



Reptile & Amphibian Monitoring at San Antonio Missions National Historical Park

Data Summary, Monitoring Year 2012

Natural Resource Data Series NPS/GULN/NRDS—2013/559



ON THE COVER

Great Plains Rat Snake, *Elaphe guttata emoryi*, at the San Antonio Missions NHP Rancho de las Cabras unit, 2011
Photograph by: RL Woodman, Gulf Coast Inventory and Monitoring Network

Reptile & Amphibian Monitoring at San Antonio Missions National Historical Park

Data Summary, Monitoring Year 2012

Natural Resource Data Series NPS/GULN/NRDS—2013/559

Robert L. Woodman

National Park Service
Gulf Coast I&M Network
646 Cajundome Blvd
Lafayette, LA 70506

September 2013

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available from the Natural Resource Publications Management website (<http://www.nature.nps.gov/publications/nrpm/>). To receive this report in a format optimized for screen readers, please email irma@nps.gov.

Please cite this publication as:

Woodman, R. L. 2013. Reptile & amphibian monitoring at San Antonio Missions National Historical Park: Data summary, monitoring year 2012. Natural Resource Data Series NPS/GULN/NRDS—2013/559. National Park Service, Fort Collins, Colorado.

Contents

	Page
Figures.....	iv
Tables.....	v
Appendices.....	v
Acknowledgments.....	vi
Introduction.....	1
Methods.....	4
Sampling Design	4
Sampling and Data Collection.....	7
Monitoring Schedule	7
Data Management.....	8
Results.....	9
SAAN MS Sites:.....	9
Numbers of amphibian and reptile species observed at MS in MY2012:	10
The accumulation of species detections over time at MS:	11
SAAN RS Sites:	13
Numbers of amphibian and reptile species observed at RS sites in MY2012:.....	14
The accumulation of species detections over time at RS sites:	16
Air temperature and percent-relative humidity recorded at RS during MY2012:.....	17
Discussion	19
Literature Cited	21

Figures

	Page
Figure 1. Map of portions of Bexar and Wilson Counties, Texas showing the locations of SAAN Missions (Inset 1) and Rancho de las Cabras (Inset 2) units.	2
Figure 2. Map of the MS unit and project sampling areas. The five smaller frames depict the mapped locations of CB panels and PVC pipe-pairs in the 6 MS sampling arrays, E1, E2, C, D, and F1 and F2.....	5
Figure 3: Map of the RS unit and project sampling arrays. The four smaller frames depict the CB and PVC sampler distributions in RS arrays A1, A2, B1, and B2.....	6
Figure 4: Total count of amphibians and reptiles observed at MS over all methods by sampling event in MY2012.....	10
Figure 5: Numbers of amphibian and reptile species observed in each MS sampling event in MY2012.	11
Figure 6: Cumulative count of amphibian, reptile, and all herps species observed at MS sites over MY2012.	12
Figure 7: Total count of amphibians and reptiles observed at RS sites over all methods by sampling event in MY2012.	14
Figure 8: Numbers of amphibian and reptile species observed in each RS sampling event in MY2012.	15
Figure 9: Cumulative count of amphibian, reptile, and all herps species observed at RS sites over MY2012.	16
Figure 10. Daily average air temperature and percent-relative humidity recorded at the RS forest area (PVC Array A1) from SEP 05 2011 through SEP 15 2012.	18

Tables

	Page
Table 1: MS Amphibians:	9
Table 2. MS reptiles:	9
Table 3: Number of amphibian species seen at MS in MY2012.	10
Table 4: Number of reptile species seen at MS in MY2012.	11
Table 5: Cumulative species counts for amphibians, reptiles, and all herp species detected at MS sites over MY2012..	12
Table 6: Amphibian and Reptile species observed at MS in MY2012.	13
Table 7: RS Amphibians:	13
Table 8: RS Reptiles:	14
Table 9: Number of amphibian species seen at RS sites in MY2012.	15
Table 10: Number of reptile species seen at RS sites in MY2012.	15
Table 11: Cumulative species counts for amphibians, reptiles, and all herp species at RS sites over MY2012.	16
Table 12: Amphibian and Reptile species observed at RS sites in MY2012.	17

Appendices

	Page
Appendix A.....	23

Acknowledgments

We thank Kurt Buhlmann, University of Georgia – Savannah River Ecological Laboratory, for his assistance in development of methods leading to this park project and creation of the Gulf Coast Reptile and Amphibian Monitoring Protocol. Implementation of this monitoring project would not have been possible without the help of the park staff. Special thanks to Greg Mitchell, Natural Resources Program Manager at San Antonio Missions National Historical Park, for his support during development and implementation of this effort. Field sampling was performed by GULN and SAAN staff and under contract with Atkins North America, Inc.

Introduction

The Gulf Coast Inventory and Monitoring Network (GULN) of the National Park Service started implementation of its reptile and amphibian monitoring protocol (GRAMP) on the Missions (MS) and Rancho de las Cabras (RS) units of San Antonio Missions National Historical Park (SAAN) in April of 2011. The GRAMP is a protocol developed by GULN in collaboration with Kurt Buhlmann, of the University of Georgia – Savannah River Ecological Laboratory, to provide basic herpetological assemblage monitoring at selected sites on network parks based on peer-reviewed and widely used standard sampling methods supported by a unified data management and analysis system (Woodman, et al, 2013, in review). This annual report summarizes data collected at MS and RS sampling sites in Monitoring Year (MY) 2012, and includes a summary of the GRAMP, extracts of data collected, and lists of amphibians and reptiles, with count by species, detected in each site in MY2012. The complete MS and RS data tables for MY2012 are provided in Appendix A.

The GULN is located in portions of six states, spanning from Brownsville, Texas, to Pensacola, Florida, and north to Nashville, Tennessee, with main offices located in Lafayette, Louisiana. The network includes eight National Park Service (NPS) units: Big Thicket National Preserve (BITH), Gulf Islands National Seashore (GUIS), Jean Lafitte National Historical Park and Preserve (JELA), Natchez Trace Parkway (NATR), Palo Alto Battlefield National Historical Park (PAAL), Padre Island National Seashore (PAIS), San Antonio Missions National Historical Park (SAAN), and Vicksburg National Military Park (VICK). The network is currently (2013) implementing the GRAMP on six parks (GUIS, JELA, NATR, PAAL, SAAN, and VICK), and is developing park projects on BITH and PAIS for anticipated start-up in FY2014.

SAAN is a largely urban historical park commemorating the Spanish colonial missions of the upper San Antonio River Valley in the vicinity of San Antonio, Texas (Figure 1). The park consists of two major units; “The Missions” (MS, for this project) comprises approximately 725 acres of land and historic mission structures located along the banks of the San Antonio River in the southern portion of metropolitan San Antonio, Bexar County, Texas. The Missions lie within an urban area and experiences the impacts associated with high human population size and density such as residential and industrial land conversion. The Missions unit includes several small parcels of successional riparian bank habitat being managed as natural resource areas on the park. The other unit is the 99 acre Rancho de las Cabras (RS, for this project) located on the San Antonio River approximately 10 miles west-southwest of Floresville, Wilson County, Texas. The Rancho consists of successional “old field” habitats ranging from grass and scrubland to the mixed hardwood forest at the river’s edge. Current park management plans include restoring portions of the Rancho to its historic Spanish colonial era agricultural vegetation, and allowing other portions to transition to grass, scrub and forested vegetation once typical of the south Texas plains. The Rancho is surrounded by agricultural land and potentially experiences over-spray and drift of fertilizers and pesticides applied to fields and frequent incursion by feral animals.

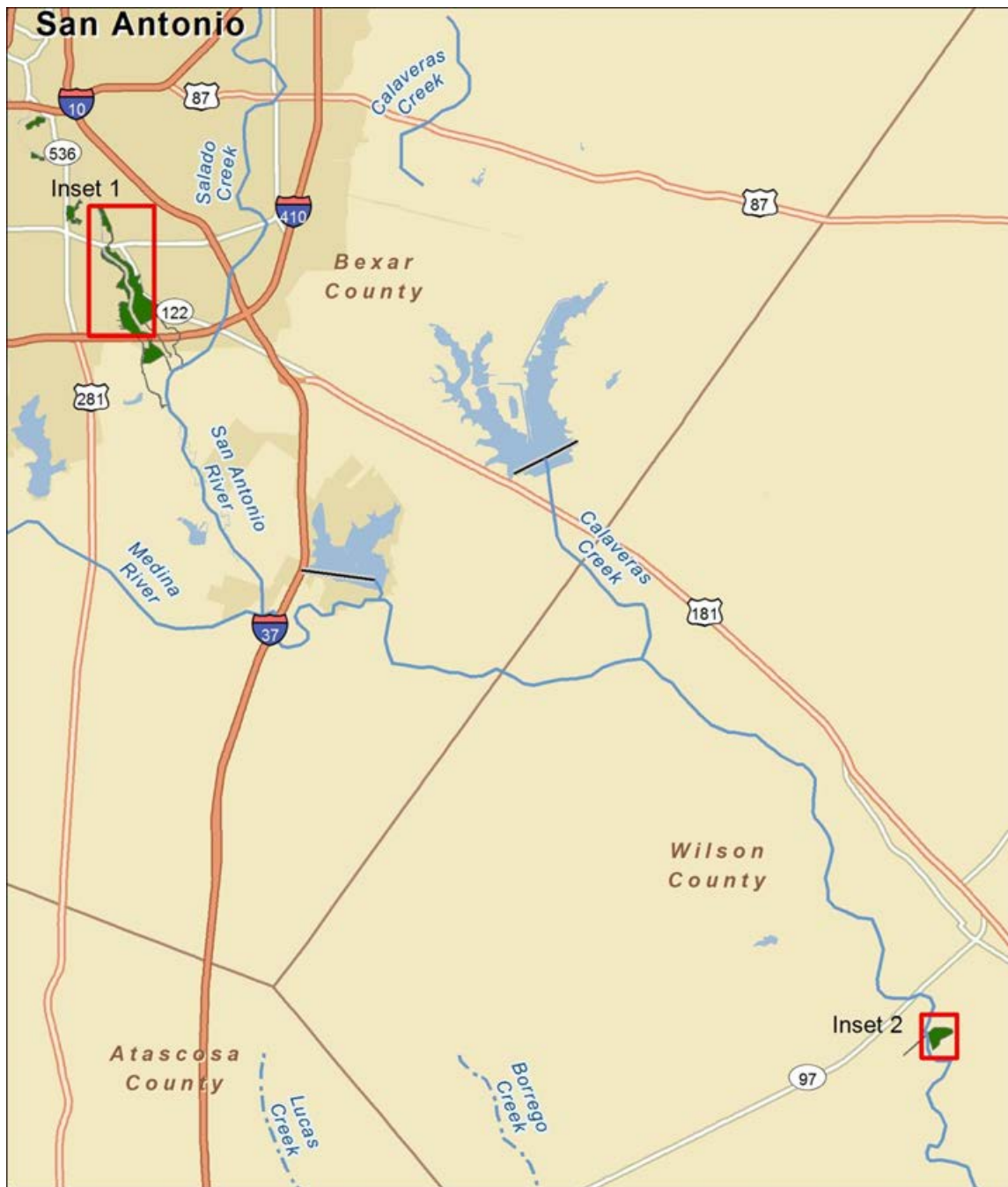


Figure 1. Map of portions of Bexar and Wilson Counties, Texas showing the locations of SAAN Missions (Inset 1) and Rancho de las Cabras (Inset 2) units.

Amphibians were identified as a network high priority vital sign during initial vital sign selection performed in 2004. Amphibians were combined with reptiles when the GULN Monitoring Plan (Segura et al, 2007) was finalized, as it was broadly accepted that sampling for many amphibians is equally effective for coexisting reptiles. Amphibians and reptiles (herps) are ranked highly among potential vital signs for GULN because herps 1) are a diverse fauna associated with many habitats on all GULN parks, 2) specific species come under legal mandates related to state – level protected

status, and 3), herps constitute a diverse set of potential indicators of local and regional changes in ecosystems, due to their widely-demonstrated sensitivities to many anthropogenic system inputs and actions (pollutants and habitat disruption and fragmentation). In addition, herps have collectively become the subject of ever-growing conservationist and resource-management concern given the increasing recognition of their widespread decline at scales ranging from the local to global.

This monitoring project addresses terrestrial and arboreal herp assemblages in MS and RS sites. These sites were selected for monitoring based on a combination of patch size, site access for sampling crew, site security, desire to distribute monitoring effort into multiple regions and ecosystems on the park, and consideration of park management interests. The MS sites address resource conditions on federally-protected areas which can serve as local faunal refugia in this heavily impacted urban environment. The RS sites assess fauna associated with the Rancho de las Cabras. Faunal monitoring will inform the park about changes which may occur as the unit undergoes continued succession from its historic agricultural habitat.

SAAN has expressed specific management interest in two reptile species, Texas Horned Lizard (*Phrynosoma cornutum*) and Texas Tortoise (*Gopherus berlandieri*). Both of these species are listed by the state of Texas as being threatened and are protected under state law. Both species were confirmed as being present on the park in the Duran, 2004, herp inventory, but neither has been directly observed by SAAN or GULN staff since circa 2007. An additional inventory project performed by Texas A&M University for SAAN in 2010 to specifically assess presence of Texas Tortoise and Texas Horned Lizard on the park failed to detect either species (Dittmer and Fitzgerald, 2011). While this monitoring project does not target either species, both could be encountered in sampling areas, and repeated crew visits to designated sites may offer a high probability of detecting these animals if they are present in these locations. Monitoring herps on SAAN will contribute to both park-level resource knowledge and improved management, and provide insight into habitat and ecosystem change. Monitoring is designed to provide data comparable to that obtained by other research and inventory efforts and will potentially contribute to regional and national databases that further our understanding of population and community trends at many scales.

This annual report provides an overview of methodology and implementation of monthly sampling across the monitoring year. Results presented here are limited to descriptive summaries of the annual findings and data about observed species and abundance presented at a monthly sampling scale. Additional analyses and synthesis reports will be completed every 4 – 5 years beginning in 2015, to include assessment of potential trends in species-count, changes in relative abundance, and changes in measurable assemblage composition and structure. Faunal trends will be evaluated in the context of recorded environmental data and with consideration of noted events, such as rainfall and significant anthropogenic and other impacts to local resources.

Methods

Sampling Design

Herp monitoring at MS and RS sites utilizes terrestrial cover-board (CB) and arboreal PVC-pipe (PVC) fixed-point sampling methods coupled with environmental conditional monitoring. The MS area is sampled using six CB arrays (clusters) located in wooded areas distributed along the banks of the San Antonio River (Figure 2). Arrays E1 and E2 sample the wooded river bank and adjacent successional “old field” habitat of the historic Mission San Juan dam area, Arrays C and D sample the Mission San Juan nature trail and wooded river bank habitat, and Arrays F1 and F2 sample the successional riparian woodland located adjacent to the west bank of the San Antonio River across from Mission San Juan. PVC clusters are collocated with CB arrays D and F1 and F2 to simultaneously assess terrestrial and arboreal species within the selected sampling space (Figure 2). The RS area is sampled using four linear CB arrays distributed in the upland “old field” successional areas and the upper wooded bank habitat (Figure 3). One PVC cluster is collocated with CB array A1 in the upper riparian forest area.

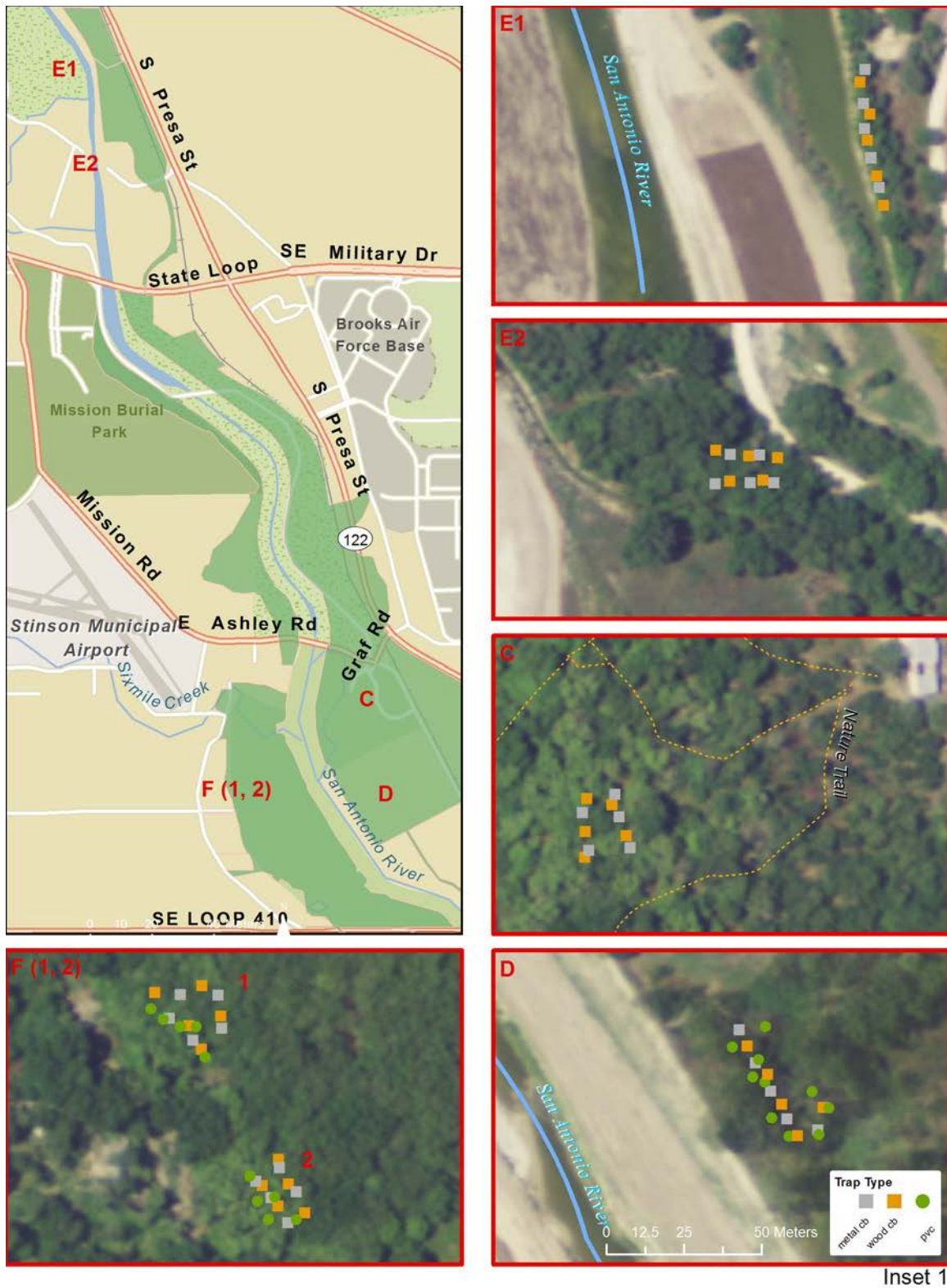


Figure 2. Map of the MS unit and project sampling areas. The five smaller frames depict the mapped locations of CB panels and PVC pipe-pairs in the 6 MS sampling arrays, E1, E2, C, D, and F1 and F2.

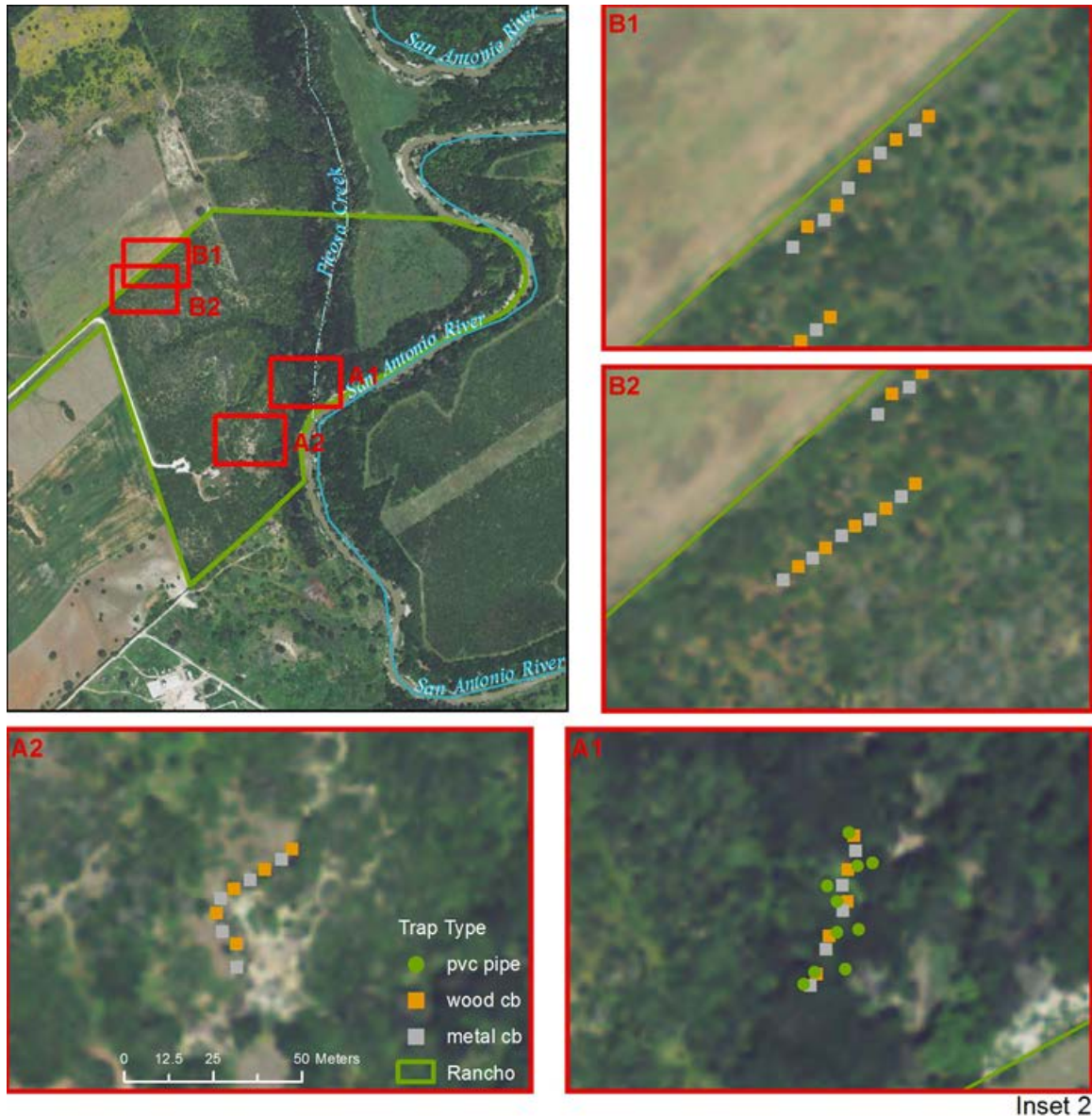


Figure 3: Map of the RS unit and project sampling arrays. The four smaller frames depict the CB and PVC sampler distributions in RS arrays A1, A2, B1, and B2.

The spatial distribution of CB and PVC constitute fixed multiple-array sampling designs in each sampling area, where each array is statistically independent of and does not share possible specimens with any other. Initial locations of each linear CB and PVC array start-point were selected by randomizing from among five available possible start-points in each area, followed by placing CB panels at about 5m spacing in a line extending along the prevailing ground feature in the site. Each CB array consists of 10 permanently-sited 3 x 4 foot panels (five roofing tin, and five $\frac{3}{4}$ inch plywood). Each collocated PVC cluster consists of ten pairs of PVC pipes attached to trees located within the CB Array area. Each PVC pair consists of one 1 inch x 2 foot pipe and one 2 inch x 2 foot pipe. Note that the PVC cluster collocated with MS CB arrays F1 and 2 is split between the two 10 – panel CB arrays located at that site (Figure 2). Individual device locations are determined by natural

microhabitat and site availability (spaces suitable for CB panels, trees large enough to host pipe pairs). All CB and PVC locations are mapped onto the project GIS layers and database using GPS location data. No baits, lures, added food or chemical attractants are used in any sampling at SAAN sites.

Total MS sampling effort consists of six CB clusters (a total of 60 panels) and two PVC clusters (a total of 20 pipe-pairs). Total RS sampling effort consists of four CB clusters (a total of 40 panels) and one PVC cluster (a total of 10 pipe pairs).

In addition to CB and PVC sampling, field crew record all individuals seen outside of sampling devices during sampling activities. These encounters are logged as “casual observations” (Cas. Obs.) and contribute to composite data on species-richness and species-specific population descriptive parameters, such as mean size and sex-ratio estimation in the population, but are not considered in analyses utilizing device as a factor.

One data logger (HoBo pro V2, by Onset, Inc.) is deployed at the PVC cluster collocated with CB cluster A1 on the RS unit to provide long-term air temperature and relative humidity monitoring at 10-minute intervals throughout the monitoring year.

Sampling and Data Collection

Sampling emphasizes consistent collection of detailed, high-quality data on all encountered specimens to provide a reliable database for assessing assemblage composition and structure. CB, PVC, and Casual Observations all yield hand-specimens and photographic records.

All field crew are led by experienced field biologists with detailed familiarity with the taxonomy of regional herpetofauna. Performance of sampling events follows the methodology and procedures prescribed for each sampling method in GRAMP protocol SOP (Woodman, et al 2013, in review). All specimens are hand collected where possible for detailed assessment. Data include location, time, species ID (when possible), body length and sex (when possible), and count, when multiple individuals of a type are observed but not all are handled and assessed.

Specimen information is recorded on field data sheets during sampling. Photographs are taken of collected specimens to support post-sampling taxonomic ID review. Specimens are handled with appropriate prophylaxis and technique as adapted from the ASIH Guidelines (Beaupre 2004) and specified in the GRAMP. All collected specimens are immediately released following processing at the collection point or site. Non-collected individuals (venomous snakes are never handled, other individuals may escape or avoid capture) are photo-documented during sampling procedures, and images provide confirmation of “no-catch” encounters for data records.

Monitoring Schedule

SAAN MS and RS sites are sampled every month over each Monitoring Year (MY, defined as being from October 01 to September 30), for a total of 12 monthly sampling visits per MY. Each two-day sampling visit consists of 1 work day at each sampling area (MS and RS): MS sites are sampled on

Day 1, RS sites on Day 2. The team sequentially samples CB and PVC clusters within each area starting with a safety briefing at circa 0730 and typically completing CB and PVC sampling by 1200. The array sampling order is held constant over all visits to avoid random variation in yield which could result from time of day effects. All CB and PVC sampling are completed as early in a day as possible so as to reduce impacts on yield from increasing air and ground temperatures.

Data Management

Data are recorded in the field on standard GULN paper field data sheets. Field crew submits completed data sheets to the GULN Data Manager and the GULN GRAMP Project Leader for review and verification of taxonomic information. All data are entered into the GRAMP database following procedures specified in SOP 5 Data Entry of the GRAMP protocol (Woodman, et al, 2013, in review). Project data are managed following procedures and standards specified in the GULN Data Management Plan (Granger, 2007). Data are extracted from this database for analysis and reporting. The complete MY2012 faunal data are provided in Appendix A of this report. These data are also made available by going to the GULN Amphibian & Reptile Monitoring Project in the NPS Integrated Resource Management Applications (IRMA) portal at: <https://irma.nps.gov/App/Reference/Profile/2192506>.

Results

The complete MS and RS Project datasets are provided in Appendix A of this report. The Project Data Tables list observation date, sampling location, sampling method, common and scientific name, and body length and sex (if determined) for each individual recorded. Key aspects of this dataset are summarized in the following tables and graphs by sampling site. All summary data are presented in a per-sampling-event format with cumulative totals for the MY where appropriate.

SAAN MS Sites:

Sampling at MS sites yielded a total of 188 individual observations (142 amphibians, 42 reptiles) representing 12 species (4 amphibians, 8 reptiles) from all methods in MY2012. The most abundant amphibians were Coastal Plain Toad (*Incilius nebulifer*, 70) and Rio Grande Chirping Frog (*Eleutherodactylus cystignathoides*, 68) accounting for 97% of all amphibians observed. Two species, Mediterranean Gecko (*Hemidactylus turcicus*, 16), and Ground Skink (*Scincella lateralis*, 16), accounted for 76% of reptiles observed.

Tables 1 and 2 present the summary counts of individual amphibians and reptiles, respectively, observed by sampling method (CB = cover-boards, PVC = PVC-pipes, Cas Obs = Casual Observations) by sampling month at MS in MY2012.

Table 1: MS Amphibians:

Sampling Method	OCT 2011	NOV 2011	DEC 2011	JAN 2012	FEB 2012	MAR 2012	APR 2012	MAY 2012	JUN 2012	JUL 2012	AUG 2012	SEP 2012	Total By Method
CB	1	2	2	8	1	3	8	20	13	35	15	10	118
PVC	0	0	0	0	0	0	0	0	0	0	0	0	0
Cas Obs	0	0	0	0	0	0	12	2	0	7	1	2	24
Total n by Event	1	2	2	8	1	3	20	22	13	42	16	12	142

Table 2. MS reptiles:

Sampling Method	OCT 2011	NOV 2011	DEC 2011	JAN 2012	FEB 2012	MAR 2012	APR 2012	MAY 2012	JUN 2012	JUL 2012	AUG 2012	SEP 2012	Total By Method
CB	2	0	1	1	5	3	3	2	3	2	6	4	32
PVC	0	2	0	1	1	0	0	0	0	0	0	0	4
Cas Obs	1	0	0	0	0	0	1	2	0	0	2	0	6
Total n by Event	3	2	1	2	6	3	4	4	3	2	8	4	42

The total numbers of individual reptiles and amphibians observed at MS across all methods varied among sampling events, with amphibians showing substantially greater abundance than did reptiles in 7 of 12 events, and greater abundance later in the MY (Figure 4).

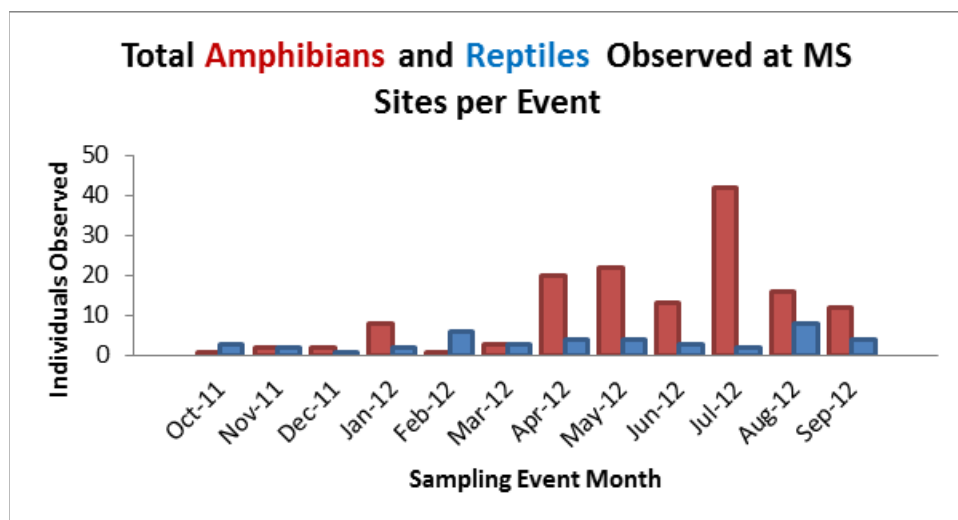


Figure 4: Total count of amphibians and reptiles observed at MS over all methods by sampling event in MY2012.

Numbers of amphibian and reptile species observed at MS in MY2012:

Tables 3 and 4 present the counts of amphibian and reptile species, respectively, observed by sampling method (CB = cover-boards, PVC = PVC-pipes, Cas Obs = Casual Observations) by sampling month at MS sites in MY2012. The total column presents the counts of all species of the class observed by method over the year. The yellow block reports the sum of all species of the class for all methods for the year.

Table 3: Number of amphibian species seen at MS in MY2012.

Sampling Method	OCT 2011	NOV 2011	DEC 2011	JAN 2012	FEB 2012	MAR 2012	APR 2012	MAY 2012	JUN 2012	JUL 2012	AUG 2012	SEP 2012	Total Spp.
CB	1	1	2	2	1	2	2	2	2	2	2	2	2
PVC	0	0	0	0	0	0	0	0	0	0	0	0	0
Cas Obs	0	0	0	0	0	0	1	1	0	2	1	1	3
Total species by Event	1	1	2	2	1	2	2	3	2	3	3	2	4

Table 4: Number of reptile species seen at MS in MY2012.

Sampling Method	OCT 2011	NOV 2011	DEC 2011	JAN 2012	FEB 2012	MAR 2012	APR 2012	MAY 2012	JUN 2012	JUL 2012	AUG 2012	SEP 2012	Total Spp.
CB	1	0	1	1	2	1	2	2	2	1	2	1	4
PVC	0	1	0	1	1	0	0	0	0	0	0	0	1
Cas Obs	1	0	0	0	0	0	1	2	0	0	1	0	4
Total species by Event	1	1	1	2	3	1	2	2	2	1	2	1	8

MS sampling yielded only small numbers of species in any event during MY2012, with no event yielding more than 4 species in either class (Figure 5).

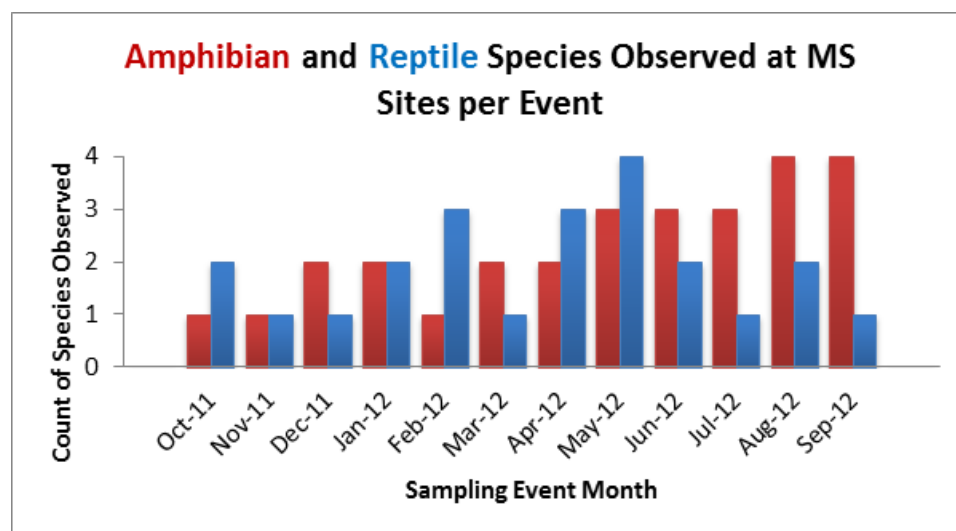


Figure 5: Numbers of amphibian and reptile species observed in each MS sampling event in MY2012.

The accumulation of species detections over time at MS:

Amphibian species accumulation at MS continued through July of 2012, while reptile species accumulation plateaued as of May, 2012 (Table 5, and visualized in Figure 6). These results suggest that most of the herp species likely to be detected by our sampling methods in the MS area have been detected by the end of MY2012, and that few additional species are likely to be added in the near future.

Table 5: Cumulative species counts for amphibians, reptiles, and “all herps” species detected at MS sites over MY2012. The highlighted counts in the SEP 2012 column are the cumulative totals for the MY.

Taxon Group	OCT 2011	NOV 2011	DEC 2011	JAN 2012	FEB 2012	MAR 2012	APR 2012	MAY 2012	JUN 2012	JUL 2012	AUG 2012	SEP 2012
Amphibians	1	1	2	2	2	2	2	3	3	3	4	4
Reptiles	2	3	3	3	4	4	6	8	8	8	8	8
Cum of all Herp Species	3	4	5	5	6	6	8	11	11	11	12	12

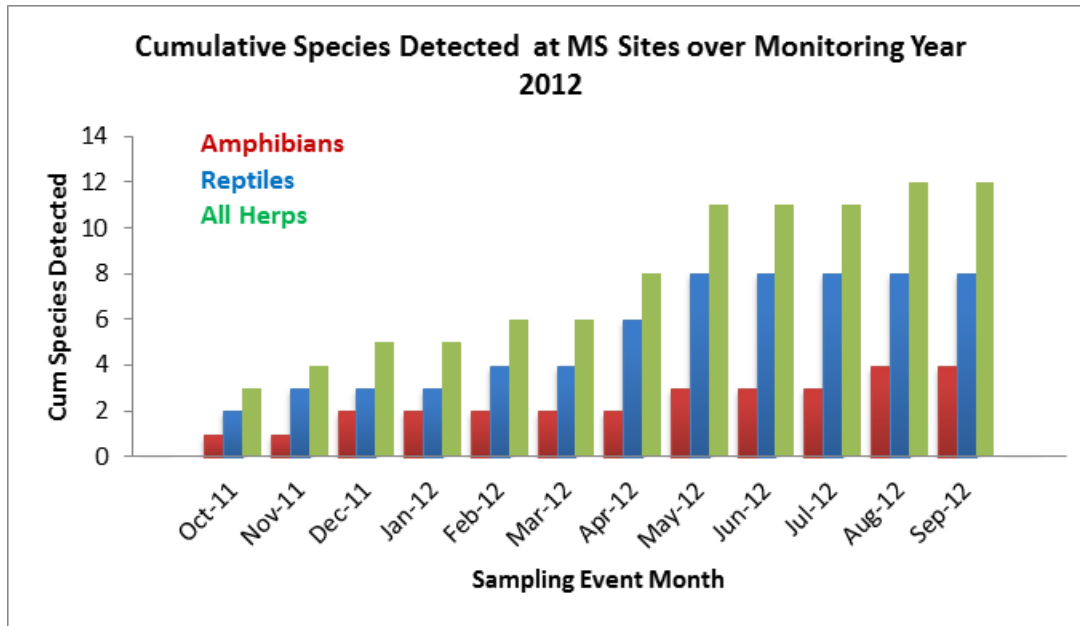


Figure 6: Cumulative count of amphibian, reptile, and all herps species observed at MS sites over MY2012.

The amphibian and reptile species detected at MS in MY2012 sampling are listed in Table 6, below.

Table 6: Amphibian and Reptile species observed at MS in MY2012.

Amphibians			Reptiles		
Scientific Name:	Common Name:		Scientific Name:	Common Name:	
<i>Eleutherodactylus cystignathoides</i>	Rio Grande Chirping Frog	68	<i>Anolis carolinensis</i>	Green Anole	4
<i>Hyla cinerea</i>	Green Tree Frog	3	<i>Hemidactylus turcicus</i>	Mediterranean Gecko	16
<i>Incilius nebulifer</i>	Great Plains Toad	70	<i>Masticophis schotti</i>	Ruthven's Whipsnake	2
<i>Lithobates sphenoccephalus</i>	Southern Leopard Frog	1	<i>Micrurus fulvius</i>	Texas Coral Snake	1
			<i>Nerodia erythrogaster</i>	Blotched Water Snake	1
			<i>Pseudemys concinna</i>	Texas River Cooter	1
			<i>Sceloporus olivaceus</i>	Texas Spiny Lizard	1
			<i>Scincella lateralis</i>	Ground Skink	16

SAAN RS Sites:

Sampling at RS sites yielded a total of 57 individual observations (24 amphibians, 33 reptiles) representing 15 species (5 amphibians, 10 reptiles) from all methods in MY2012. The most abundant amphibian was the Great Plains Narrow-mouth Toad (*Gastrophryne olivacea*, 18), accounting for 75% of all amphibians observed. The most abundant reptile was the Ground Skink (*Scincella lateralis*, 12), accounting for 36% of reptiles observed.

Tables 7 and 8 present the summary counts of individual amphibians and reptiles, respectively, observed by sampling method (CB = cover-boards, PVC = PVC-pipes, Cas Obs = Casual Observations) by sampling month at RS sites in MY2012.

Table 7: RS Amphibians:

Sampling Method	OCT 2011	NOV 2011	DEC 2011	JAN 2012	FEB 2012	MAR 2012	APR 2012	MAY 2012	JUN 2012	JUL 2012	AUG 2012	SEP 2012	Total By Method
CB	0	0	0	0	0	1	0	15	0	2	0	0	18
PVC	0	0	0	0	1	0	0	0	0	0	1	0	2
Cas Obs	0	0	0	0	0	0	0	1	0	3	0	0	4
Total n by Event	0	0	0	0	1	1	0	16	0	5	1	0	24

Table 8: RS Reptiles:

Sampling Method	OCT 2011	NOV 2011	DEC 2011	JAN 2012	FEB 2012	MAR 2012	APR 2012	MAY 2012	JUN 2012	JUL 2012	AUG 2012	SEP 2012	Total By Method
CB	6	1	2	6	6	4	3	1	0	3	0	0	32
PVC	0	0	0	0	0	0	0	0	0	0	0	0	0
Cas Obs	0	0	0	0	0	0	0	0	0	0	1	0	1
Total n by Event	6	1	2	6	7	4	3	1	0	3	1	0	33

The total numbers of individual reptiles and amphibians observed at RS sites across all methods varied among sampling events across the MY (Figure 7).

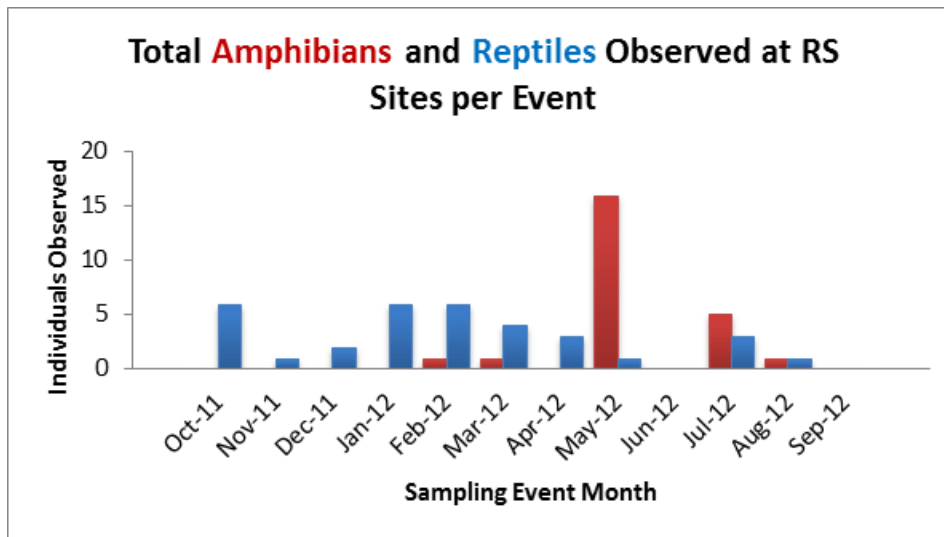


Figure 7: Total count of amphibians and reptiles observed at RS sites over all methods by sampling event in MY2012. The notable larger amphibian abundance in the May, 2012 sample indicates a distinct, localized cluster of Great Plains Narrow-mouth Toad (*G. olivacea*) observed under two CB panels in CB cluster B1.

Numbers of amphibian and reptile species observed at RS sites in MY2012:

Tables 9 and 10 present the counts of amphibian and reptile species, respectively, observed by sampling method (CB = cover-boards, PVC = PVC-pipes, Cas Obs = Casual Observations) by sampling month at RS sites in MY2012. It should be noted that one species, the Ground Skink (*S. lateralis*), was observed in both CB and Cas. Obs. sampling. The total column presents the counts of all species of the class observed by method over the year. The yellow block reports the sum of all species of the class for all methods for the MY.

Table 9: Number of amphibian species seen at RS sites in MY2012.

Sampling Method	OCT 2011	NOV 2011	DEC 2011	JAN 2012	FEB 2012	MAR 2012	APR 2012	MAY 2012	JUN 2012	JUL 2012	AUG 2012	SEP 2012	Total Spp.
CB	0	0	0	0	0	1	0	1	0	1	0	0	1
PVC	0	0	0	0	1	0	0	0	0	0	1	0	2
Cas Obs	0	0	0	0	0	0	0	1	0	2	0	0	2
Total species by Event	0	0	0	0	1	1	0	2	0	3	1	0	5

Table 10: Number of reptile species seen at RS sites in MY2012.

Sampling Method	OCT 2011	NOV 2011	DEC 2011	JAN 2012	FEB 2012	MAR 2012	APR 2012	MAY 2012	JUN 2012	JUL 2012	AUG 2012	SEP 2012	Total Spp.
CB	4	1	1	2	3	3	3	1	1	2	0	0	10
PVC	0	0	0	0	0	0	0	0	0	0	0	0	0
Cas Obs	0	0	0	0	0	0	0	0	0	0	1	0	1
Total species by Event	4	1	1	2	3	3	3	1	1	2	1	0	10

The numbers of amphibian and reptile species observed at RS sites both varied by event over MY2012, and only few species (≤ 4) herp species occurred in either class in any event (Figure 8).

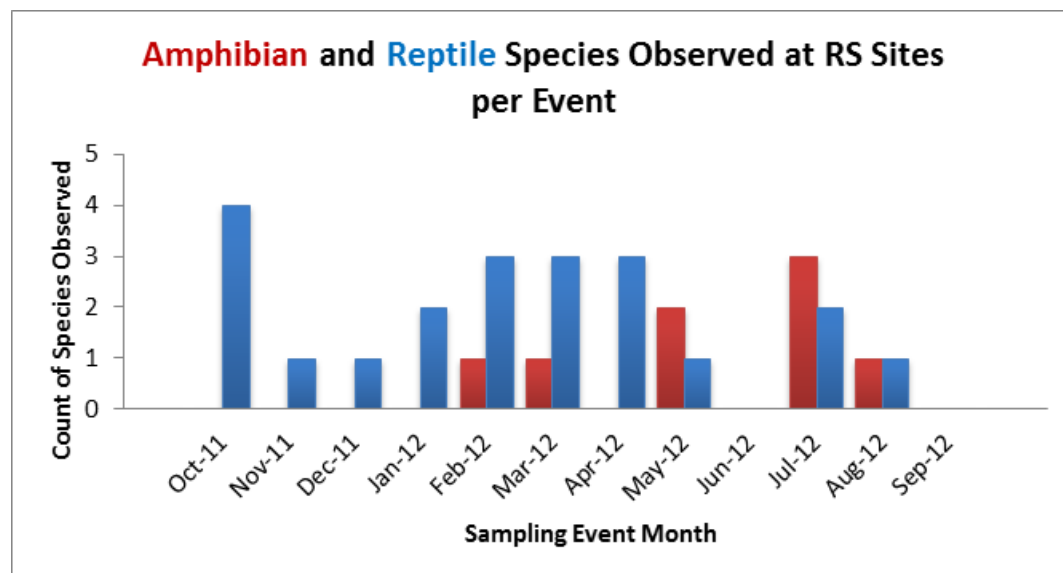


Figure 8: Numbers of amphibian and reptile species observed in each RS sampling event in MY2012.

The accumulation of species detections over time at RS sites:

Species accumulation at RS plateaued for both amphibians and reptiles in the last quarter of MY2012 (Table 11, and visualized in Figure 9). These results suggest that most of the herp species likely to be detected by our sampling methods in the RS area have been detected by the end of MY2012, given the current severe drought conditions prevailing for several years in the central Texas region.

Table 11: Cumulative species counts for amphibians, reptiles, and all herp species at RS sites over MY2012. The highlighted counts in the SEP 2012 event are the cumulative totals for the MY.

Taxon Group	OCT 2011	NOV 2011	DEC 2011	JAN 2012	FEB 2012	MAR 2012	APR 2012	MAY 2012	JUN 2012	JUL 2012	AUG 2012	SEP 2012
Amphibians	0	0	0	0	1	2	2	3	4	4	5	5
Reptiles	4	4	4	5	5	6	7	8	8	10	10	10
Cum of all Herp Species	4	4	4	5	6	8	9	11	12	14	15	15

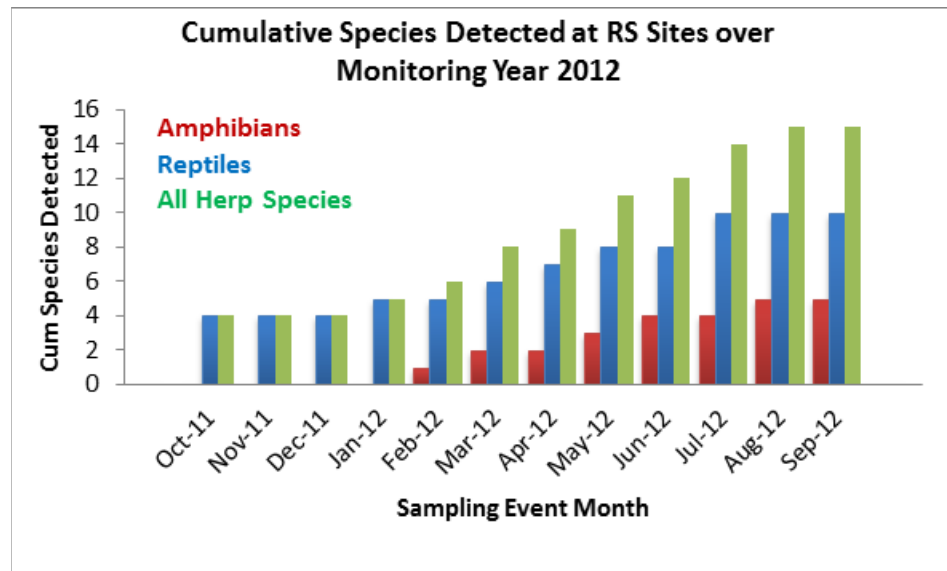


Figure 9: Cumulative count of amphibian, reptile, and “all herps” species observed at RS sites over MY2012.

The amphibian and reptile species detected at RS sites in MY2012 sampling are listed in Table 12 below.

Table 12: Amphibian and Reptile species observed at RS sites in MY2012.

Amphibians			Reptiles		
Scientific Name:	Common Name:		Scientific Name:	Common Name:	
<i>Gastrophryne olivacea</i>	Great Plains Narrow-mouth Toad	18	<i>Cnemidophorus gularis</i>	Texas Spotted Whiptail	2
<i>Hyla cinerea</i>	Green Tree Frog	1	<i>Elaphe guttata</i>	Great Plains Rat Snake	4
<i>Hyla versicolor / chrysoceles</i>	Gray Tree Frog	1	<i>Hemidactylus turcicus</i>	Mediterranean Gecko	1
<i>Incilius nebulifer</i>	Coastal Plain Toad	3	<i>Leptotyphlops dulcis</i>	Plains Blind Snake	1
<i>Lithobates sphenoccephalus</i>	Southern Leopard Frog	1	<i>Masticophis flagellum</i>	Western Coachwhip	1
			<i>Masticophis schotti</i>	Ruthven's Whipsnake	1
			<i>Salavadora grahamiae</i>	Texas Patch-nosed Snake	5
			<i>Sceloporus variabilis</i>	Texas Rose-bellied Lizard	5
			<i>Scincella lateralis</i>	Ground Skink	12
			<i>Virginia striatula</i>	Rough Earth Snake	1

Air temperature and percent-relative humidity recorded at RS during MY2012:

Air temperature and %-RH were recorded at 10-minute intervals throughout MY2012 using HoBo data loggers placed in the RS riparian forest sampling area of PVC Array A1 to provide an environmental condition covariate to faunal data. Air-T and %-RH are presented as data traces over the MY2012 period in Figure 10 below. Note that these data traces include data for approximately 30 days prior to start of MY2012 sampling, in recognition that potential impacts from changing air-T and %-RH may take several weeks to affect faunal behavior and manifest in detection rates. Formal assessment of possible relationships between environmental conditions and faunal parameters is an anticipated element in long-term trend analysis to be performed from 2015 on.

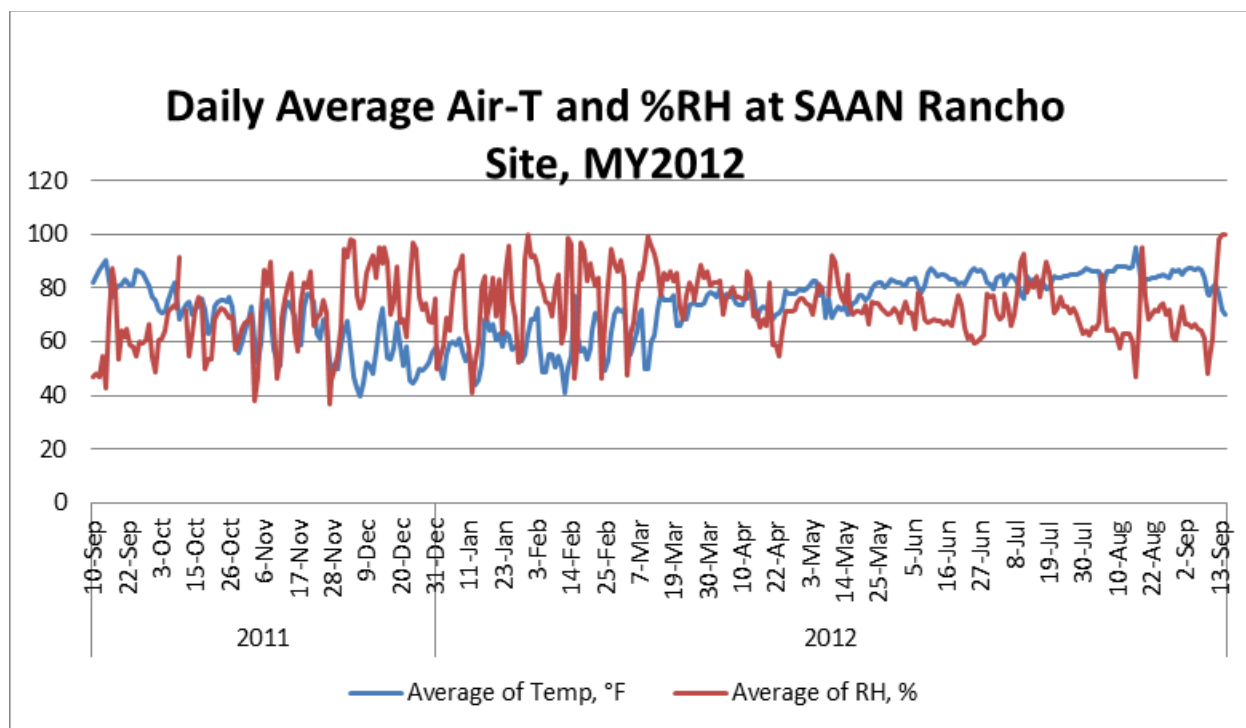


Figure 10. Daily average air temperature and percent-relative humidity recorded at the RS forest area (PVC Array A1) from SEP 05 2011 through SEP 15 2012.

Discussion

The 21 herp species (6 amphibians, 15 reptiles) detected in SAAN sampling (MS and RS sites combined) during MY2012 represent 40 percent of the 52 species (12 amphibians, 40 reptiles) reported for SAAN in the most recent herp inventory (Duran, 2004). Duran confirmed only 36 of these species (7 amphibians and 29 reptiles, including 8 aquatic turtles associated primarily with the San Antonio River) as actually being present on the park. All 21 species detected during MY2012 fall within this confirmed “present” list. As the aquatic turtles are not effectively sampled by project methods (although one individual of one species was recorded within an MS site), the 20 non-turtle species detected in CB, PVC and Cas Obs sampling represent 71% of the 28 confirmed terrestrial herps on SAAN. Notably, two reptiles, Texas Horned Lizard (*Phrynosoma cornutum*) and Texas Tortoise (*Gopherus berlandieri*) confirmed by Duran in 2004 are possibly now extirpated from SAAN, as they were last seen on the park circa 2007 by park resource management staff and GULN biologists, and a targeted search project conducted by Texas A&M University biologists in 2009 - 2010 failed to detect either species on several sites in the MS and RS areas (Dittmer and Fitzgerald, 2011).

SAAN lies in the transition zone from the Edwards Plateau and Balcones Escarpment to the South Texas Plain, an area historically noted for high reptile diversity (Duran, 2004). Balanced against this potential for high diversity is the fact that the park lies within metropolitan San Antonio, Texas, a large and heavily-developed urban area where many species may be expected to experience substantial habitat fragmentation and loss, and many may exist only as small, relict populations. Many species historically reported from the area have not been detected on the park in recent years, and it should be assumed that species listed in the recent inventory (Duran, 2004) as being “possible” or “rare” are not likely to be encountered in a limited sampling effort. It is broadly recognized in herp monitoring and research (Graeter, et al 2010, Heyer, et al 1994) that many herp species are notably habitat-specific and no sampling method is uniformly effective for all species even within its habitat-range (i.e., CB panels sample terrestrial fauna, but are unlikely to detect Box Turtles nor equally detect all snakes, lizards, and salamanders in the area); from these factors, we accept that some species may be present and active in the sampling area but unlikely to be seen in our effort.

Of the amphibians and reptiles detected, two, Rio Grande Chirping Frog (*E. cystignathoides*) and the Mediterranean Gecko (*H. turcicus*), are introduced species confirmed as being present in the Duran (2004) inventory. All other detected species are considered expected and typical in the region and habitats. No detected species were identified as being “new to the park”. No obvious pathologies or abnormalities were noted in any species.

Species accumulation plateaued at both MS and RS before MY2012 sampling concluded. Detected species count is expected to level off with time, as the methods in use and available effort attain their maximum likely detection of species in the sampled area. As both amphibian and reptile species did level off in the MY, it appears possible that the project may have approached this hypothetical maximum detected species-count for the areas being sampled and methods used. However, MY2012

observations must be considered in respect to the severe drought experienced in central Texas over the several years prior to start of monitoring at SAAN. It should be anticipated that both species-presence and abundance detection patterns may change if prevailing regional weather conditions change in future monitoring years.

The recorded air-T and %RH indicated no extreme variation or apparent departures from anticipated pattern and ranges in MY2012; the lack of large and abrupt changes likely indicates that no substantial weather changes occurred in the sampling period. This would suggest that faunal detections recorded in MY2012 did not reflect any strong impacts from unusual weather shifts or events during this year.

Literature Cited

- Beaupre, S.J, (Ed.), 2004. ASIH Guidelines for the Use of Live Amphibians and Reptiles in Field Research, 2cd. Edition. American Society of Ichthyologists and Herpetologists.
- Dittmer, D. E, and L. E. Fitzgerald, 2011. Surveys for two Rare Reptile Species in San Antonio Missions National Historical Park. Investigator's Final Report to San Antonio NHP. Texas A&M University. Not Published.
- Duran, C. M. 2004. An inventory of reptiles and amphibians of Padre Island National Seashore, San Antonio Missions National Historical Park and Palo Alto Battlefield National Historic Site. The Nature Conservancy, San Antonio, TX.
- Graeter, G, K.A. Buhlmann, L.R. Wilkinson, and J.W. Gibbons, 2013 (In Prep.) Inventory and Monitoring: Recommended Techniques for Reptiles and Amphibians. PARC (Partners in Amphibian and Reptile Conservation).
- Granger, W. 2007. Gulf Coast Network Data Management Plan. Natural Resource Report NPS/GULN/NRR-2007/00X. National Park Service, Fort Collins, Colorado.<http://science.nature.nps.gov/im/units/guln/networkhome/datamgmt.cfm>
- Heyer, W.R, M.A. Donnelly, R.W. McDiarmid, L.C. Hayek, and M.S. Foster, Eds.1994. Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians. Smithsonian Institution Press, Wash. DC.
- Segura, M., R.L Woodman, J. Meiman, W. Granger, and J. Bracewell, 2007. Gulf Coast Network Vital Signs Monitoring Plan. Natural Resource Report NPS/GULN/NRR-2007-015, National Park Service, Ft. Collins, CO
- Woodman, RL, et al. 2013 (in review). Gulf Coast Network Amphibian & Reptile Monitoring Protocol. Natural Resource Report NPS/GULN/NRR-2013/000. National Park Service, Fort Collins, Colorado.

Appendix A

SAAN Project Data. The following tables present all faunal observation data recorded at the SAAN-MS and SAAN-R sampling areas in Monitoring Year 2012.

Table 1. SAAN-MS

Start Date	Category	Species	Common Name	Number Observed	Avg. SVL (mm)	Trap Type
10/12/2011	Reptile	Hemidactylus turcicus	Mediterranean Gecko	2	31	CB
10/12/2011	Amphibian	Incilius nebulifer	Coastal Plains Toad	1	51	CB
11/9/2011	Amphibian	Anaxyrus fowleri	Fowler's Toad	2	28	CB
11/10/2011	Reptile	Anolis carolinensis	Green Anole	2	65.5	PVC
12/21/2011	Amphibian	Eleutherodactylus cystignathoides	Rio Grande Chirping Frog	1	31	CB
12/21/2011	Amphibian	Incilius nebulifer	Coastal Plains Toad	1	40	CB
12/21/2011	Reptile	Scincella lateralis	Ground Skink	1	41	CB
1/18/2012	Amphibian	Eleutherodactylus cystignathoides	Rio Grande Chirping Frog	1	29	CB
1/18/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	7	22.285714	CB
1/18/2012	Reptile	Scincella lateralis	Ground Skink	1	49	CB
1/18/2012	Reptile	Anolis carolinensis	Green Anole	1	58	PVC
2/15/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	1	49	CB
2/15/2012	Reptile	Sceloporus olivaceus	Texas Spiny Lizard	1		CB
2/15/2012	Reptile	Scincella lateralis	Ground Skink	2	44.5	CB
2/15/2012	Reptile	Scincella lateralis	Ground Skink	2	39.5	CB
2/15/2012	Reptile	Anolis carolinensis	Green Anole	1	69	PVC
3/14/2012	Amphibian	Eleutherodactylus cystignathoides	Rio Grande Chirping Frog	1	28	CB
3/14/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	2	39	CB
3/14/2012	Reptile	Scincella lateralis	Ground Skink	3	58.333333	CB
4/11/2012	Amphibian	Eleutherodactylus cystignathoides	Rio Grande Chirping Frog	5	21	CB
4/11/2012	Reptile	Hemidactylus turcicus	Mediterranean Gecko	2	37	CB
4/11/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	3	43.666667	CB
4/11/2012	Reptile	Masticophis schotti	Ruthven's Whipsnake	1	1038	CB
5/8/2012	Amphibian	Eleutherodactylus cystignathoides	Rio Grande Chirping Frog	8	25.857143	CB
5/8/2012	Reptile	Hemidactylus turcicus	Mediterranean Gecko	1	35	CB
5/8/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	9	19.142857	CB
5/8/2012	Reptile	Masticophis schotti	Ruthven's Whipsnake	1	790	CB
5/8/2012	Reptile	Nerodia sipedon	Northern Water Snake	1		CB

Start Date	Category	Species	Common Name	Number Observed	Avg. SVL (mm)	Trap Type
5/9/2012	Amphibian	Eleutherodactylus cystignathoides	Rio Grande Chirping Frog	3	22	CB
6/13/2012	Amphibian	Anaxyrus woodhousii	Woodhouse's Toad	1	37	CB
6/13/2012	Amphibian	Eleutherodactylus cystignathoides	Rio Grande Chirping Frog	5	26.5	CB
6/13/2012	Reptile	Hemidactylus turcicus	Mediterranean Gecko	1	46	CB
6/13/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	7	30.714286	CB
6/13/2012	Reptile	Scincella lateralis	Ground Skink	1	27	CB
7/11/2012	Amphibian	Eleutherodactylus cystignathoides	Rio Grande Chirping Frog	30	22.272727	CB
7/11/2012	Reptile	Hemidactylus turcicus	Mediterranean Gecko	2	47.5	CB
7/11/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	1	67	CB
7/11/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	4	40.25	CB
8/16/2012	Amphibian	Eleutherodactylus cystignathoides	Rio Grande Chirping Frog	9	23.571429	CB
8/16/2012	Reptile	Hemidactylus turcicus	Mediterranean Gecko	4	32	CB
8/16/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	1	56	CB
8/16/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	5	56.2	CB
8/16/2012	Reptile	Scincella lateralis	Ground Skink	2	35.5	CB
9/12/2012	Amphibian	Eleutherodactylus cystignathoides	Rio Grande Chirping Frog	5	27.325	CB
9/12/2012	Reptile	Hemidactylus turcicus	Mediterranean Gecko	3	33	CB
9/12/2012	Reptile	Hemidactylus turcicus	Mediterranean Gecko	1		CB
9/12/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	3	47.433333	CB
9/12/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	2	64	CB

Table 2. SAAN-R

Start Date	Category	Species	Common Name(s)	Number Observed	Avg. SVL (mm)	Trap Type
6/16/2011	Reptile	Cnemidophorus gularis	Texas Spotted Whiptail	1		CB
7/15/2011	Reptile	Cnemidophorus gularis	Texas Spotted Whiptail	1		CB
8/11/2011	Reptile	Cnemidophorus gularis	Texas Spotted Whiptail	1		CB
8/11/2011	Reptile	Salvadora grahamiae	Texas Patch-nosed Snake	1	564	CB
8/11/2011	Reptile	Salvadora grahamiae	Texas Patch-nosed Snake	2		COBS
10/13/2011	Reptile	Elaphe guttata emoryi	Great plains rat snake	1	67	CB
10/13/2011	Reptile	Leptotyphlops dulcis	Plains Blind Snake	1	16.5	CB
10/13/2011	Reptile	Salvadora grahamiae	Texas Patch-nosed Snake	2	60.5	CB
10/13/2011	Reptile	Scincella lateralis	Ground Skink	2	38	CB
11/10/2011	Reptile	Scincella lateralis	Ground Skink	1	52	CB
12/22/2011	Reptile	Scincella lateralis	Ground Skink	2	48	CB
1/19/2012	Reptile	Sceloporus variabilis	Rose-bellied Lizard	1	47	CB
1/19/2012	Reptile	Sceloporus variabilis	Rose-bellied Lizard	2	46	CB
1/19/2012	Reptile	Scincella lateralis	Ground Skink	3	46	CB
2/16/2012	Reptile	Elaphe guttata emoryi	Great plains rat snake	1	674	CB
2/16/2012	Reptile	Sceloporus variabilis	Rose-bellied Lizard	2	49	CB
2/16/2012	Reptile	Scincella lateralis	Ground Skink	3	49.666667	CB
3/15/2012	Reptile	Elaphe guttata	Great plains rat snake	1	705	CB
3/15/2012	Amphibian	Gastrophryne olivacea	Great Plains Narrow-mouthed Toad	1	36	CB
3/15/2012	Reptile	Salvadora grahamiae	Texas Patch-nosed Snake	2	607.5	CB
3/15/2012	Reptile	Virginia striatula	Rough Earth Snake	1	191	CB
4/12/2012	Reptile	Elaphe guttata emoryi	Great plains rat snake	1	805	CB
4/12/2012	Reptile	Masticophis schotti	Ruthven's Whipsnake	1	587	CB
4/12/2012	Reptile	Salvadora grahamiae	Texas Patch-nosed Snake	1	628	CB
5/9/2012	Amphibian	Gastrophryne carolinensis	Eastern Narrow-mouthed Toad	1	16	CB
5/9/2012	Amphibian	Gastrophryne olivacea	Great Plains Narrow-mouthed Toad	14	16.846154	CB
5/9/2012	Reptile	Hemidactylus turcicus	Mediterranean Gecko	1	42	CB

Start Date	Category	Species	Common Name(s)	Number Observed	Avg. SVL (mm)	Trap Type
5/9/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	1		COBS
7/12/2012	Reptile	Cnemidophorus gularis	Texas Spotted Whiptail	2	85	CB
7/12/2012	Amphibian	Gastrophryne olivacea	Great Plains Narrow-mouthed Toad	2	22	CB
7/12/2012	Reptile	Masticophis flagellum	Coachwhip	1	670	CB
7/12/2012	Amphibian	Incilius nebulifer	Coastal Plains Toad	2		COBS
7/12/2012	Amphibian	Lithobates sphenoccephalus	Southern Leopard Frog	1		COBS
8/16/2012	Reptile	Scincella lateralis	Ground Skink	1		COBS