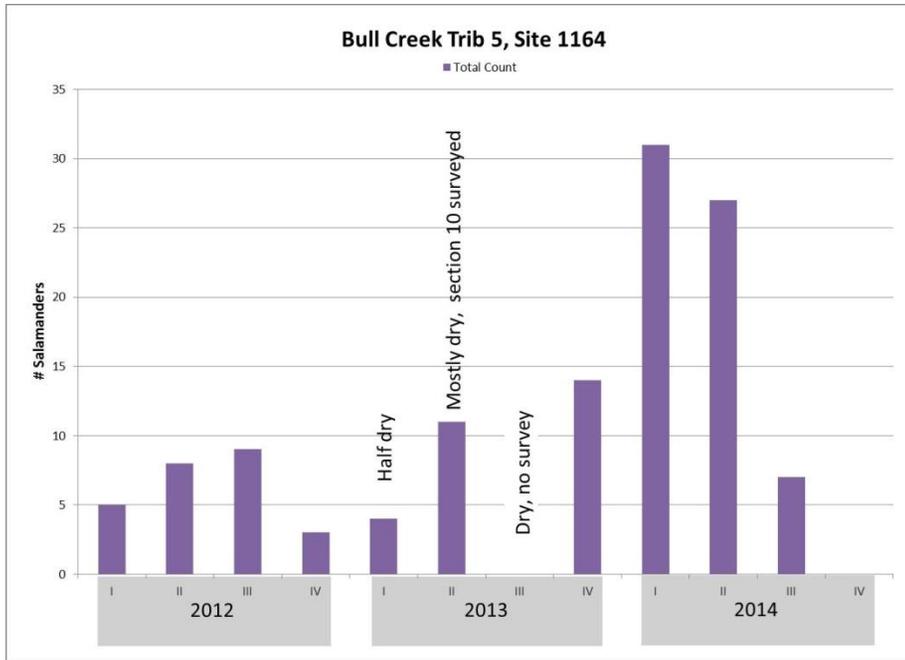


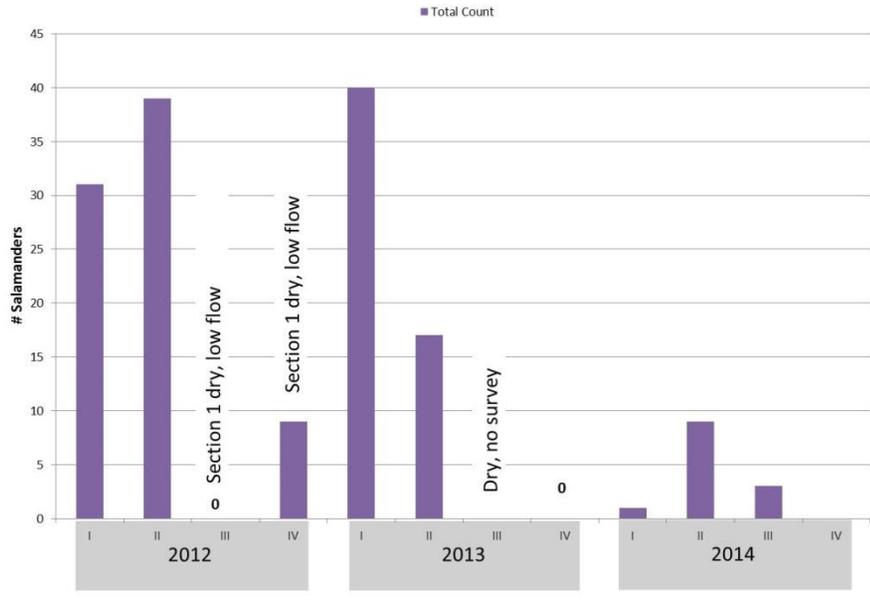
Figure 1. Map of 14 population monitoring sites in Travis and Williamson Counties, Texas.

Figure 2: Quarterly Count Summary

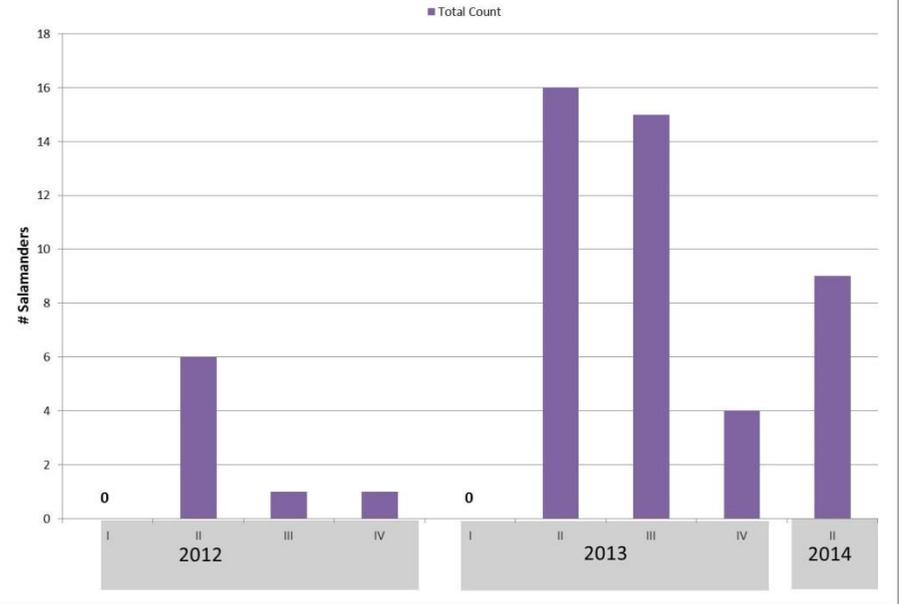
Below are the quarterly results of count surveys conducted at 14 sites between 2012 and 2014. Total salamander counts include the total of all size classes: ≤ 1 inch, 1-2 inches, and ≥ 2 inches. Each graph has the same x -axis, but a different y -axis. Missing data are noted on each graph as “no survey” 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 (exact survey dates are listed in Table 1). Quarter IV in 2014 is blank in all plots where data have yet to be collected.



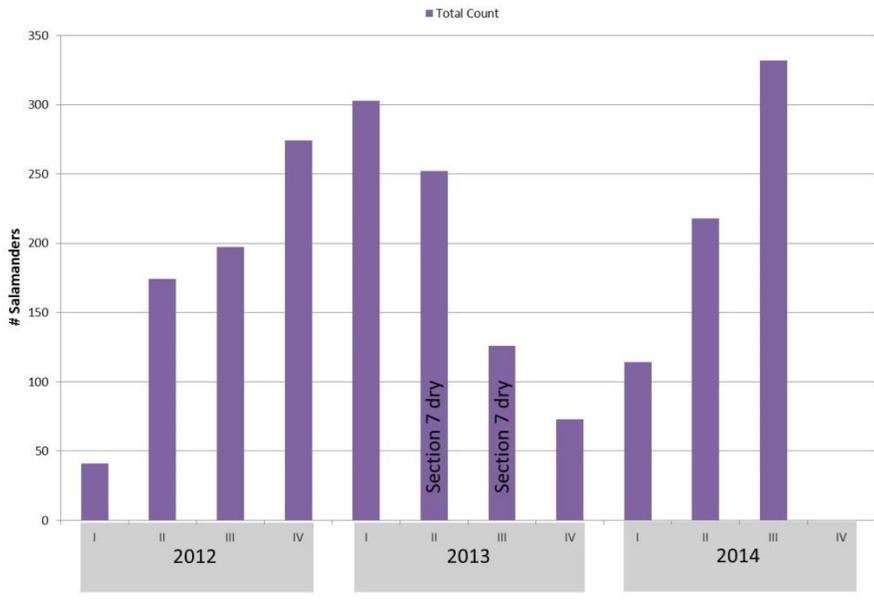
Barrow Hollow, Site 929



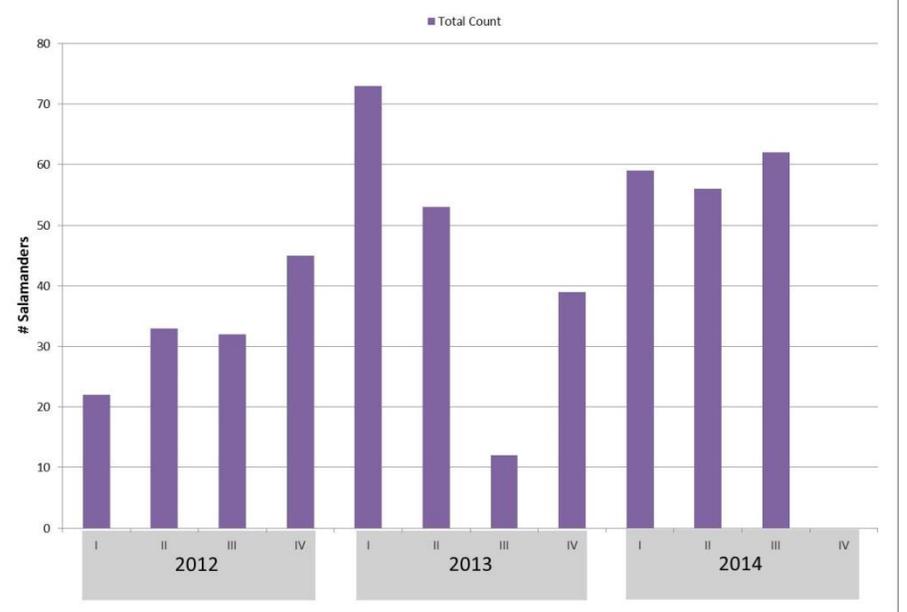
Stillhouse Hollow, Site 927

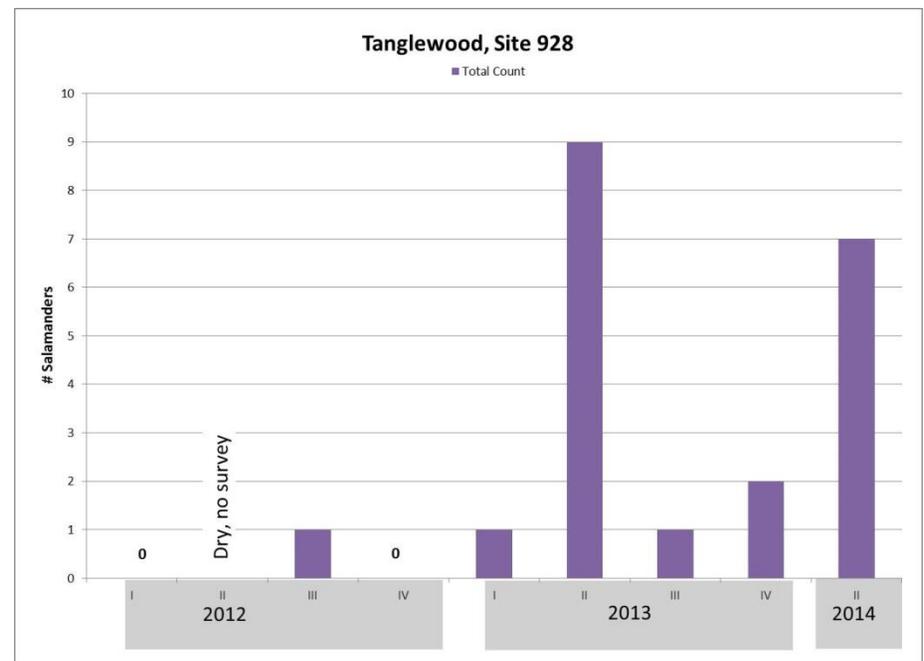
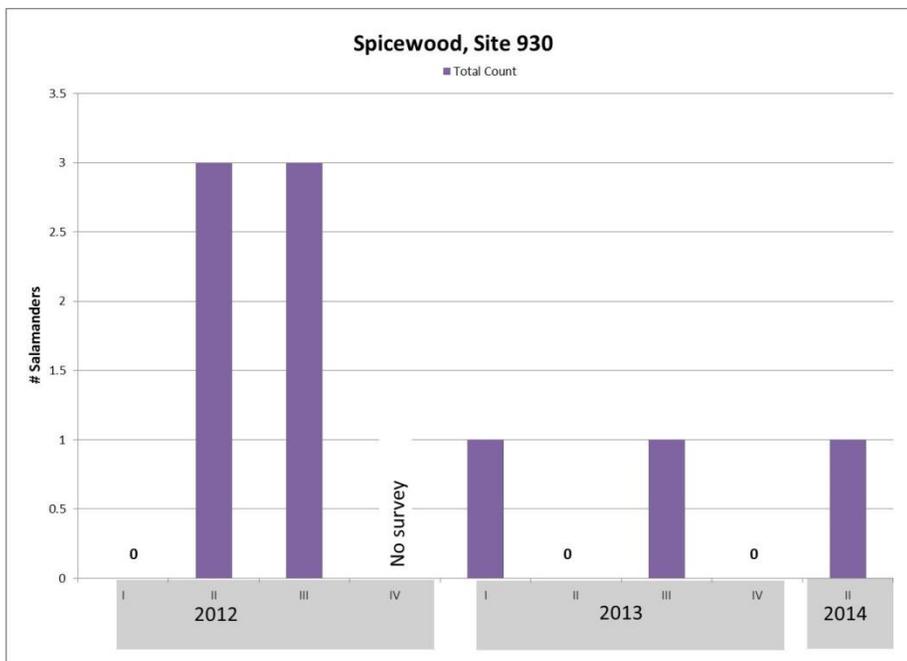
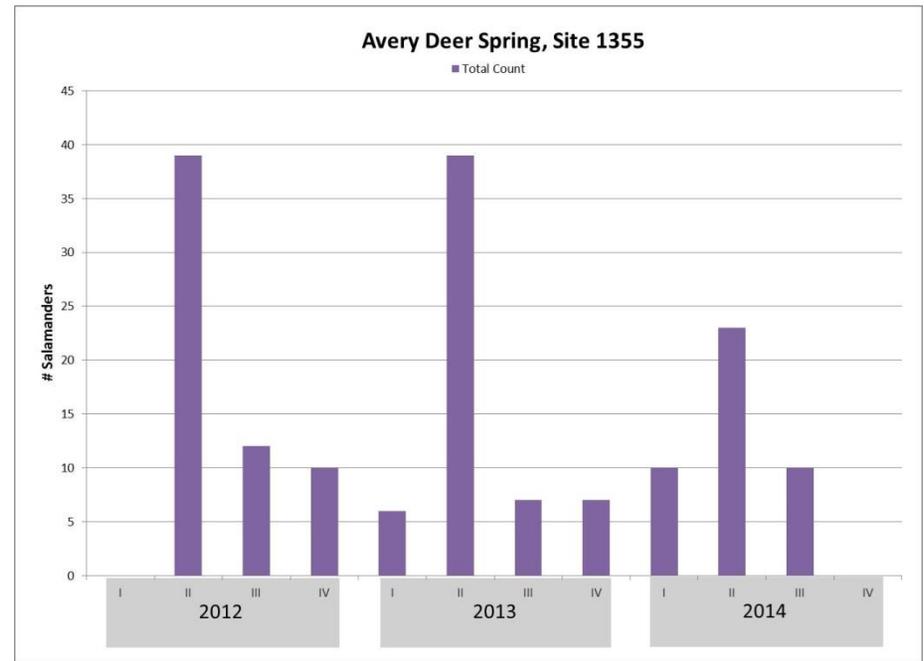
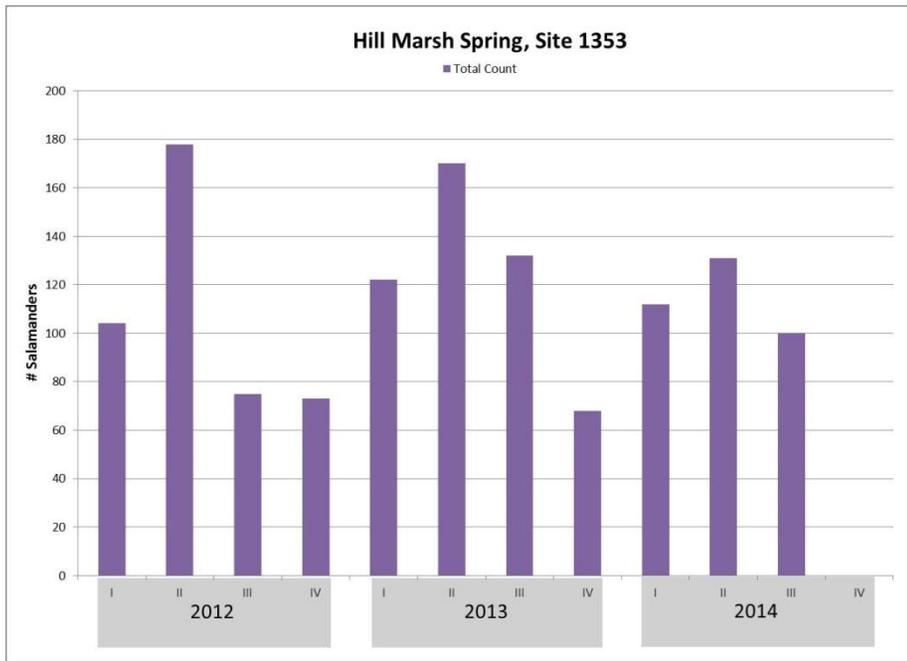


Franklin, Site 349

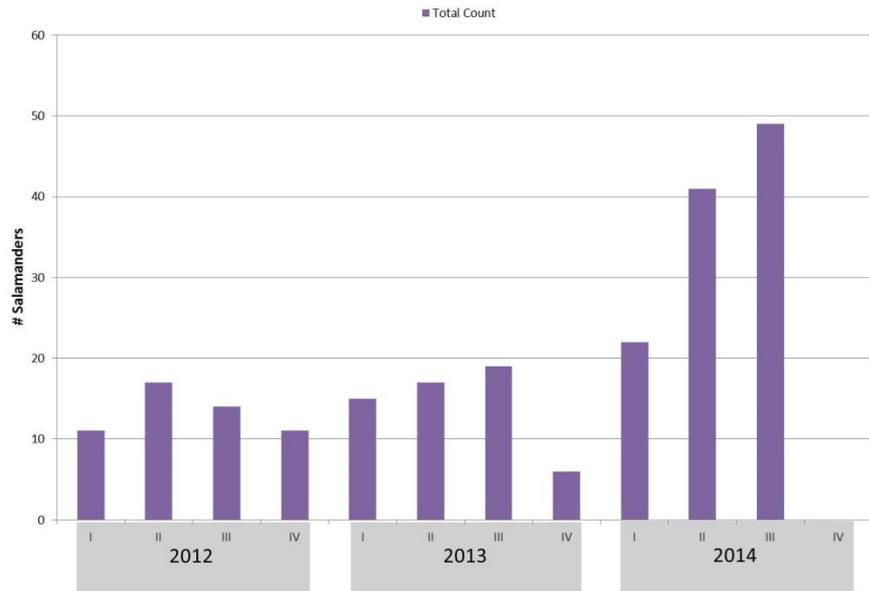


Bull Creek Trib 6, Site 151

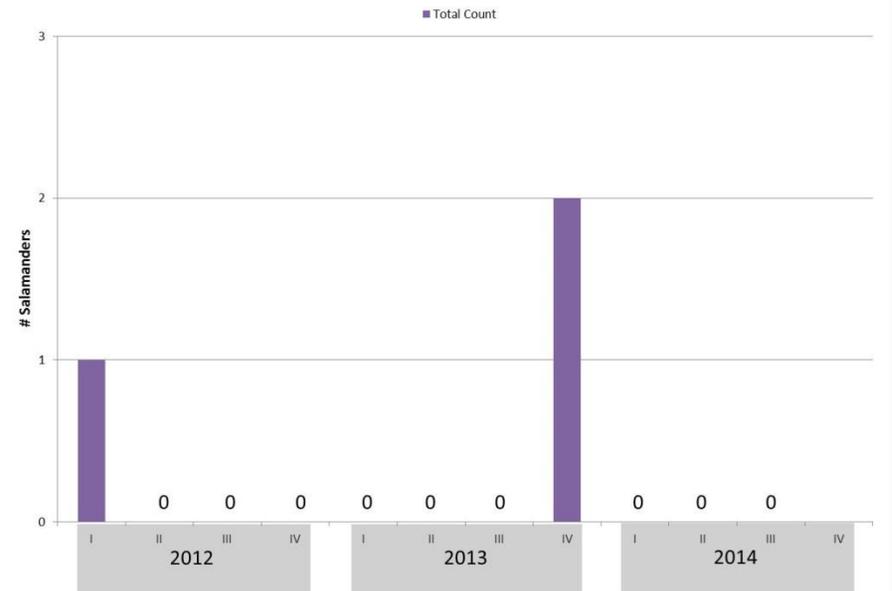




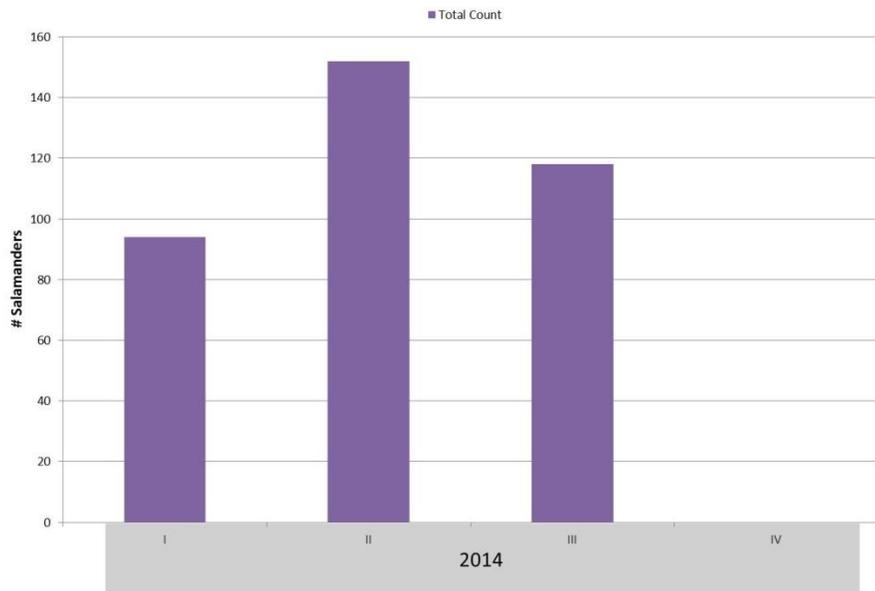
Troll Spring, Site 4457



Balcones District Park Spring, Site 445



Lower Ribelin Spring, Site 4035



Lanier Spring, Site 3963

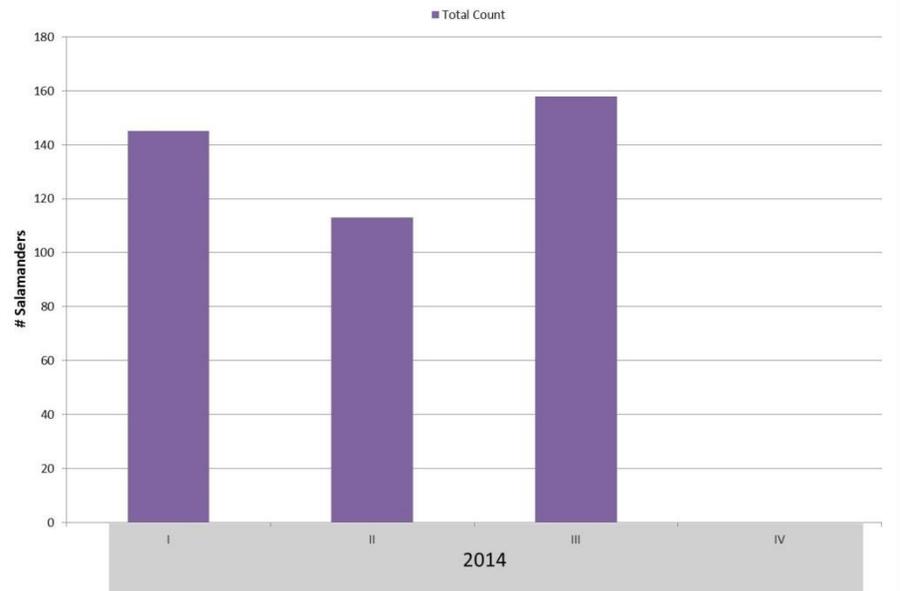


Table 1. Dates, times and man-hours of survey time for each site during 2014.

| 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 |

Below are the release tables for each site (Tables 2–11). 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.

Table 4: Troll Spring site 4457

| | 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 5: Trib 5 site 1164

| | 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 6: Lower Ribelin site 4035

| | 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 |

Occupancy Study (year 2)

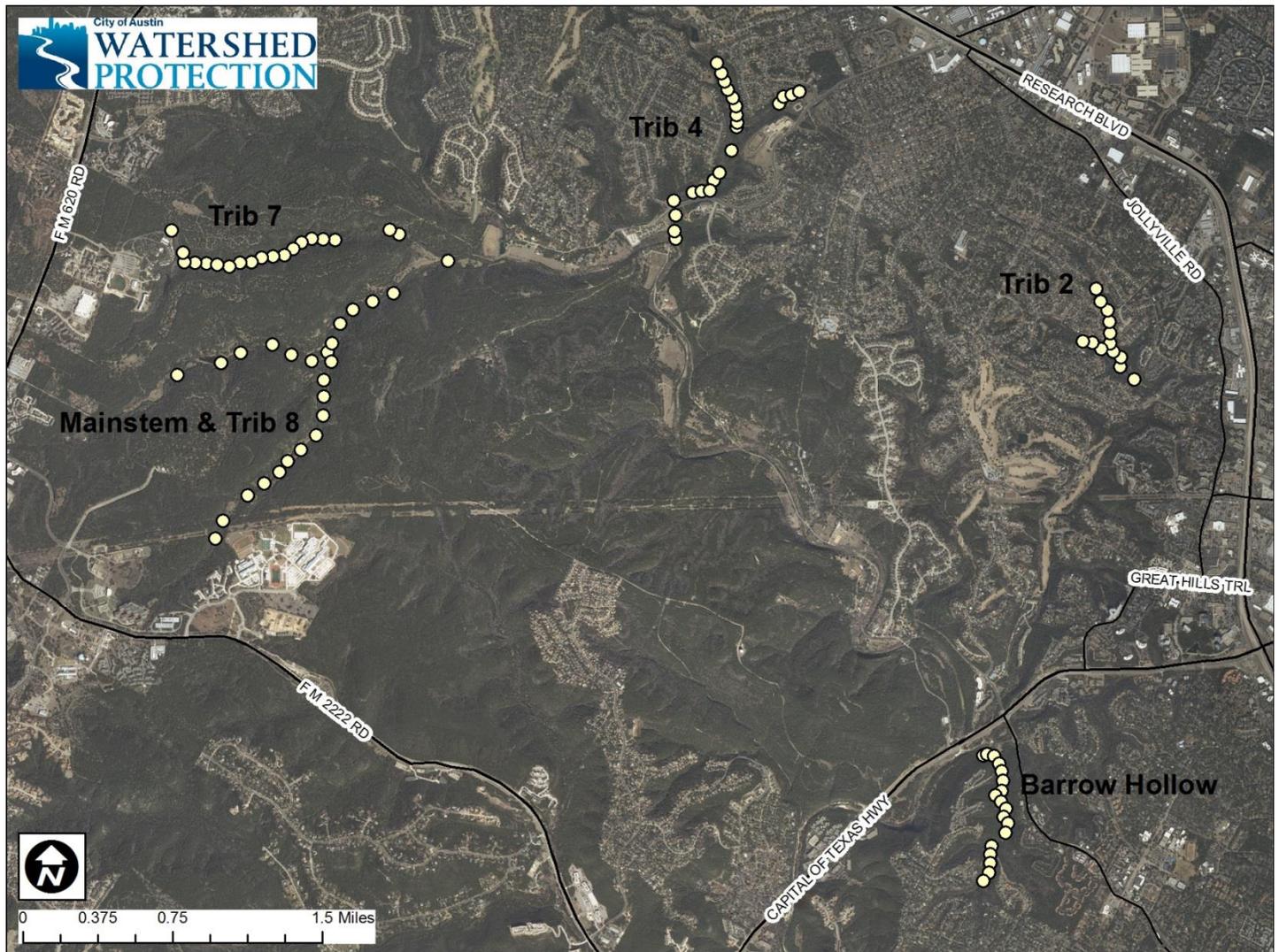


Figure 3. Map of occupancy monitoring sites in tributaries of Bull Creek, Travis County, Texas.

Summary of Methods

In the spring of 2014 we conducted occupancy monitoring on five tributaries of Bull Creek (Figure 3), which includes Barrow Hollow, Trib 7 (Concordia), Trib 4 (Spicewood Valley Park and Tanglewood Spring), Trib 2, and the mainstem/trib 8 (Franklin, Lanier, and Ribelin [Sam Hamilton East] tracts). Each reach is within either undisturbed (Mainstem/trib 8, Trib 7) or disturbed (Trib 4, Barrow, Trib 2) catchments, defined as having less than or greater than 10% impervious cover, respectively. Sites were defined by 10 m sections of linear stream and were selected using a systematic sampling method as follows: starting at a random position (0-100 steps) from the downstream end of each tributary (at the nearest major confluence), we set out to delimit 20 to 30 sites within each tributary, at a minimum distance of 70 m apart (measured as 90 steps). The Mainstem/trib 8 reach was almost twice the length of the other tributaries, so sampling intervals were doubled (180 steps) to keep site numbers relatively consistent between tributaries. Each site was flagged, numbered and GPS coordinates were recorded. Light brush removal along each stretch facilitated site access.

The survey design included repeated sampling ($k = 3$) at each site to account for imperfect detection. Sites were surveyed by N Bendik and B Sissel for 5 minutes during each visit. The choice of a timed survey was used to ensure that a similar amount of effort was expended to search each site, regardless of variation in site area and total available cover (partly due to differences in wetted width). Salamander presence (and approximate size to the nearest 25 mm) or absence was noted for each visit. Additionally, we recorded several environmental variables. During the first visit we recorded stream depth and velocity in three equally spaced locations at the center of flow within the creek (i.e., the primary path of flow or center of creek if flow was homogeneous) as well as wetted width (bank to bank, perpendicular to the flow direction). Presence of maiden hair ferns were noted, and the amount of calcium carbonate deposition was ranked on a scale from one (least) to three (most). At every site visit we also recorded water quality parameters using a Hydrolab minisonde (pH, temperature, dissolved oxygen, specific conductance) and visually estimated the percent area consisting of rock cover (gravel, cobble and boulders), algae or plant cover, and leaf litter or woody debris cover. Cover estimates were mutually exclusive, such that an area with algae and leaf cover could be on top of rock cover, and all would be included for their respective estimates (thus, they do not need to sum to 100%). Finally, since not all sites had flow during the study period, we recorded hydrologic condition for each site and noted any changes in flow. Many sites were dry despite wetter conditions compared to last. However, the typical hydrologic regimes of these streams are not well documented, so the high proportion of dry sites may be typical

Analysis

We used the R package ‘unmarked’ to construct models of occupancy rates and detection probability and used AIC-based model selection to draw inferences regarding the relative important of covariates on occupancy and detection. For additional details on covariate selection and occupancy models, please see [DR-14-01](#). Here, we present only preliminary results, repeating a similar analysis to last year. A more comprehensive analysis is forthcoming.

```
##2013

## 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

## 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
```

Note that temperature SD is still an important predictor of occupancy, while water depth no long appears to be as important, compared to 2013.

List of WRE QAPPs

Project 118: Jollyville Water Quality and Salamander Assessment

Project 545: Jollyville Salamander Occupancy Study

Project 547: Assessing Jollyville Plateau Salamander Stress in Urban and Rural streams

Collaborators and/or Field Assistants for 2014:

Population studies. **COA:** Blake Sissel, Mark Sanders, Jonny Scalise, Laurie Dries, Liza Colucci, Tom Devitt, Donelle Robinson, Dee Ann Chamberlain. **Travis County:** Renee Fields.

CORT study. **Texas State:** Megan Mondelli, Caitlin Gabor, Chelsea Blake, Diana Kim, Kristina Zabierek, Thomas Marshall, Kim Ort, Laura Alberici Da Bariano..

Toxicant study. **USFWS:** Pete Diaz and Eric Orsak. **USGS:** David Alvarez.