Final Report
in partial fulfillment of
State Wildlife Grant T-7

Distribution and Status of
Kansas Herpetofauna in Need of Information

Travis W. Taggart
Sternberg Museum of Natural History
3000 Sternberg Drive
Hays, Kansas 67601
ttaggart@fhsu.edu

30 January 2006
Abstract

Between 1 October 2003 and 1 September 2005 an extensive statewide project to survey the amphibians, reptiles, and turtles of Kansas was conducted. Objectives accomplished were: 1) the identification of new localities for imperiled species in Kansas; 2) the determination of population status estimates for imperiled species in Kansas; 3) the characterization of habitat preferences for imperiled species in Kansas; 4) the collection and curation of tissues of Kansas' amphibians, reptiles, and turtles; and 5) the construction of an online database system to serve both the management and education interest of its users.

The survey resulted in the addition of 14,831 new occurrences of amphibians, reptiles, and turtles in Kansas. Of those, 3,459 (23.3%) are museum vouchers with associated tissues, and the remainder are recorded observations. The new occurrences were collected from 4,046 unique localities across Kansas. At each occurrence site, latitude, longitude, date, and time were recorded.

The project data was combined with all available data collected previously in a Geographic Information System to characterize each species general habitat.

An on-line accessible database (the Kansas Herp Atlas; available currently at webcat.fhsu.edu/ksfauna/herps) was created to store all project data. The website serves both general educational and wildlife management roles.
Table of Contents

Introduction ................................................................................................................................. 1
Materials and Methods ............................................................................................................... 2
Results ........................................................................................................................................ 4
Discussion ................................................................................................................................... 5
Acknowledgements ..................................................................................................................... 8
Literature Cited ............................................................................................................................ 10
List of Figures

1. Summary Dot Map ............................................................................................................. 18
2. Occurrence Dot Maps
   A. Anura ............................................................................................................................... 19
   B. Caudata ......................................................................................................................... 20
   C. Sauria ............................................................................................................................... 21
   D. Serpentes ......................................................................................................................... 22
   E. Chelonia ............................................................................................................................ 24
3. Anuran Chorusing Activity .................................................................................................. 25
4. Kansas Reference Maps
   A. Counties ......................................................................................................................... 26
   B. Rivers and Streams .......................................................................................................... 26
   C. Herpetofaunal Ecoregions ............................................................................................... 26
List of Tables

1. Museums List........................................................................................................27
2. Occurrence Summary..............................................................................................29
3. Occurrence Detail ....................................................................................................
   A. Anura .................................................................................................................30
   B. Caudata ..............................................................................................................31
   C. Sauria..................................................................................................................32
   D. Serpentes ..........................................................................................................33
   E. Chelonia..............................................................................................................34
4. Observation Type Summary....................................................................................35
5. Observation Type by Taxon
   A. Anura ...............................................................................................................36
   B. Caudata ............................................................................................................37
   C. Sauria...............................................................................................................38
   D. Serpentes ........................................................................................................39
   E. Chelonia.............................................................................................................40
List of Appendices

A. Species in Need of Information
1. Anura .................................................................................... 41
2. Caudata ................................................................................. 42
3. Sauria.................................................................................... 43
4. Serpentes............................................................................... 44
5. Chelonia................................................................................. 45

B. Land Cover Designations .......................................................... 46

C. Observation Type Designations .................................................. 47

D. Species Accounts

Anura
1. Dwarf American Toad, *Bufo charlesmithi* ..................................... 48
2. Green Toad, *Bufo debilis* ........................................................... 50
3. Fowler's Toad, *Bufo fowleri* ....................................................... 52
4. Red-spotted Toad, *Bufo punctatus* ............................................. 53
5. Spring Peeper, *Pseudacris crucifer* .............................................. 54
6. Strecker's Chorus Frog, *Pseudacris streckeri* ............................ 56
7. Crawfish Frog, *Rana areolata* ..................................................... 58
8. Pickerel Frog, *Rana palustris* ..................................................... 60
9. Green Frog, *Rana clamitans* ...................................................... 61
10. Eastern Narrowmouth Toad, *Gastrophryne carolinensis* .......... 62

Caudata
12. Eastern Newt, *Notophthalmus viridescens* ............................... 64
15. Longtail Salamander, *Eurycea longicauda* ............................... 67
16. Cave Salamander, *Eurycea lucifuga* ......................................... 68
17. Grotto Salamander, *Eurycea spelaea* ......................................... 69
18. Oklahoma Salamander, *Eurycea tynerensis* ............................ 70

Sauria
19. Lesser Earless Lizard, *Holbrookia maculata* ............................ 71
20. Texas Horned Lizard, *Phrynosoma cornutum* ........................... 73
21. Coal Skink, *Plestiodon anthracinus* ......................................... 75
22. Broadhead Skink, *Plestiodon laticeps* ...................................... 76
23. Italian Wall Lizard, *Podarcis sicula* ......................................... 77
24. Western Green Lacerta, *Lacerta bilineata* ................................... 78

Serpentes
26. Western Hognose Snake, *Heterodon nasicus* ........................... 81
27. Eastern Hoghose Snake, *Heterodon platirhinus* ....................... 82
29. Longnose Snake, *Rhinocheilus lecontei* .................................... 84
30. Redbelly Snake, *Storeria occipitomaculata* ...................... 85
31. Checkered Garter Snake, *Thamnophis marcianus* ................. 86
32. Rough Earth Snake, *Virginia striata* ....................................... 87
33. Smooth Earth Snake, *Virginia valeriae* .................................... 88
34. New Mexico Blind Snake, *Leptotyphlops dissectionis* .......... 90
35. Cottonmouth, *Agkistrodon piscivorus* ...................................... 91
36. Western Diamondback Rattlesnake, *Crotalus atrox* ................ 92
37. Timber Rattlesnake, *Crotalus horridus* .................................... 93
38. Prairie Rattlesnake, *Crotalus viridis* ....................................... 95

Chelonia
41. False Map Turtle, *Graptemys pseudogeographica* complex ........ 100
42. Smooth Softshell, *Apalone mutica* ........................................ 102

E. Kansas Herpetofaunal Ecoregion Descriptions ........................... 103
Introduction

Perhaps more is known of the amphibians, reptiles, and turtles (a group collectively referred to as herps) in the state of Kansas, than from any other similar sized geographic area in the world. This is due in large part, to the number of active herpetologists and the collections being made at the many universities and colleges throughout the state.

Over past hundred years, significant research and collections have been accomplished at Baker University (Baldwin), Benedictine College (Atchison), Bethel College (Newton), Emporia State University (Emporia), Fort Hays State University (Hays), Kansas State University (Manhattan), Ottawa University (Ottawa), Pittsburg State University (Pittsburg), the former St. Mary's College (Dodge City), Southwestern College (Winfield), Washburn University (Topeka), and especially the University of Kansas (Lawrence).

In 1974 an effort was made to unite those individuals and entities with both academic and purely personal interests in the state's herpetofauna with the stated goal of improving the overall understanding of these animals. The result was the formation of the Kansas Herpetological Society (KHS); a truly state-wide organization with the numbers to capably tackle many of the questions concerning the Kansas herpetofauna. The KHS has created and recruited a number of excellent herpetologists over the past 30 years who in turn have yielded a wealth of important scientific contributions.

As it is in science, the accumulation of information necessitates the need for further study. In particular an effort was needed to search out new localities of amphibians, reptiles, and turtles so that the resulting baseline data would provide a wide backdrop for future studies. To accomplish that goal the following objectives were adopted:

1. **Identify new localities, determine population status estimates, and characterize habitat preferences for imperiled species of Kansas' herpetofauna.**

   Baseline data are needed to evaluate the status of our herpetofaunal taxa, and as a measure for detecting trends.

   Conversion of prairies and woodlands to other uses (e.g. agriculture, urban sprawl, and roadways) has become relatively stagnant over much of Kansas in the past 50 years. The effects of habitat loss, degradation, and fragmentation to Kansas’ herp populations, are most notable in the urban areas of the state. State and federally owned lands offer some habitat protection, however on privately owned lands; most direct impacts to threatened and endangered species are handled through various regulatory and mitigation opportunities. By identifying sensitive species, we are more able to identify critical habitats for protection and mitigation.

2. **Collect and curate tissues of sensitive species for use in future genetic research.**

   Systematic revisions are currently taking place at the molecular level, as scientists rely on sequenced strands of DNA to elucidate evolutionary relationships and species boundaries. It is imperative that Kansas animals be available for analysis in these studies so as to lessen potential confusion as to what taxa actually reside in the state. Having a tissue bank ready and accessible will greatly facilitate future research requests and ensure that Kansas is well-represented in those studies.

3. **Construct an online database system to record the results, compile historic information, and make these data available to others as needed.**
The need exists to bring together the wealth of information from disparate places (both old and new), and synthesize it into a system where it can be easily accessed by those wanting to use it. This will serve both management needs as well as the general education of the public.

**Materials and Methods**

*Collection holdings*

Voucher collection records from around the world (Table 1) were sought and compiled. Joe Collins (CNAH) had provided many of the data records prior to this study, and written requests were sent out to acquire any supplemental records for those collections. Many additional collections were queried to access their Kansas records.

Locality data was also extracted from the Kansas Anuran Monitoring Program (KAMP; www.cnah.org/KAMP). Those data points were coded as personal observations.

*Geo-referencing*

All collection records were then geo-referenced to determine the latitude and longitude (in decimal degrees, dd.ddddd) for each locality. Several sources were used to geo-reference the records, including TopoZone (www.topozone.com), TOPO! Commercial software from the National Geographic Society, and the free software GeoLocate published by Tulane University. Localities were geo-referenced manually using TopoZone and TOPO!. The GeoLocate software facilitated the importation of the data and executed the geo-referencing in a batch process with reasonable success. All coordinates determined by GeoLocate where then plotted on maps and checked for accuracy. Many coordinates could not be determined using GeoLocate, and these had to be geo-referenced manually, while another 5,741 specimens had no or insufficient locality data to be geo-referenced.

*Targeted species*

Discussions with other Kansas herpetologists led to the compilation of a list of Species In Need of Information (SINI) (Appendix A). This list included all Kansas Threatened, Endangered, and Species In Need of Conservations (SINC) as recognized by the Kansas Department of Wildlife and Parks. Additionally, taxa were added to the SINI list that were 1) of possible or questionable occurrence in the state, 2) accidentals or introductions, 3) species with populations disappearing from large portions of their range outside of Kansas, and 4) taxa with few known individuals or localities in Kansas. The SINI list was to provide a compilation of target species, while still recognizing the need to collect important baseline data on all herp taxa.

*Field Work*

Field trips were typically planned to regions of the state based on the paucity of records for a region, or the potential for finding new localities. Often the actual determination of a region for collection was based on the prevailing or forecasted local meteorological conditions and the specific taxa being sought. Initially, a system of 30 mile radius 'survey centers' spread across the state were used to conduct activity, however it soon became apparent that they were much too small and prevented the efficient collection of data.

Both passive (drift fence, funnel traps, pitfalls etc.) and active (turning cover, seining, road cruising) sampling regimes were used. Whenever a sample was located, its coordinates were determined and recorded using a handheld Global
Positioning System receiver (Garmin GPSMap 76). The GPS receiver also recorded the date and time of each observation with its respective coordinates.

Field trips generally lasted four to seven days in duration. During that time specimens were kept on ice. In instances where a specimen was in bad shape (many DORs) it was processed in the field.

**Lab Work**

Specimens and data were processed upon return to the lab. Frozen specimens were thawed and living samples were euthanized. Tissues (liver and/or skeletal muscle) were taken from every specimen from which quality samples could be reasonably obtained. Tissues were placed in vials of ethanol and stored in light-proof cabinets within the general collection. Most specimens were then prepared as alcoholics by first injecting them with 10% formalin positioning them for storage and allowing them to harden. After they are rigid (overnight to a week depending on the taxon and its size), they are rinsed for several hours and stored in their respective places in the general collection. Occasionally, selected specimens are chosen for skeletal preparations. These samples are skinned, eviscerated, and have most of their muscles removed as soon as the tissues are taken. They are then allowed to dry, and placed into a dermestid colony. The dermestid beetles consume the remaining flesh and connective tissue leaving only bones, which are then cleaned and stored in the general collection.

The preparation of those data acquired the previous week is also carried out in the lab. Locality and date data are downloaded from the GPS receivers and associated with the observation notes taken at each locality. The data are then imported into the general database and made available immediately via the Kansas Herp Atlas.

**Habitat characterizations**

In survey work, when obtaining distribution data in quantity is paramount, it is time prohibitive to make detailed environmental notes at each site of capture. Optimal conditions are ephemeral and being out and moving when the animals are active is important to the efficient collection of locality data. Additionally, collections made during darkness or inclement weather, prevent an adequate assessment of the surrounding habitat. Fortunately the data and tools exist that allow us to determine these variables secondarily. All of the locality coordinates obtained were imported into the Geographic Information System (GIS) ArcView, to create a coverage or layer containing those points. Additional coverage's were then included to analyze associations with landcover, public lands, and geology. To do this, ArcView determined the corresponding value in each additional coverage, for each locality in the points layer.

**Population status and trends**

Objective species by species evaluations of population status and trends are inherently difficult. Variations in life-history traits, number of occurrences or unique localities, habitat type, or even habitat use yield detailed estimates meaningless across taxa.

The population status estimates and trends utilized in this study are therefore generalized, and then explained in each species account (Appendix D). They are as follows:

*Decreasing* - Indicating a taxon for which all, or a portion, of its range has decreased, or the density of individuals within has become less over the past 50 years.
**Increasing** - Indicating a taxon for which all, or a portion, of its range has increased, or the density of individuals within has become greater over the past 50 years.

**Stable** - Indicating taxa with no discernable change in range, or density therein over the past 50 years.

**Not Known** - Recent and/or historic data is insufficient to be meaningful.

Even using the simplistic criterion shown above, it is still easy to see how certain taxa might possess characteristics of two or even all three designations. In such cases the criterion was selected that best represents the overall status of the taxon in Kansas, and care is taken to explain the circumstances in the text.

**Online Database/Kansas Herp Atlas**
The Kansas Herp Atlas began as a small personal project in 1999. It is intended to serve both education and conservation. The information acquired through this study and from interested participants serves as baseline data for further research, provides data to assist with conservation needs as they arise, and contributes to an increasing public awareness of the amphibians, reptiles, and turtles in the state.

The Atlas contains information on all known occurrences of Kansas’ herpetofauna. Unique to the site, are the most up-to-date distribution maps of each species known to occur (or potentially occur) in the state. Each species account has text descriptions summarizing the distribution, fossil history, maximum size, taxonomy, and an ever-growing list of references.

The Atlas represents the work of thousands of individuals, who over countless hours, collected and recorded the nearly 70,000 specimens and observations presented herein. Our current high-level of understanding with respect to the Kansas herpetofauna is largely due of their efforts.

The Kansas Herp Atlas files are stored on an IBM compatible server running Microsoft Server NT software. The data is stored in a Microsoft SQL Server (version 8.0) running on a separate IBM compatible server. The site utilizes Microsoft Active Server Pages (ASP) technology and Visual Basic scripting to dynamically pull data from the database to create an web page customized to the users parameters.

**Results**
The survey resulted in the addition of 14,831 new occurrences of amphibians, reptiles, and turtles in Kansas (Table 2, Figure 1). Of those, 3,459 (23.3%) represent museum vouchers with associated tissues, and the remainder are recorded observations. The newly reported occurrences were collected from 4,046 unique localities across Kansas. At each occurrence site, latitude, longitude, date, time, and various environmental variables were recorded.

Occurrence data for each of the 100 species in Kansas is reported in Table 3, and discussed in Appendix D for the 42 taxa covered in this report. The number of total accumulated occurrences ranged from 6,613 for *Acris crepitans* to 3 for both *Rana palustris* and *Eurycea tynerensis*. Of occurrences reported just during this study the range was from 2,463 for *Pseudacris maculata* to none for *Rana palustris, Eurycea tynerensis, Necturus louisianensis, Necturus maculosus, Plestiodon anthracinus, Thamnophis marcianus, Agkistrodon piscivorus, and Macrochelys temminckii*.

The observation types resulting in the most occurrence records (Table 4) were of chorusing anurans (7,945). Occurrences observed under cover (1,553), DOR (1,522), active, off-road (1,513), and AOR (1,427) represented the second tier of observation types noted. The least common observation types to result in recorded occurrences were basking (162), dead, off-road (58), and five occurrences were reported as a prey item.
Forty-two 'species in need of information' (Appendix A1-5) were included in the individual species accounts presented in Appendix D. These accounts detail those data specific to the particular species being covered. Text descriptions of occurrence finding are presented, and a narrative on the status of each species is provided. Names of counties, rivers and streams, and ecoregions discussed in the text are provided in Figure 4A-C respectively, and descriptions of each ecoregion can be found in Appendix E. Observations types are reported individually for each species in these accounts, and for all species in Table 5. Text descriptions of each observation type is supplied in Appendix C. Landcover designations are reported individually for each species in Appendix D, and text descriptions of each land cover designation are produced in Appendix B.

Occurrence dot maps for each of the forty-two taxa presented are illustrated in (Figure 2A-E). Occurrence records are color-coded to differentiate voucher collections made prior to the study, during the study, and non-voucheried observations. County maps are provided for those taxa that occur in only one county and state out-line maps are used for the remainder of the species maps.

Chorusing activity is presented in Figure 3. Box plot diagrams show the distribution of unique dates over each species respective chousing period. The taxa are arranged bottom to top from the earliest to the latest date that chorusing activity was initiated by each particular taxon. Only taxa with more than three unique observations of chorusing activity were incorporated.

Fifty-two different museum collections (Table 1) were queried for their holdings of Kansas material. Of those, 37 had Kansas specimens in their care.

**Kansas Herp Atlas**

The on-line component was created and is in operation (currently at webcat.fhsu.edu/ksfauna/herps). It is up-to-date with all data collected through this study.

**Discussion**

Most discussion concerning the findings for individual species is found in their respective accounts (Appendix D) under the 'Status' heading. Text descriptions of each status type can be found in the 'Materials and Methods' section of this manuscript.

This study was successful in identifying new localities of amphibians, reptiles, and turtles overall. As expected, success by taxon varied with few to no reported occurrences of several species. Any subsequent survey efforts should target these taxa, as the increase in baseline knowledge allows more robust comparisons in the future.

For those taxa relatively well-sampled, population status estimates were determined. Most of the species in the state were either stable or increasing over the past 50 years; however a few exhibited appreciable declines. Most notable among these was *Holbrookia maculata*. Not initially selected as a Species in Need of Information, it was once numerous and widespread throughout the western two-thirds of the state. Now it appears to be absent throughout most (>90%) of its former range in the state. This example further demonstrates the importance of having a measure of baseline data to compare to.

Future studies should target those species whose population status estimates are declining, and investigate possible causes. In some cases causation can be readily assessed (*Virginia valeriae* and *Storeria occipitomaculata* populations in Wyandotte County) whereas in other taxa the causes are not so obvious (*Holbrookia maculata*; *Rana areolata* populations in Baker Wetlands).

Habitat preferences for imperiled species of Kansas' herpetofauna were determined generally as habitat association. Determining what constitutes the habitat of any
particular organism is a difficult endeavor. Sampling plays a large role even at the crude scale presented herein, and those species with a greater number of recorded occurrences certainly have more robust characterizations of associated habitat. For those taxa with greater number of occurrences, and as other taxa acquire more occurrences, future analyses should be conducted at a finer scale. For instance, breaking the woodland category into smaller community types (i.e. CRP, maple-basswood forest, oak-hickory forest, pecan-hackberry floodplain forest, cottonwood-sycamore floodplain forest, post oak-blackjack oak woodland, etc).

Tissues were collected and curated for each species collected during the study and are available for use in future genetic research. Already, samples of two salamanders, 15 species of snake, and one lizard are being investigated at three different research centers outside of Kansas.

The Kansas Herp Atlas continues to be an ever-improving entity. It relies on the feedback of users to maintain its user friendliness in providing access to the data as needed.

Aside from accomplishing the stated goals for this project, several discoveries and/or findings merit special reference. The sensitive species listed below are discussed in greater detail in their respective Species Accounts (Appendix D); however several of the notable observations didn't involve Species In Need of Information.

1. The Fowler's Toad (*Bufo fowleri*) and Dwarf American Toad (*Bufo charlesmithi*) were added to the states herpetofaunal list, based in part on specimens collected and analyses performed during this study.

2. The decline in numbers and populations of several taxa were noted during this study. It is unknown whether these declines are natural occurrences; however existing populations of these species should be monitored especially along the edges of their respective ranges.
   a. As previously mentioned the greatest decline was observed in the Lesser Earless Lizard (*Holbrookia maculata*), which could not be found throughout most of the area it was previously known from. Populations that existed within the past 15 years are now either reduced or extinct.
   b. Northern Cricket Frogs (*Acris crepitans*) were formerly known to occur statewide. They are now extirpated in eastern Colorado and southwestern Nebraska, and based on this study; they have also disappeared from much of the western third of Kansas.
   c. Both the Common Mudpuppy (*Necturus maculosus*) and Red River Mudpuppy (*Necturus louisianensis*) escaped detection during this study. Recent baseline data is needed for these obligate aquatic salamanders and a surveying effort to target these taxa by winter trapping is warranted.
   d. The Texas Horned Lizard (*Phrynosoma cornutum*) was not observed through much of its former range in southeastern Kansas. In light of the pronounced decline of the closely related *Holbrookia maculata*, and of this species elsewhere in its range, the monitoring of this species is needed.
   e. Other species that may be experiencing unexplained declines in either range or density include the Smooth Softshell (*Apalone mutica*), Common Map Turtle (*Graptemys geographica*), Coal Skink (*Plestiodon anthracinus*), Alligator Snapping Turtle (*Macrochelys temminckii*), and Checkered Garter Snake (*Thamnophis marcianus*). In most instances however, data is lacking to confirm the decline of any of these taxa.

3. Several significant range extensions were discovered during the course of this study. Herps are a relatively sedentary group of animals, and these collections undoubtedly represent long-established populations and not recent range expansion.
a. An isolated population of Strecker's Chorus Frogs (*Pseudacris streckeri*) was found in dune sand habitat in Pratt, Kingman, Barber, and Harper counties, constituting a range extension of 24 kilometers (15 miles).

b. An isolated population of the Great Plains Rat Snake (*Pantherophis emoryi*) was discovered in a unique habitat in southwestern Stanton County. These specimens represent a range extension of 65 kilometers (40 miles) east of the nearest population in Colorado and 97 kilometers (60 miles) west of the nearest population in Kansas.

c. Several specimens of the Ground Skink were found around the Medicine Lodge River in Kiowa County. Specimens may ultimately be discovered along this waterway through Barber County.

d. Two populations of Eastern Newt (*Notophthalmus viridescens*) were discovered in Bourbon County. These records substantially filled in the hiatus of previously known collection in Linn and Cherokee counties.

e. County records were documented for the following species; *Apalone spinifera* (Bourbon, Clark, and Jefferson counties), *Bufo cognatus* (Grant County), *Bufo woodhousii* (Miami and Montgomery counties), *Cheyldra serpentina* (Finney, Jewell, Ness, and Seward counties), *Chrysemys picta* (Finney and Sherman counties), *Crotalus horridus* (Allen County), *Diadophis punctatus* (Seward County), *Eumeces laticeps* (Bourbon County), *Gastrophryne olivacea* (Rooks County), *Hyla chrysoscelis/versicolor* (Washington County), *Kinosternon flavescens* (Stanton County), *Masticophis flagellum* (Miami and Sherman counties), *Nerodia erythrogaster* (Seward County), *Ophisaurus attenuatus* (Harper and Kiowa counties), *Phrynosoma cornutum* (Lyon County), *Pantherophis emoryi* (Stanton County), *Pituophis catenifer* (Linn and Thomas counties), *Podarcis sicula* (Ellis County), *Pseudacris streckeri* (Kingman and Pratt counties), *Rana areolata* (Chautauqua, Montgomery, and Neosho counties), *Rana catesbeiana* (Hodgeman County), *Sceloporus undulatus* (Decatur County), *Scincella lateralis* (Kiowa County), *Thamnophis proximus* (Wyandotte County), *Thamnophis sirtalis* (Seward County), *Trachemys scripta* (Finney County), and *Tropidoclonion lineatum* (Logan County), *Storeria dekayi* (Kiowa and Osborne counties).

4. Systematic road surveys of Spring Peepers (*Pseudacris crucifer*) and Eastern Narrowmouth Toads (*Gastrophryne carolinensis*) in Cherokee County served to better define their range in that county. Notable for both taxa, was the extent to which they left followed riparian corridors along Shawnee and Cow creeks to the north and west of the Ozark Plateau. The Eastern Narrowmouth Toad had not previously been recorded outside of the Ozark Plateau in Kansas.

5. Despite finding no Crawfish Frogs (*Rana areolata*) in 2004, surveying efforts during the late winter and spring of 2005 resulted in the discovery of many new localities of this highly secretive species. Systematic road surveys were conducted for calling males and were concentrated in the southwestern and western extents of their range in the state. County records were obtained from Chautauqua, Montgomery, and Neosho counties. Systematic surveying in Osage County failed to produce any new localities, despite the discovery of populations within one mile to the south in Coffey County.

6. A Southern Prairie Skink (*Plestiodon obtusirostris*) was regurgitated from a Night Snake (*Hypsiglena torquata*) collected in Clark County. This constitutes a rare diet observation on Kansas *Hypsiglena torquata* and documents only the second known specimen of *Plestiodon obtusirostris* from Clark County.

7. The systematics of the *Sceloporus undulatus* is in need of further examination. Two very different forms exist in Kansas. A southeastern variety is found in the
Ozark Plateau and the southern portion of the Cross Timbers, and a western form throughout the remainder of its range in the state including the populations along the Kansas River.

Acknowledgements

This study would not have been possible without the support of the United States Fish and Wildlife Service and Kansas Department of Wildlife and Parks in administering the State Wildlife Grant monies.

Ken Brunson in particular was instrumental in seeing that the entire process proceeded smoothly, and amidst his other duties, still managed to get out and participate in a few field trips, documenting several important occurrences. Other employees of the Kansas Department of Wildlife and Parks provide administrative, budgetary, or field expertise during this project. I thank Mike Hayden, Keith Sexson, Nate Davis, Sheila Wells, Carl Magnuson, Deb Simon, Jeff Clouser, Kristen Hase, Kent Hensley, Mike Rader, and Mike Mitchener.

Faculty, staff, and students at the Sternberg Museum of Natural History and Fort Hays State University that were instrumental in the completion of this study were Jerry Choate (Director, Sternberg Museum), Elmer Finck (Director, Biological Sciences), Edward Hammond (President, FHSU), Curtis Schmidt, Richard Hayes, Mike Drees, Mike Barnett, Geralyn Allen, Richard Lisichenko, Gregory Liggett, Gene Beilman, Richard Zakarewski, Mark Orth, Amy Klein, Kathy Jungle, Mark Kellerman, Thea Haughen, Cami Liggett, Bill Stark, Elmer Finck, Robert Channel, Eric Gillok, Mark Eberle, Cheryl Helget, Derek Johnson, Mark Griffin, Chad Whitney, Mike Rochford, David Bender, and Leslie Paige.

Joe and Suzanne Collins of the Center for North American Herpetology (CNAH) were a constant source of reference and expertise on the Kansas herpetofauna. Many of the questions and problems encountered during this project were dealt with by Joe over the past three editions of his Kansas herp book, and so much time was saved in consultation with him. Suzanne's pictures appear throughout the Kansas Herp Atlas.

Special thanks are due to my family (Jennifer, MacKenzie, Charlie, Max, and Meg) for allowing me to travel about the state for extended periods.

Much of the historic data was provide by Joe Collins. Lists of more recent holdings were supplied John Simmons (KU), David Cannatella and Travis LaDuc (TNHC), Kathyrn Vaughn, James Dixon (TCWC), Darrel Frost (AMNH), Ned Gilmore (ANSP), Jeff Boundy (LSUV), Kevin de Queiroz (USNM), F. Wayne King and Kenny Krysko (FLMNH), Alan Resetar (FMNH), Chris Phillips (IU), Gregory Schneider and Ronald A. Nussbaum (UMMZ), and Steve Sullivan and Joe Slowinski (CAS).

Stan Roth, Bill Busby, and Jennifer Deslile of the Kansas Biological Survey provided support in the form of data and localities.

Derek Welch (Fort Scott) and Josh Jagels (Pittsburg) provided information of several sensitive species in east central Kansas.

This study was aided by the hard work of many participants by conducting field work, running down data, or making other significant contributions. They include: Mark Ellis, Kathy Ellis, Larry Miller, Suzanne Miller, David Oldham, Robin Oldham Jackson Oldham, Tag Oldham, Guntram Deichsel, Chad Whitney, Ginny Weatherman Robert Acuff, Ross McNearney, Andy Durbin, Mike Rochford, Mary Kate Baldwin, Erica Peterson, Eric Kessler, Victor Wilkinson, Brian Crother, Matt Miller, Sam Fairleigh, Lisle Gibbs, Dan Murrow, Derek Schmidt, MacKenzie Wiley, Jennifer Taggart, Charlie Stieben, Max Stieben, Nick Pipkin, Jay Kirk, Jim Gubany,i Marla Gubanyi, Keith Coleman, Kelly J. Irwin, John Stoklosa, Erik Bartholomew, Amanda Schmidt, Jonathan Van Campen, Brad Schwartz, Mike Washburne, Jeremy Washburne, Austin Triboulet, Eric Rundquist, Marty Capron, John Tollefson, Greg Sievert, Darren Riedle, Amy Zavala, Joel Voelker, Gibra Suleiman, Thea Haugen,
Cami Liggett, Mitch Sommers, Sharon Richards, Gene Beilman, Bruce Wolhuter, Curtis Wolfe, Megan Taggart, Bruce Taggart, Rebecca Kessler, Tanner Gravenstein, Nate Davis, Ann Randle, Maura Kessler, George Pisani, shawn Silliman, Gibran Suleiman, Crissy Supples, Dan Thalman, Linda Phipps, and Lisa Leeman.
Literature Cited

Ahrens, John.


Baird, Spencer Fullerton.


Baird, Spencer Fullerton and Charles Girard.


Ball, Robert L.

Bonett, R. M. & P. T. Chippindale.

Bragg, Arthur N.

Branson, Edwin B.

Brumwell, M. J.

Burkhart, Jeffery T.
1984, Status of the Western Green Toad (*Bufo debilis insidior*) in Kansas. Agency Contract No. 72, Kansas Fish and Game Commission.

Burt, C. E.

Burt, C. E. and W. L. Hoyle.


Capron, Marty.


Clark, D. R. 


Clarke, R. F.


Collins, Joseph T.


Collins, Joseph T. and David M. Hillsis.

Cragin, F. W.
1880. A preliminary catalogue of Kansas reptiles and batrachians. Transactions of the Kansas Academy of Sciences, VII. pp 114-123.


Daniel, Richard and Brian Edmond.

Edds, David R.


1956, An ecological study of the collared lizard (Crotaphytus collaris), University of Kansas Publications, Museum of Natural History. 8(3): 213-274.


Gloyd, H. K. 1928. The amphibians and reptiles of Franklin County, Kansas. Transactions of the Kansas Academy of Science. 31. 115-141.

1932. The herpetological fauna of the Pigeon Lake Region, Miami County, Kansas. Papers of the Michigan Academy of Science Arts and Letters. 15. 389-408.


Griffith, Hugh, Andre Ngo and Robert W. Murphy.  

Günther, Albert.  

Hall, Henry H. and Hobart M. Smith.  

Hammerson, Geoffrey A.  

Harlan, Richard.  


Hillis, David M. and Thomas P. Wilcox.  

Holbrook, John Edwards.  
1836. North American Herpetology; or, a Description of the Reptiles Inhabiting the United States. Philadelphia. 5 Volumes. J. Dobson, 1032

Ireland, Patrick H.  

Irwin, Kelly J.  


Irwin, Kelly J. and J. T. Collins.  


Iverson, John B.  

Johnson, Tom R.  

Kangas, D. A.  

Kennicott, Robert.

Lacepede, B. G. E.


Layher, Bill.


Legler, John M.


Linneaus, Carl.


Linneaus, Carl.


Lokke, John.


Loraine, Raymond K.


Mahmoud, I. Y.


Manier, Mollie K.


Masta, Susan E., Brian K. Sullivan, Trip Lamb, and Eric J. Routman.


Matlack, R. S. and R. L. Rehmeier.


Meacham.


Miller, Larry.


Moriarty, Emily C. and David C. Cannatella.  

Mozley, Annie E.  
1877. List of Kansas snakes in the museum of the Kansas State University. Transactions of the Kansas Academy of Science, VI, 34-35.

Platt, Dwight R.  
1969. Natural history of the hognose snakes *Heterodon platyrhinos* and *Heterodon nasicus*. University of Kansas, Museum of Natural History, 18(4): 253-420

Plummer, Michael V.  

Reilly, S. M.  

Riedle, Daren.  
Riedle, J. Daren, Paul A, Shipman, Stanley F. Fox, & David M. Leslie, Jr.  

Royal, S. M.  

Rundquist, Eric M.  

Say, Thomas in Edwin James.  

Schmidt, Curtis J. and William J. Stark.  
2002. An assessment of the harvest of Prairie Rattlesnakes (*Crotalus viridis*) during the Sharon Springs rattlesnake roundups in 2000 and 2001 and an
investigation of unexploited populations within the Smoky Valley Ranch.
Kansas Department of Wildlife and Parks. 15 pp.


Wied-Neuwied, Maximilian Prinz zu. 1838. Reise in das Innere Nord-America in den Jahren 1822 bis 1834, Band 1, Koblenz, J. Hoelscher.


Figure 1.
Locality summary dot map. Localities reported prior to this study are represented by black dots (●). Localities of records obtained during this study are represented by red dots (●).
Figure 2-A. Occurrence dot maps of selected Anuran taxa in Kansas. Symbols shown are: Pre-existing voucher (●), project voucher (●), project observation (●), and literature observation (○).
Figure 2-B.
Occurrence dot maps of selected salamander species in Kansas. Symbols shown are:
Pre-existing voucher (●), project voucher (○), project observation (○), and literature observation (○).
Figure 2-C.
Occurrence dot maps of selected lizard species in Kansas. Symbols shown are:
Pre-existing voucher (●), project voucher (○), project observation (●), and literature observation (○).

19. Holbrookia maculata

20. Phrynosoma cornutum

21. Plestiodon anthracinus

22. Plestiodon laticeps

23. Podarcis sicula

24. Lacerta bilineata
Figure 2-D1.
Occurrence dot maps of selected snake species in Kansas. Symbols shown are:
Pre-existing voucher (●), project voucher (●), project observation (○), and literature observation (○).
**Figure 2-D2.**
Occurrence dot maps of selected snake species in Kansas. Symbols shown are:
Pre-existing voucher (●), project voucher (●), project observation (○), and literature observation (○).
Figure 2-E.
Occurrence dot maps of selected turtle species in Kansas. Symbols shown are:
Pre-existing voucher (●), project voucher (●), project observation (○), and literature observation (○).

39. *Macrochelys temminckii*

40. *Graptemys geographica*

41. *Graptemys pseudogeographica*

42. *Apalone mutica*
Figure 3.
Anuran Chorusing Activity. Box plot diagrams showing the range of activity (between the vertical red bars), median (vertical blue bar), and the first and third quartile (the start and end respectively, of the thicker horizontal red bar). The taxa are identified by scientific name. N= the number of unique days represented in each respective plot.
Figure 4.
Kansas reference maps

A. Counties

B. Principal Rivers and Streams

C. Herpetofaunal Ecoregions

1. Central Shortgrass Prairie
   1a. Breaks
   1b. Western Plains
   1c. Arkansas River Sand Sage Prairie
   1d. Cimarron Plains

2. Central Mixedgrass Prairie
   2a. Smoky Hills
   2b. Arkansas River Sand Prairie
   2c. Red Hills Prairie

3. Southern Tallgrass Prairie
   3a. Drift Hills
   3b. Loess Hills
   3c. Flint Hills
   3d. Ridge Prairie
   3e. Gage Plains
   3f. Osage Border
   3g. Osage Plateau
### Table 1

**Museums List - Collections queried for data**

A listing of all collections queried for amphibians, reptiles, and turtles from Kansas.

<table>
<thead>
<tr>
<th>Collection</th>
<th>Location</th>
<th>Kansas Holdings</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM - Australian Museum</td>
<td>Sydney, Australia</td>
<td>0 specimens</td>
</tr>
<tr>
<td>AMNH - American Museum of Natural History</td>
<td>New York, New York</td>
<td>741 specimens of 56 species</td>
</tr>
<tr>
<td>ANSP - Academy of Natural Sciences</td>
<td>Philadelphia, Pennsylvania</td>
<td>297 specimens of 35 species</td>
</tr>
<tr>
<td>ASU - Arizona State University</td>
<td>Tempe, Arizona</td>
<td>31 specimens of 18 species</td>
</tr>
<tr>
<td>AUNHMLC - Auburn University Museum</td>
<td>Auburn, Alabama</td>
<td>25 specimens of 15 species</td>
</tr>
<tr>
<td>BC - Bethel College</td>
<td>North Newton, Kansas</td>
<td>80 specimens of 22 species</td>
</tr>
<tr>
<td>BM - British Museum (Natural History)</td>
<td>London, United Kingdom</td>
<td>0 specimens</td>
</tr>
<tr>
<td>BuM - Burke Museum of Natural History</td>
<td>Seattle, Washington</td>
<td>0 specimens</td>
</tr>
<tr>
<td>BPBM - Bernice P. Bishop Museum</td>
<td>Honolulu, Hawaii</td>
<td>0 specimens</td>
</tr>
<tr>
<td>BYU - Monte L. Bean Life Science Museum</td>
<td>Provo, Utah</td>
<td>343 specimens of 51 species</td>
</tr>
<tr>
<td>CAS - California Academy of Sciences</td>
<td>San Francisco, California</td>
<td>922 specimens of 52 species</td>
</tr>
<tr>
<td>CAS-SUA - formerly Stanford University</td>
<td>San Francisco, California</td>
<td>330 specimens of 30 species</td>
</tr>
<tr>
<td>CHAS - Chicago Academy of Sciences</td>
<td>Chicago, Illinois</td>
<td>346 specimens of 31 species</td>
</tr>
<tr>
<td>CHM - Charleston Museum</td>
<td>Charleston, South Carolina</td>
<td>0 specimens</td>
</tr>
<tr>
<td>CMNH - Carnegie Museum of Natural History</td>
<td>Pittsburgh, Pennsylvania</td>
<td>982 specimens of 64 species</td>
</tr>
<tr>
<td>CPS - Slater Museum of Natural History</td>
<td>Tacoma, Washington</td>
<td>0 specimens</td>
</tr>
<tr>
<td>CUMV - Cornell University Museum of Vertebrates</td>
<td>Ithaca, New York</td>
<td>0 specimens</td>
</tr>
<tr>
<td>DMNH - Delaware Museum of Natural History</td>
<td>Greenville, Delaware</td>
<td>0 specimens</td>
</tr>
<tr>
<td>FLMNH - Florida State Museum, University of Florida</td>
<td>Gainesville, Florida</td>
<td>663 specimens of 50 species</td>
</tr>
<tr>
<td>FMNH - Field Museum of Natural History</td>
<td>Chicago, Illinois</td>
<td>1545 specimens of 72 species</td>
</tr>
<tr>
<td>INHS - Illinois Natural History Survey</td>
<td>Champaign, Illinois</td>
<td>42 specimens of 14 species</td>
</tr>
<tr>
<td>JFBM - Bell Museum of Natural History, Univ. of Minnesota</td>
<td>St. Paul Minnesota</td>
<td>72 specimens of 21 species</td>
</tr>
<tr>
<td>KU - Museum of Natural History, Kansas University</td>
<td>Lawrence, Kansas</td>
<td>23275 specimens of 110 species</td>
</tr>
<tr>
<td>KU-CS - KU Color Slide Collection</td>
<td>Lawrence, Kansas</td>
<td>18 specimens of 10 species</td>
</tr>
<tr>
<td>LACM - Natural History Museum of Los Angeles County</td>
<td>Los Angeles, California</td>
<td>221 specimens of 54 species</td>
</tr>
<tr>
<td>LSUMZ - Museum of Natural Science, Louisiana State Univ.</td>
<td>Baton Rouge, Louisiana</td>
<td>67 specimens of 25 species</td>
</tr>
<tr>
<td>MCZ - Museum of Comparative Zoology, Harvard University</td>
<td>Cambridge, Massachusetts</td>
<td>771 specimens of 47 species</td>
</tr>
<tr>
<td>MHP - Sternberg Museum of Natural History, Fort Hays St. Univ.</td>
<td>Hays, Kansas</td>
<td>9383 specimens of 101 species</td>
</tr>
<tr>
<td>MPM - Milwaukee Public Museum</td>
<td>Milwaukee, Wisconsin</td>
<td>7 specimens of 3 species</td>
</tr>
<tr>
<td>MSU - The Museum, Michigan State University</td>
<td>East Lansing, Michigan</td>
<td>620 specimens of 56 species</td>
</tr>
<tr>
<td>MVZ - University of California, Museum of Vertebrate Zoology</td>
<td>Berkeley, California</td>
<td>828 specimens of 55 species</td>
</tr>
<tr>
<td>OMNHN - Sam Noble Museum of Natural History, University of Oklahoma</td>
<td>Norman, Oklahoma</td>
<td>64 specimens of 26 species</td>
</tr>
<tr>
<td>OSUS - Oklahoma State University</td>
<td>Stillwater Oklahoma</td>
<td>0 specimens</td>
</tr>
<tr>
<td>ROM - Royal Ontario Museum</td>
<td>Toronto, Ontario, Canada</td>
<td>76 specimens of 12 species</td>
</tr>
<tr>
<td>SDSNH - San Diego Natural History Museum</td>
<td>San Diego, California</td>
<td>446 specimens of 40 species</td>
</tr>
<tr>
<td>SIUC - Southern Illinois University</td>
<td>Carbondale, Illinois</td>
<td>52 specimens of 22 species</td>
</tr>
<tr>
<td>SM - Strecker Museum, Baylor University</td>
<td>Waco, Texas</td>
<td>0 specimens</td>
</tr>
</tbody>
</table>
### Table 1 - continued
**Museums List - Collections queried for data**

A listing of all collections queried for amphibians, reptiles, and turtles from Kansas.

<table>
<thead>
<tr>
<th>Collection</th>
<th>Location</th>
<th>Kansas Holdings</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCWC - Texas Cooperative Wildlife Collection, Texas A&amp;M Univ.</td>
<td>College Station, Texas</td>
<td>224 specimens of 38 species</td>
</tr>
<tr>
<td>TNHC - Texas Natural History Collection, Texas Memorial Museum</td>
<td>Austin, Texas</td>
<td>102 specimens of 12 species</td>
</tr>
<tr>
<td>TTU - Texas Tech University</td>
<td>Lubbock, Texas</td>
<td>82 specimens of 13 species</td>
</tr>
<tr>
<td>TU - Museum of Natural History, Tulane University</td>
<td>Belle Chasse, Louisiana</td>
<td>0 specimens</td>
</tr>
<tr>
<td>UAZ - Amphibian and Reptile Collection, University of Arizona</td>
<td>Tucson, Arizona</td>
<td>0 specimens</td>
</tr>
<tr>
<td>UCM - University of Colorado Museum</td>
<td>Boulder, Colorado</td>
<td>522 specimens of 45 species</td>
</tr>
<tr>
<td>UG - University of Georgia</td>
<td>Athens, Georgia</td>
<td>2 specimens of 1 species</td>
</tr>
<tr>
<td>UIMNH - Illinois Natural History Survey</td>
<td>Urbana, Illinois</td>
<td>1022 specimens of 71 species</td>
</tr>
<tr>
<td>UMMZ - Museum of Zoology, University of Michigan</td>
<td>Ann Arbor, Michigan</td>
<td>888 specimens of 73 species</td>
</tr>
<tr>
<td>UMZ - University Museum of Zoology, Cambridge University</td>
<td>Cambridge, United Kingdom</td>
<td>0 specimens</td>
</tr>
<tr>
<td>UNMH - Utah Museum of Natural History</td>
<td>Salt Lake City, Utah</td>
<td>0 specimens</td>
</tr>
<tr>
<td>USNM - National Museum of Natural History, Smithsonian Institution</td>
<td>Washington, District of Columbia</td>
<td>1607 specimens of 74 species</td>
</tr>
<tr>
<td>UTA - University of Texas at Arlington</td>
<td>Arlington, Texas</td>
<td>0 specimens</td>
</tr>
<tr>
<td>UTEP - University of Texas at El Paso, Centennial Museum</td>
<td>El Paso, Texas</td>
<td>551 specimens of 63 species</td>
</tr>
<tr>
<td>YPM - Yale Peabody Museum</td>
<td>New Haven, Connecticut</td>
<td>5 specimens of 5 species</td>
</tr>
</tbody>
</table>
Table 2
Occurrence Summary

Recorded occurrences of all Kansas amphibians, reptiles, and turtles made before and during this study, and the number of unique localities they are known from.

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>During</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vouchers</td>
<td>44,331</td>
<td>3,459</td>
<td>47,790</td>
</tr>
<tr>
<td>Observations</td>
<td>206(^A)</td>
<td>11,372</td>
<td>11,578</td>
</tr>
<tr>
<td>Total Occurrences</td>
<td>44,537</td>
<td>14,831</td>
<td>59,368</td>
</tr>
<tr>
<td>Unique Localities</td>
<td>8,877</td>
<td>4,046</td>
<td>12,923</td>
</tr>
</tbody>
</table>

\(^A\) - Pre-study observations are literature records
Table 3-A  
Occurrence Detail - Anura  
Number of occurrences recorded in each occurrence type category by each species of frog, for which data is available.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Total Occurrences</th>
<th>Vouchers Before</th>
<th>New</th>
<th>Observations Personal Literature</th>
<th>Localities Before</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bufo americanus</td>
<td>969</td>
<td>476</td>
<td>32</td>
<td>461</td>
<td>137</td>
<td>133</td>
</tr>
<tr>
<td>Bufo charlesmithi</td>
<td>303</td>
<td>266</td>
<td>21</td>
<td>16</td>
<td>61</td>
<td>27</td>
</tr>
<tr>
<td>Bufo cognatus</td>
<td>991</td>
<td>719</td>
<td>33</td>
<td>239</td>
<td>215</td>
<td>58</td>
</tr>
<tr>
<td>Bufo debilis</td>
<td>64</td>
<td>59</td>
<td>4</td>
<td>1</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Bufo fowleri</td>
<td>15</td>
<td>10</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Bufo punctatus</td>
<td>138</td>
<td>129</td>
<td>4</td>
<td>5</td>
<td>33</td>
<td>6</td>
</tr>
<tr>
<td>Bufo woodhousii</td>
<td>2,166</td>
<td>1,461</td>
<td>82</td>
<td>623</td>
<td>385</td>
<td>153</td>
</tr>
<tr>
<td>Acris crepitans</td>
<td>6,613</td>
<td>4,968</td>
<td>100</td>
<td>1,545</td>
<td>589</td>
<td>197</td>
</tr>
<tr>
<td>Hyla chrysoscelis/versicolor</td>
<td>1,384</td>
<td>666</td>
<td>35</td>
<td>683</td>
<td>204</td>
<td>88</td>
</tr>
<tr>
<td>Pseudacris clarkii</td>
<td>303</td>
<td>141</td>
<td>7</td>
<td>155</td>
<td>58</td>
<td>10</td>
</tr>
<tr>
<td>Pseudacris crucifer</td>
<td>200</td>
<td>109</td>
<td>45</td>
<td>46</td>
<td>42</td>
<td>41</td>
</tr>
<tr>
<td>Pseudacris maculata</td>
<td>3,808</td>
<td>1,345</td>
<td>79</td>
<td>2,384</td>
<td>322</td>
<td>396</td>
</tr>
<tr>
<td>Pseudacris streckeri</td>
<td>166</td>
<td>91</td>
<td>6</td>
<td>69</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>Gastrophryne carolinensis</td>
<td>64</td>
<td>28</td>
<td>9</td>
<td>27</td>
<td>17</td>
<td>32</td>
</tr>
<tr>
<td>Gastrophryne olivacea</td>
<td>903</td>
<td>780</td>
<td>29</td>
<td>94</td>
<td>188</td>
<td>52</td>
</tr>
<tr>
<td>Spea bombifrons</td>
<td>1,482</td>
<td>1,234</td>
<td>48</td>
<td>200</td>
<td>229</td>
<td>75</td>
</tr>
<tr>
<td>Rana areolata</td>
<td>474</td>
<td>310</td>
<td>28</td>
<td>136</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>Rana blairi</td>
<td>2,242</td>
<td>1,452</td>
<td>68</td>
<td>722</td>
<td>544</td>
<td>171</td>
</tr>
<tr>
<td>Rana catesbeiana</td>
<td>1,260</td>
<td>728</td>
<td>47</td>
<td>485</td>
<td>330</td>
<td>134</td>
</tr>
<tr>
<td>Rana clamitans</td>
<td>29</td>
<td>24</td>
<td>3</td>
<td>2</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Rana palustris</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Rana sphenoecephala</td>
<td>637</td>
<td>217</td>
<td>63</td>
<td>357</td>
<td>95</td>
<td>171</td>
</tr>
</tbody>
</table>
Table 3-B  
Occurrence Detail - Caudata
Number of occurrences recorded in each occurrence type category by each species of salamander, for which data is available.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Total Occurrences</th>
<th>Vouchers Before</th>
<th>New</th>
<th>Observations Personal</th>
<th>Literature</th>
<th>Localities Before</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambystoma mavorium</td>
<td>1,039</td>
<td>998</td>
<td>32</td>
<td>9</td>
<td>0</td>
<td>162</td>
<td>20</td>
</tr>
<tr>
<td>Ambystoma texanum</td>
<td>527</td>
<td>473</td>
<td>38</td>
<td>16</td>
<td>0</td>
<td>59</td>
<td>25</td>
</tr>
<tr>
<td>Ambystoma tigrinum</td>
<td>132</td>
<td>130</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td>Eurycea longicauda</td>
<td>196</td>
<td>159</td>
<td>5</td>
<td>32</td>
<td>2</td>
<td>29</td>
<td>6</td>
</tr>
<tr>
<td>Eurycea lucifuga</td>
<td>59</td>
<td>38</td>
<td>2</td>
<td>19</td>
<td>1</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Eurycea spelaea</td>
<td>85</td>
<td>73</td>
<td>10</td>
<td>2</td>
<td>0</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Eurycea tynerensis</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Necturus louisianensis</td>
<td>22</td>
<td>22</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Necturus maculosus</td>
<td>27</td>
<td>27</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>Notophthalmus viridescens</td>
<td>73</td>
<td>63</td>
<td>7</td>
<td>3</td>
<td>9</td>
<td>15</td>
<td>6</td>
</tr>
</tbody>
</table>
Table 3-C  
Occurrence Detail - Sauria
Number of occurrences recorded in each occurrence type category by each species of lizard, for which data is available.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Total Occurrences</th>
<th>Vouchers Before</th>
<th>New</th>
<th>Observations Personal Literature</th>
<th>Localities Before</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ophisaurus attenuatus</td>
<td>293</td>
<td>229</td>
<td>32</td>
<td>32</td>
<td>98</td>
<td>53</td>
</tr>
<tr>
<td>Crotaphytus collaris</td>
<td>2,007</td>
<td>1,853</td>
<td>61</td>
<td>93</td>
<td>314</td>
<td>89</td>
</tr>
<tr>
<td>Lacerta bilineata</td>
<td>15</td>
<td>6</td>
<td>2</td>
<td>7</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Podarcis sicula</td>
<td>123</td>
<td>15</td>
<td>1</td>
<td>107</td>
<td>4</td>
<td>108</td>
</tr>
<tr>
<td>Holbrookia maculata</td>
<td>947</td>
<td>944</td>
<td>1</td>
<td>2</td>
<td>141</td>
<td>3</td>
</tr>
<tr>
<td>Phrynosoma cornutum</td>
<td>667</td>
<td>511</td>
<td>35</td>
<td>121</td>
<td>169</td>
<td>146</td>
</tr>
<tr>
<td>Sceloporus consobrinus</td>
<td>1,055</td>
<td>982</td>
<td>37</td>
<td>36</td>
<td>277</td>
<td>57</td>
</tr>
<tr>
<td>Plestiodon anthracinus</td>
<td>86</td>
<td>86</td>
<td>0</td>
<td>3</td>
<td>37</td>
<td>0</td>
</tr>
<tr>
<td>Plestiodon fasciatus</td>
<td>1,240</td>
<td>1,186</td>
<td>34</td>
<td>20</td>
<td>167</td>
<td>35</td>
</tr>
<tr>
<td>Plestiodon laticeps</td>
<td>34</td>
<td>26</td>
<td>3</td>
<td>5</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Plestiodon obsoletus</td>
<td>1,737</td>
<td>1,548</td>
<td>84</td>
<td>105</td>
<td>322</td>
<td>86</td>
</tr>
<tr>
<td>Plestiodon obtusirostris</td>
<td>56</td>
<td>49</td>
<td>6</td>
<td>1</td>
<td>27</td>
<td>5</td>
</tr>
<tr>
<td>Plestiodon septentrionalis</td>
<td>282</td>
<td>266</td>
<td>6</td>
<td>10</td>
<td>85</td>
<td>5</td>
</tr>
<tr>
<td>Scincella lateralis</td>
<td>324</td>
<td>298</td>
<td>11</td>
<td>15</td>
<td>91</td>
<td>20</td>
</tr>
<tr>
<td>Aspidoscelis sexlineata</td>
<td>1,375</td>
<td>1,229</td>
<td>38</td>
<td>108</td>
<td>298</td>
<td>105</td>
</tr>
</tbody>
</table>

32
Table 3-D
Occurrence Detail - Serpentes
Number of occurrences recorded in each occurrence type category by each species of snake, for which data is available.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Total Occurrences</th>
<th>Vouchers Before</th>
<th>New</th>
<th>Observations Before New</th>
<th>Literature Before New</th>
<th>Localities Before New</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona elegans</td>
<td>148</td>
<td>86</td>
<td>31</td>
<td>31</td>
<td>0</td>
<td>61</td>
<td>48</td>
</tr>
<tr>
<td>Carphophis vermis</td>
<td>823</td>
<td>784</td>
<td>28</td>
<td>11</td>
<td>2</td>
<td>150</td>
<td>20</td>
</tr>
<tr>
<td>Coluber constrictor</td>
<td>1,201</td>
<td>940</td>
<td>92</td>
<td>169</td>
<td>1</td>
<td>381</td>
<td>213</td>
</tr>
<tr>
<td>Diadophis punctatus</td>
<td>3,465</td>
<td>3,044</td>
<td>256</td>
<td>165</td>
<td>2</td>
<td>405</td>
<td>169</td>
</tr>
<tr>
<td>Heterodon nasicus</td>
<td>351</td>
<td>318</td>
<td>17</td>
<td>16</td>
<td>0</td>
<td>136</td>
<td>31</td>
</tr>
<tr>
<td>Heterodon platirhinos</td>
<td>153</td>
<td>137</td>
<td>11</td>
<td>5</td>
<td>0</td>
<td>75</td>
<td>14</td>
</tr>
<tr>
<td>Hypsiglena torquata</td>
<td>31</td>
<td>26</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>17</td>
<td>4</td>
</tr>
<tr>
<td>Lampropeltis calligaster</td>
<td>305</td>
<td>273</td>
<td>13</td>
<td>19</td>
<td>1</td>
<td>137</td>
<td>26</td>
</tr>
<tr>
<td>Lampropeltis getula</td>
<td>263</td>
<td>212</td>
<td>28</td>
<td>23</td>
<td>0</td>
<td>130</td>
<td>32</td>
</tr>
<tr>
<td>Lampropeltis triangulum</td>
<td>478</td>
<td>399</td>
<td>55</td>
<td>24</td>
<td>4</td>
<td>178</td>
<td>44</td>
</tr>
<tr>
<td>Masticophis flagellum</td>
<td>341</td>
<td>231</td>
<td>35</td>
<td>75</td>
<td>0</td>
<td>120</td>
<td>95</td>
</tr>
<tr>
<td>Nerodia erythrogaster</td>
<td>334</td>
<td>244</td>
<td>48</td>
<td>42</td>
<td>0</td>
<td>82</td>
<td>49</td>
</tr>
<tr>
<td>Nerodia rhombifer</td>
<td>256</td>
<td>241</td>
<td>6</td>
<td>9</td>
<td>0</td>
<td>77</td>
<td>14</td>
</tr>
<tr>
<td>Nerodia sipedon</td>
<td>1,471</td>
<td>1,411</td>
<td>32</td>
<td>28</td>
<td>0</td>
<td>211</td>
<td>31</td>
</tr>
<tr>
<td>Opheodrys aestivalis</td>
<td>122</td>
<td>101</td>
<td>12</td>
<td>9</td>
<td>0</td>
<td>44</td>
<td>20</td>
</tr>
<tr>
<td>Pantherophis emoryi</td>
<td>400</td>
<td>339</td>
<td>38</td>
<td>23</td>
<td>0</td>
<td>178</td>
<td>42</td>
</tr>
<tr>
<td>Pantherophis obsoletus</td>
<td>463</td>
<td>361</td>
<td>52</td>
<td>50</td>
<td>1</td>
<td>148</td>
<td>82</td>
</tr>
<tr>
<td>Pituophis sayi</td>
<td>1,132</td>
<td>627</td>
<td>109</td>
<td>396</td>
<td>0</td>
<td>289</td>
<td>440</td>
</tr>
<tr>
<td>Regina grahamii</td>
<td>203</td>
<td>195</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>55</td>
<td>6</td>
</tr>
<tr>
<td>Rhinocelis lecontei</td>
<td>64</td>
<td>54</td>
<td>7</td>
<td>3</td>
<td>0</td>
<td>40</td>
<td>9</td>
</tr>
<tr>
<td>Sonora semiannulata</td>
<td>358</td>
<td>327</td>
<td>19</td>
<td>12</td>
<td>0</td>
<td>47</td>
<td>7</td>
</tr>
<tr>
<td>Storeria dekayi</td>
<td>355</td>
<td>289</td>
<td>48</td>
<td>18</td>
<td>1</td>
<td>120</td>
<td>47</td>
</tr>
<tr>
<td>Storeria occipitomaculata</td>
<td>44</td>
<td>43</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>Tantilla gracilis</td>
<td>1,056</td>
<td>1,049</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>138</td>
<td>4</td>
</tr>
<tr>
<td>Tantilla nigriceps</td>
<td>210</td>
<td>202</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>101</td>
<td>5</td>
</tr>
<tr>
<td>Thamnophis marcius</td>
<td>20</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Thamnophis proximus</td>
<td>360</td>
<td>299</td>
<td>41</td>
<td>20</td>
<td>0</td>
<td>115</td>
<td>39</td>
</tr>
<tr>
<td>Thamnophis radix</td>
<td>711</td>
<td>629</td>
<td>55</td>
<td>27</td>
<td>0</td>
<td>208</td>
<td>56</td>
</tr>
<tr>
<td>Thamnophis sirtalis</td>
<td>715</td>
<td>588</td>
<td>61</td>
<td>66</td>
<td>1</td>
<td>216</td>
<td>106</td>
</tr>
<tr>
<td>Tropidoclonion lineatum</td>
<td>545</td>
<td>513</td>
<td>17</td>
<td>15</td>
<td>0</td>
<td>142</td>
<td>23</td>
</tr>
<tr>
<td>Virginia striatula</td>
<td>60</td>
<td>58</td>
<td>2</td>
<td>0</td>
<td>7</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Virginia valeriae</td>
<td>55</td>
<td>52</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>35</td>
<td>2</td>
</tr>
<tr>
<td>Leptotyphlops dissection</td>
<td>78</td>
<td>66</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>35</td>
<td>7</td>
</tr>
<tr>
<td>Agkistrodon contortrix</td>
<td>838</td>
<td>772</td>
<td>34</td>
<td>32</td>
<td>0</td>
<td>143</td>
<td>29</td>
</tr>
<tr>
<td>Agkistrodon piscivorus</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Crotalus atrox</td>
<td>8</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Crotalus horridus</td>
<td>297</td>
<td>258</td>
<td>10</td>
<td>29</td>
<td>0</td>
<td>54</td>
<td>12</td>
</tr>
<tr>
<td>Crotalus viridis</td>
<td>456</td>
<td>276</td>
<td>64</td>
<td>116</td>
<td>0</td>
<td>126</td>
<td>142</td>
</tr>
<tr>
<td>Sistrurus catenatus</td>
<td>465</td>
<td>335</td>
<td>53</td>
<td>77</td>
<td>0</td>
<td>158</td>
<td>107</td>
</tr>
</tbody>
</table>
Table 3-E  
Occurrence Detail - Chelonia  
Number of occurrences recorded in each occurrence type category by each species of turtle, for which data is available.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Total Occurrences</th>
<th>Vouchers Before</th>
<th>New</th>
<th>Observations Personal</th>
<th>Literature</th>
<th>Localities Before</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chelydra serpentina</td>
<td>345</td>
<td>247</td>
<td>22</td>
<td>76</td>
<td>1</td>
<td>125</td>
<td>85</td>
</tr>
<tr>
<td>Macrochelys temminckii</td>
<td>12</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Chrysemys picta</td>
<td>441</td>
<td>334</td>
<td>26</td>
<td>81</td>
<td>1</td>
<td>144</td>
<td>95</td>
</tr>
<tr>
<td>Graptemys geographica</td>
<td>17</td>
<td>14</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Graptemys pseudogeographica</td>
<td>163</td>
<td>116</td>
<td>5</td>
<td>42</td>
<td>0</td>
<td>54</td>
<td>39</td>
</tr>
<tr>
<td>Pseudemys concinna</td>
<td>56</td>
<td>38</td>
<td>1</td>
<td>17</td>
<td>0</td>
<td>29</td>
<td>17</td>
</tr>
<tr>
<td>Terrapene carolina</td>
<td>231</td>
<td>189</td>
<td>10</td>
<td>32</td>
<td>1</td>
<td>65</td>
<td>33</td>
</tr>
<tr>
<td>Terrapene ornata</td>
<td>1,224</td>
<td>872</td>
<td>30</td>
<td>322</td>
<td>0</td>
<td>332</td>
<td>327</td>
</tr>
<tr>
<td>Trachemys scripta</td>
<td>405</td>
<td>183</td>
<td>37</td>
<td>185</td>
<td>0</td>
<td>104</td>
<td>177</td>
</tr>
<tr>
<td>Kinosternon flavescens</td>
<td>493</td>
<td>449</td>
<td>13</td>
<td>31</td>
<td>0</td>
<td>110</td>
<td>36</td>
</tr>
<tr>
<td>Sternotherus odoratus</td>
<td>63</td>
<td>54</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>30</td>
<td>8</td>
</tr>
<tr>
<td>Apalone mutica</td>
<td>247</td>
<td>246</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>36</td>
<td>1</td>
</tr>
<tr>
<td>Apalone spinifera</td>
<td>195</td>
<td>130</td>
<td>22</td>
<td>43</td>
<td>0</td>
<td>67</td>
<td>53</td>
</tr>
</tbody>
</table>
Table 4
Observation Type Summary

Recorded occurrences of all Kansas amphibians, reptiles, and turtles by observation type. Categories are defined in Appendix C.

<table>
<thead>
<tr>
<th>Category</th>
<th># of Occurrences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active, off-road</td>
<td>1,513</td>
</tr>
<tr>
<td>AOR</td>
<td>1,427</td>
</tr>
<tr>
<td>Basking</td>
<td>162</td>
</tr>
<tr>
<td>Chorusing</td>
<td>7,945</td>
</tr>
<tr>
<td>Dead, off-road</td>
<td>58</td>
</tr>
<tr>
<td>DOR</td>
<td>1,522</td>
</tr>
<tr>
<td>Prey item</td>
<td>5</td>
</tr>
<tr>
<td>Under cover</td>
<td>1,553</td>
</tr>
</tbody>
</table>
Table 5-A
Observation Type by Taxon - Anura
Number of occurrences recorded in each observation type category by each species of frog, for which data is available.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Active, off-road</th>
<th>AOR</th>
<th>Basking</th>
<th>Chorusing</th>
<th>Dead, off-road</th>
<th>DOR</th>
<th>Prey Item</th>
<th>Under Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bufo americanus</em></td>
<td>5</td>
<td>33</td>
<td>0</td>
<td>424</td>
<td>0</td>
<td>15</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><em>Bufo charlesmithi</em></td>
<td>3</td>
<td>21</td>
<td>0</td>
<td>24</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><em>Bufo cognatus</em></td>
<td>4</td>
<td>45</td>
<td>0</td>
<td>212</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><em>Bufo debilis</em></td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Bufo fowleri</em></td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Bufo punctatus</em></td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td><em>Bufo woodhousii</em></td>
<td>29</td>
<td>88</td>
<td>0</td>
<td>549</td>
<td>0</td>
<td>18</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td><em>Acris crepitans</em></td>
<td>124</td>
<td>3</td>
<td>0</td>
<td>1,475</td>
<td>24</td>
<td>1</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td><em>Hyla chrysoscelis/versicolor</em></td>
<td>11</td>
<td>9</td>
<td>0</td>
<td>711</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Pseudacris clarkii</em></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>162</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Pseudacris crucifer</em></td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Pseudacris maculata</em></td>
<td>15</td>
<td>25</td>
<td>0</td>
<td>2,326</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td><em>Pseudacris streckeri</em></td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>72</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><em>Gastrophryne carolinensis</em></td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>32</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><em>Gastrophryne olivacea</em></td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>86</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td><em>Spea bombifrons</em></td>
<td>3</td>
<td>75</td>
<td>0</td>
<td>162</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><em>Rana areolata</em></td>
<td>1</td>
<td>6</td>
<td>0</td>
<td>165</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td><em>Rana blairi</em></td>
<td>100</td>
<td>41</td>
<td>0</td>
<td>627</td>
<td>0</td>
<td>23</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td><em>Rana catesbeiana</em></td>
<td>82</td>
<td>40</td>
<td>0</td>
<td>394</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td><em>Rana clamitans</em></td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Rana palustris</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Rana sphenoecephala</em></td>
<td>21</td>
<td>44</td>
<td>0</td>
<td>322</td>
<td>0</td>
<td>21</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>
### Table 5-B
**Observation Type by Taxon - Caudata**
Number of occurrences recorded in each observation type category by each species of salamander, for which data is available.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Active, off-road</th>
<th>AOR</th>
<th>Basking</th>
<th>Chorusing</th>
<th>Dead, off-road</th>
<th>DOR</th>
<th>Prey Item</th>
<th>Under Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambystoma mavoritium</td>
<td>29</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Ambystoma texanum</td>
<td>29</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Ambystoma tigrinum</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Eurycea longicauda</td>
<td>38</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Eurycea lucifuga</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Eurycea spelaea</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Eurycea tynerensis</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Necturus louisianensis</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Necturus maculosus</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Notophthalmus viridescens</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 5-C  
Observation Type by Taxon - Sauria  
Number of occurrences recorded in each observation type category by each species of lizard, for which data is available.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Active, off-road</th>
<th>AOR</th>
<th>Basking</th>
<th>Chorusing</th>
<th>Dead, off-road</th>
<th>DOR</th>
<th>Prey Item</th>
<th>Under Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ophisaurus attenuatus</td>
<td>3</td>
<td>27</td>
<td>0</td>
<td>0</td>
<td>29</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Crotaphytus collaris</td>
<td>79</td>
<td>10</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>57</td>
</tr>
<tr>
<td>Lacerta bilineata</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Podarcis sicula</td>
<td>110</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Holbrookia maculata</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Phrynosoma cornutum</td>
<td>12</td>
<td>91</td>
<td>0</td>
<td>0</td>
<td>51</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Sceloporus consobrinus</td>
<td>48</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Plestiodon anthracinus</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Plestiodon fasciatus</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>47</td>
</tr>
<tr>
<td>Plestiodon laticeps</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Plestiodon obsoletus</td>
<td>22</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>165</td>
</tr>
<tr>
<td>Plestiodon obtusirostris</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Plestiodon septentrionalis</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Scincella lateralis</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>26</td>
</tr>
<tr>
<td>Aspidoscelis sexlineata</td>
<td>70</td>
<td>42</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>51</td>
</tr>
</tbody>
</table>
Table 5-D
Observation Type by Taxon - Serpentes
Number of occurrences recorded in each observation type category by each species of snake, for which data is available.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Active, off-road</th>
<th>AOR</th>
<th>Basking</th>
<th>Chorusing</th>
<th>Dead, off-road</th>
<th>DOR</th>
<th>Prey Item</th>
<th>Under Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona elegans</td>
<td>0</td>
<td>35</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>27</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Carphophis vermis</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>41</td>
</tr>
<tr>
<td>Coluber constrictor</td>
<td>16</td>
<td>62</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>104</td>
<td>0</td>
<td>64</td>
</tr>
<tr>
<td>Diadophis punctatus</td>
<td>8</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>1</td>
<td>381</td>
</tr>
<tr>
<td>Heterodon nasicus</td>
<td>1</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>23</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Heterodon platirrhinos</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hypsiglena torquata</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Lampropeltis calligaster</td>
<td>2</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Lampropeltis getula</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>19</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td>Lampropeltis triangulum</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>77</td>
</tr>
<tr>
<td>Masticophis flagellum</td>
<td>7</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>69</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Nerodia erythrogaster</td>
<td>56</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>13</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Nerodia rhombifer</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Nerodia sipedon</td>
<td>25</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>Opheodrys aestivus</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pantherophis emoryi</td>
<td>3</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Pantherophis obsoletus</td>
<td>10</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>37</td>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td>Pituophis sayi</td>
<td>19</td>
<td>110</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>338</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>Regina grahamii</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Rhinocelis lecontei</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Sonora semiannulata</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>Storeria dekayi</td>
<td>9</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>Storeria occipitomaculata</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Tantilla gracilis</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Tantilla nigriceps</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Thamnophis marcianus</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Thamnophis proximus</td>
<td>17</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Thamnophis radix</td>
<td>8</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>36</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Thamnophis sirtalis</td>
<td>24</td>
<td>27</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>46</td>
<td>0</td>
<td>28</td>
</tr>
<tr>
<td>Tropidion lineatum</td>
<td>6</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Virginia striatula</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Virginia valeriae</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Leptotyphlops dissectus</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Agkistrodon contortrix</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>52</td>
</tr>
<tr>
<td>Agkistrodon piscivorus</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Crotalus atrox</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Crotalus horridus</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Crotalus viridis</td>
<td>1</td>
<td>71</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>104</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Sistrurus catenatus</td>
<td>4</td>
<td>50</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>64</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>
Table 5-E
Observation Type by Taxon - Chelonia
Number of occurrences recorded in each observation type category by each species of turtle, for which data is available.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Active, off-road</th>
<th>AOR</th>
<th>Basking</th>
<th>Chorusing</th>
<th>Dead, off-road</th>
<th>DOR</th>
<th>Prey Item</th>
<th>Under Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chelydra serpentina</td>
<td>59</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>7</td>
<td>21</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Macrochelys temminckii</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chrysemys picta</td>
<td>33</td>
<td>6</td>
<td>34</td>
<td>0</td>
<td>0</td>
<td>29</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Graptemys geographica</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Graptemys pseudogeographica</td>
<td>17</td>
<td>0</td>
<td>29</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pseudemys concinna</td>
<td>10</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Terrapene carolina</td>
<td>5</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>12</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Terrapene ornata</td>
<td>23</td>
<td>177</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>144</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Trachemys scripta</td>
<td>97</td>
<td>18</td>
<td>60</td>
<td>0</td>
<td>7</td>
<td>34</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Kinosternon flavescens</td>
<td>20</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Sternotherus odoratus</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Apalone mutica</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Apalone spinifera</td>
<td>47</td>
<td>0</td>
<td>14</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Appendix A-1
Species In Need of Information - Anura

Bufonidae
- Dwarf American Toad, Bufo charlesmithi - Possible
- Green Toad, Bufo debilis - Threatened
- Fowler’s Toad, Bufo fowleri - Possible
- Red-spotted Toad, Bufo punctatus - SINC
- Texas Toad, Bufo speciosus - Possible

Hylidae
- Green Treefrog, Hyla cinerea - Accidental
- Cuban Treefrog, Osteopilus septentrionalis - Accidental
- Spring Peeper, Pseudacris crucifer - Threatened
- Strecker’s Chorus Frog, Pseudacris streckeri - Threatened

Microhylidae
- Eastern Narrowmouth Toad, Gastrophyne carolinensis - Threatened

Pipidae
- African Clawed Frog, Xenopus sp. - Accidental

Ranidae
- Crawfish Frog, Rana areolata - SINC
- Bullfrog, Rana catesbeiana - Harvested
- Green Frog, Rana clamitans - Threatened
- Pickerel Frog, Rana palustris - Questionable
- Northern Leopard Frog, Rana pipsis - Possible
- Wood Frog, Rana sylvatica - Accidental

Scaphiopodidae
- Couch's Spadefoot, Scaphiopus couchii - Possible
- Eastern Spadefoot, Scaphiopus holbrookii - Possible
- Western Spadefoot, Spea hammondii - Possible
- New Mexico Spadefoot, Spea multiplicata - Possible

Accidental - Not believed to be native; probably represents an escaped pet or a single introduction.
Harvested - Game animal; formal state designation.
Possible - Not known from Kansas, however individuals/populations may yet be discovered.
Questionable - Known from Kansas by one or more specimens, but lacking evidence of being established.
SINC - Species In Need of Conservation: Formal state designation.
Threatened - Formal state designation.
Appendix A-2
Species In Need of Information - Caudata

Ambystomatidae
Spotted Salamander, *Ambystoma maculatum* - **Accidental**
Eastern Tiger Salamander, *Ambystoma tigrinum* - **Rare**

Cryptobranchidae
Hellbender, *Cryptobranchus alleganiensis* - **Questionable**

Plethodontidae
Longtail Salamander, *Eurycea longicauda* - **Threatened**
Cave Salamander, *Eurycea lucifuga* - **Endangered**
Grotto Salamander, *Eurycea spelaea* - **Endangered**
Oklahoma Salamander, *Eurycea tynerensis* - **Questionable**
Western Slimy Salamander, *Plethodon albagula* - **Questionable**
Ozark Zigzag Salamander, *Plethodon angusticlavius* - **Possible**

Proteidae
Red River Mudpuppy, *Necturus louisianensis* - **Rare**
Common Mudpuppy, *Necturus maculosus* - **Rare**

Salamandridae
Eastern Newt, *Notophthalmus viridescens* - **Threatened**

Sirenidae
Lesser Siren, *Siren intermedia* - **Accidental**

---

**Accidental** - Not believed to be native; probably represents an escaped pet or a single introduction.
**Endangered** - Formal state designation.
**Possible** - Not known from Kansas, however individuals/populations may yet be discovered.
**Questionable** - Known from Kansas by one or more specimens, but lacking evidence of being established.
**Rare** - Known from only a few records/localities. May be more apparent than real.
**Threatened** - Formal state designation.
Appendix A-3
Species In Need of Information - Sauria

Gekkonidae
   Dwarf Gecko, *Sphaerodactylus lineolatus* - *Accidental*

Helodermatidae
   Gila Monster, *Heloderma suspectum* - *Accidental*

Lacertidae
   Western Green Lacerta, *Lacerta bilineata* - *Introduced*
   Italian Wall Lizard, *Podarcis sicula* - *Introduced*

Phrynosomatidae
   Lesser Earless Lizard, *Holbrookia maculata* - *Imperiled*
   Texas Horned Lizard, *Phrynosoma cornutum* - *Imperiled*
   Northwestern Short-horned Lizard, *Phrynosoma hernandesi* - *Possible*
   Desert Side-blotched Lizard, *Uta stenjegeri* - *Accidental*
   Polychrotidae
   Green Anole, *Anolis carolinensis* - *Accidental*

Scincidae
   Coal Skink, *Plestiodon anthracinus* - *Rare*
   Broadhead Skink, *Plestiodon laticeps* - *Threatened*
   Many-lined Skink, *Plestiodon multivirgatus* - *Possible*

Accidental - Not believed to be native; probably represents an escaped pet or a single introduction.
Introduced - Not believed to be native, however established populations currently exist.
Imperiled - Experiencing population declines in portions of its range.
Possible - Not known from Kansas, however individuals/populations may yet be discovered.
Rare - Known from only a few records/localities. May be more apparent than real.
Threatened - Formal state designation.
Appendix A-4
Species In Need of Information - Serpentes

Boidae
Boa Constrictor, Boa constrictor - Accidental

Colubridae
Eastern Glossy Snake, Arizona elegans - SINC
Western Hognose Snake, Heterodon nasicus - SINC
Eastern Hognose Snake, Heterodon platirhinos - SINC
Night Snake, Hypsiglena torquata - Rare
Smooth Green Snake, Opheodrys vernalis - Questionable
Western Fox Snake, Pantherophis vulpina - Possible
Longnose Snake, Rhinocelis lecontei - Threatened
Redbelly Snake, Storeria occipitomaculata - Threatened
Blackneck Garter Snake, Thamnophis cyrtops - Questionable
Western Terrestrial Garter Snake, Thamnophis elegans - Possible
Checkered Garter Snake, Thamnophis marcianus - Threatened
Rough Earth Snake, Virginia striatula - SINC
Smooth Earth Snake, Virginia valeriae - Threatened

Leptotyphlopidae
New Mexico Blind Snake, Leptotyphlops dissectus - Threatened

Viperidae
Cottonmouth, Agkistrodon piscivorus - Rare
Western Diamondback Rattlesnake, Crotalus atrox - Questionable
Timber Rattlesnake, Crotalus horridus - SINC
Mojave Rattlesnake, Crotalus scutulatus - Accidental
Prairie Rattlesnake, Crotalus viridis - Harvested
Pigmy Rattlesnake, Sistrurus miliarius - Possible

Accidental - Not believed to be native; probably represents an escaped pet or a single introduction.
Harvested - Game animal; formal state designation.
Possible - Not known from Kansas, however individuals/populations may yet be discovered.
Questionable - Known from Kansas by one or more specimens, but lacking evidence of being established.
Rare - Known from only a few records/localities. May be more apparent than real.
SINC - Species In Need of Conservation: Formal state designation.
Threatened - Formal state designation.
Appendix A-4
Species In Need of Information - Chelonia

Chelydridae
   Alligator Snapping Turtle, *Macrochelys temminckii* - **SINC**

Emydidae
   Common Map Turtle, *Graptemys geographica* - **Threatened**
   False Map Turtle complex, *Graptemys pseudogeographica* - **Ambiguous**

Kinosternidae
   Eastern Mud Turtle, *Kinosternon subrubrum* - **Possible**

**Ambiguous** - Associated museum data is not specific enough to assign a species.
**Possible** - Not known from Kansas, however individuals/populations may yet be discovered.
**SINC** - Species In Need of Conservation: Formal state designation.
**Threatened** - Formal state designation.
Appendix B
Land Cover Designations

The Land Cover designation depicts the following 10 general land cover classes for the State of Kansas. The designations were compiled from a digital classification of Landsat Thematic Mapper (TM) imagery and made available through the Kansas Geospatial Community Commons (at http://gisdasc.ksg.ku.edu/).

*Residential* - Residential land cover consists of areas of medium density, with a more or less even distribution of vegetative cover and house/garages, to high density, represented by multiple-unit structures such as apartment complexes. Linear residential developments along transportation routes extending outward from urban areas are included. Rural subdivisions not directly connected to the core of an urbanized area are also included.

*Commercial/Industrial* - Commercial/industrial land consists of areas of intensive use with much of the land covered by structures. These areas are used predominantly for the manufacture and sale of products and/or services. This category includes the central business districts of cities, towns, and villages; suburban shopping centers and strip developments; educational, governmental, religious, health, correctional and institutional facilities; industrial and commercial complexes; and communications, power, and transportation facilities.

*Urban-Grassland* - Urban-grassland consists of areas with uses such as golf courses, zoos, urban parks, cemeteries, and undeveloped land within an urban setting. This category also includes tracts of land that have been zoned residential or commercial, but have yet to be developed.

*Urban-Woodland* - Urban-woodland consists of wooded tracts within a town or city. These wooded tracts maybe associated with golf courses, zoos, urban parks, and other undeveloped land.

*Urban-Water* - Urban-water consists of any open surface water within a town or city. This includes ponds, lakes, sewage settling ponds, etc.

*Cropland* - Cropland includes all areas in row crop and small grains, as well as harvested land and large, uniform areas of bare ground.

*Grassland* - This category includes all pasture (hayed land), rangeland, and other grasslands having insufficient trees and/or shrubs to be classified as "Forest". It does NOT include conservation reserve program (CRP) land.

*Woodland* - This class includes any wooded areas having a canopy closure of 50% and greater.

*Water* - All open water bodies, including reservoirs, lakes, ponds, rivers and streams.

*Other* - The "other" class is used to identify land cover land use classes not previously defined. In general, this class is used for exposed bare ground other than cropland. Examples include rock quarries, sand and gravel pits, sandbars, and built-up.
Appendix C
Observation Type Designations

The observation type designation depicts the following eight general classes. Determination was made for each observation at the time of capture, with the most specific criterion being selected.

Active, off-road - Observation of an individual moving about its habitat, or having been trapped in its habitat.

AOR - Observation of an individual alive on a road.

Basking - Observation of an individual or group of individuals of the same species, lying exposed to sunlight; typically used for aquatic turtles, but also for some snake and lizard observations.

Chorusing - Observation of male anurans calling either singly or groups of conspecific individuals.

Dead, off-road - Observation of an individual non-living specimen in its habitat; box turtles shells were most commonly documented.

DOR - Observation of an individual dead on a road; generally mortality due to collisions with vehicles.

Prey item - Observation resulting from the removal of a specimen from the digestive tract of another animal.

Under Cover - Observation of an individual or aggregation of the conspecifics within or underneath natural or artificial cover objects.
Appendix D-1

DWARF AMERICAN TOAD
Bufo charlesmithi, Bragg, 1954

Distribution: Map Figure 2-A-1
The Dwarf American Toad is known from the Ozark Plateau of southeastern Cherokee County and southern Cross Timbers of Chautauqua County.

Occurrence Comments:
There are 303 documented occurrences within Kansas, of which 287 are museum vouchers from the following collections (FMNH [40], KU [38], LACM [1], MHP [177], MSU [4], TNHC [4], and UIMNH [3]). Twenty of the occurrences are from literature observations.

This taxon was observed chorusing from 11 March through 11 June with a median date of 29 April. Otherwise, this species has been observed from 11 March to 3 October and is known from 95 unique localities in the state. Tissues were taken and are available from 12 Kansas specimens.

Status: Stable
Smith (1950) first pointed out the occurrence of these odd looking toads, based on specimens he discovered in Cherokee County. While not describing them as new, he noted that they possibly represented a unique form. With Smith’s comments as an impetus, Bragg (1954) described the populations from eastern Oklahoma and SE Kansas as a distinct subspecies, but noted that he could find no evidence of hybridization between this diminutive race and that of the nominate Bufo americanus. Collins (1982) mentioned the possible existence of this form in SE Kansas but declined to recognize it in the absence of more recent specimens. Collins did comment that should the form be found in Kansas, that it probably represented a distinct species. Masta et al. (2002) demonstrated that charlesmithi was a distinct clade and may merit specific recognition.

The Dwarf American Toad is merited specific status (Bufo charlesmithi) and considered a newly recognized taxon to the state of Kansas. The work of Masta et al. (2002), coupled with the apparent lack of hybrids with Bufo americanus, Bufo fowleri, or Bufo woodhousii in Kansas, Missouri, Oklahoma, or Arkansas warrants its distinction. Additionally, Keith Coleman (pers. comm.) has remarked on the dissimilarity of the calls of this taxon and its sympatric congeners.

Where this taxon occurs in the state it is by no means rare. However, future studies are necessary to determine the limits of its distribution in Kansas.

Observation Type
DOR ..............................................................7
AOR ..............................................................21
Active, off-road ...............................................3
Under cover ....................................................1
Chorusing ....................................................24

Landcover Type
Commercial/Industrial ......................................1
Cropland ........................................................6
Grassland .....................................................117
Other ..........................................................1
Residential ....................................................36
Water ..........................................................1
Woodland .......................................................... 108

**Public Land Records**
Spring River Wildlife Area .................................. 1
Appendix D-2

GREEN TOAD
Bufo debilis, Girard, 1854

Distribution: Map Figure 2-A-2
The Green Toad is currently known from rangeland/canyon systems above the Smoky Hill River and Ladder Creek drainages in Greeley, Logan, Wallace, and Wichita counties.

Occurrence Comments:
There are 64 documented occurrences within Kansas, of which 63 are museum vouchers from the following collections (KU [54], MHP [6], MVZ [2], and UMMZ [1]). This taxon was observed chorusing from 6 June through 15 August with a median date of 29 April. This species has been observed from 15 May to 15 August and is known from 16 unique localities in the state. Tissues were taken and are available from two Kansas specimens.

Status: Stable
Kansas State Threatened Species
The Green Toad was formerly more widespread in Kansas than recent records would indicate. The first records were reported by Cragin (1894) and Taylor (1929) from Morton County. Those populations in southwest Kansas were probably contiguous with populations to the south and west prior to the intensive farming practices utilized prior to the dust bowl of the 1930s.
Stan Roth (Roth and Collins, 1979) discovered a disjunct population of this species in Wallace County, and it was subsequently found to the east in Logan County (Burkhart, 1984) and to the south in Greeley and Wichita counties, Taggart (1997). These northern populations are most likely relictual, and currently represent the only recent occurrences of this taxon in Kansas.

Within the northern populations, the greatest abundance of this species is found on chalk flat prairies, Ogallala outcrops, and associated breaks along the Smoky Hill River drainage in Logan and Wallace counties. Records from Hamilton, Morton, and Scott counties are in need of verification. The records reported from Hamilton County by Taggart, 1997 are in error. Those specimens were actually from Greeley County.

A repatriation effort was initiated by the Kansas Department of Wildlife and Parks (Taggart, 1997) to introduce the species back into managed areas of their former range in Kansas. Releases were made in the early 1990s at several sites in the Cimarron National Grassland. Despite repeated surveys at the release sites from 2001 through 2005, no Green Toads have been discovered.

Futures studies of the species in Kansas should include more surveys in Morton, Stanton, and Grant counties. Additionally, population genetic analyses comparing the northern populations with those from other parts of its range may yield interesting taxonomic results from this small isolated population.

Where it currently occurs in Kansas, the Green Toad appears to be thriving. However, aspects of its biology coupled with its small disjunct distribution, leave it vulnerable to extinction in the state, as illustrated by the former populations in southwest Kansas.

Observation Type:
Active, off-road .................................................5
Chorusing .........................................................9

Landcover Type:
Cropland ..........................................................3
Grassland .......................................................44
Other................................................................2

State/Federal Land Records:
Cimarron National Grassland .................................9
Appendix D-3

FOWLER'S TOAD

*Bufo fowleri*, Hinckley, 1882

**Distribution:** *Map Figure 2-A-3*

Specimens are known from Bourbon, Crawford, and Cherokee counties in southeast Kansas. Further work is necessary to better define the western and northern limits of its range in the state. Toads are often overlooked by herpetologists and this species is probably more widespread than currently understood.

**Occurrence Comments:**

There are 14 documented occurrences within Kansas, of which 12 are museum vouchers from the following collections (BYU [5], KU [4], MHP [3], and MSU [1]). The Fowler's Toad was observed from 29 March through 2 October with a median date of 16 April and is known from 8 unique localities. Tissues were taken and are available from two Kansas specimens.

**Status:** *Unknown*

This species is reported herein as an addition to the state's herpetofauna. While, long suspected to occur in Kansas (Collins, 1992; Johnson, 2000), only recently have specimens been discovered that are assignable to this taxon. The presence of this species in Kansas was established by collections made during this study.

The status of *Bufo fowleri* as distinct from *Bufo woodhousii* was formerly controversial although now seems to be generally accepted. See Green (1996) and Sullivan et al. (1996) for discussion of the issue, and Meacham (1962), for a presentation of the evidence and delimitation of the taxon.

Most recently Masta et al. (2002), using molecular evidence, suggested that *Bufo fowleri* is most closely related to (and molecularly paraphyletic to) *Bufo terrestris*, not the closest relative of *Bufo woodhousii*, and together with *Bufo terrestris* forming the sister taxon of *Bufo americanus* plus *Bufo woodhousii*. According to these authors *Bufo fowleri* is composed of three distinctive clades, which require additional study as to their specific status.

*Bufo fowleri* is known to hybridize with *Bufo woodhousii* and *Bufo americanus* in other parts of its range, in which case the offspring may show characteristics of only one or both parent species.

**Observation Type:**

AOR: .................................................................3
Chorusing .........................................................1

**Landcover Type:**

Cropland ..........................................................5
Grassland ..........................................................6
Residential ........................................................1
Woodland ........................................................2
Appendix D-4

RED-SPOTTED TOAD
Bufo punctatus, Baird & Girard, 1852

Distribution: Map Figure 2-A-4
The occurrence of this species has been documented in western Barber County and extreme southeastern Comanche County, with the isolated populations in northern Clark County and western Morton County.

Occurrence Comments:
Occurrence data consist of 138 reports of which 133 represent museum vouchers. This study added 4 additional vouchers and 5 personal observations from Barber, Clark, and Comanche counties. Six new unique localities were added during the study, to the 33 already known. Individuals were observed most often under rocks in grassland habitats associated with canyon systems. Due to the remoteness of its occurrence and opportunistic breeding habits, few observations have been made on chorusing individuals in Kansas. Based on three recorded events, this species is known to chorus from 2 - 13 June (Figure 3); however a greater range of chorusing dates is expected. Specimens have been collected from 6 April through 4 September in Kansas. Tissues were taken and are available from six Kansas specimens.

Status: Stable
Kansas Species in Need of Conservation (SINC)
The Morton County specimen was collected in 1927 and all but one of the Clark County specimens were collected in 1936 and 1938. A single specimen was collected by Jim Knight (MHP 5250) below the dam at Clark County State Lake, in 1971; however this specimen cannot be located. The persistence of the Clark County population was further verified by a specimen taken 12 May 2005 under a rock below the state lake. The Clark County records probably represent a relictual population, as extensive survey efforts to the south and east have produced no specimens in the intervening area through southeastern Comanche County. The population that previously existed in Morton County was undoubtedly extirpated during the 1930s.

Miller (1983, 1987) studied this species in western Barber County, and contributed several new localities. Of particular importance in his study were his records of chorusing activity in Kansas.

The Barber and Comanche county populations occur over a vast area of relatively contiguous habitat, and appear to be secure. Potential threats include agricultural runoff, gypsum mining, overgrazing, and the encroachment of red cedar.

Observation Type:
AOR .................................................................2
Active, off-road ..................................................1
Under cover.....................................................17
Chorusing..........................................................9

Landcover Type:
Cropland ...........................................................4
Grassland ..................................................... 134

State/Federal Land Records:
Cimarron National Grassland .........................1
Clark Wildlife Area ........................................1
Appendix C-5

SPRING PEEPER

*Pseudacris crucifer*, (Wied-Neuwied, 1838)

**Distribution:** *Map Figure 2-A-5*

In Kansas this species is confined to the eastern border south of Johnson County. During spring chorusing it can be found calling from ditches, ponds, and vernal pools associated with riparian corridors.

**Occurrence Comments:**

Data are available from 200 occurrences at 84 unique localities for this species in Kansas. Of those, 154 are museum vouchers, 46 are observations obtained during this study, and 25 are records taken from the literature. This frog was discovered at 41 unique localities during the study. It had previously been known from 42 localities bringing the total to 83 sites in the state. Tissues were taken and are available from 46 Kansas specimens.

Specimens were observed chorusing between 20 February and 25 May, however typically chorusing activity has ceased by April (Figure 3). Calling activity was preceded by rainfall events filling backwater marshes, ponds bordered by grass or cattails, and vernal pools. Calling males were found chorusing at temperatures between 34 and 65 degrees Fahrenheit.

In Cherokee County, an attempt was made to survey the eastern half of the county for calling males by systematically driving the county roads and stopping to listen for choruses, every half-mile. By this method, several new sites were discovered in northeastern Cherokee County, along the tributaries of Shawnee and Cow creeks as the branched away from the Spring River. Much of this area is cultivated; however Spring Peepers could commonly be located where patches of riparian forest were found and associated with a vernal pool, backwater, or small farm pond.

Specimens were observed active throughout the calling period, and as late as 30 July. Despite efforts to collect this species in late summer during and after heavy rains, none have turned up.

**Status:** *Stable to increasing*

Kansas State Threatened Species

Rundquist (1977) thoroughly summarized the available information on this species. The type locality of this taxon is in Leavenworth County, however there are no additional specimens to support that record north of Miami County or even across the state line into Missouri. It is not clear from original description that animal actually came specifically from Leavenworth rather than anywhere between there and St. Louis, Missouri as Rundquist (1997) questioned.

Collins (1982) extensively surveyed the Ozark Plateau and resulted in the discovery of several new localities. He suggested at that time that this taxon be designated as state Endangered Species.

Simon (1988) reported 5-10 calling males from a site 3 miles south of Atchison in Atchison County (just north of the type locality). Subsequent surveys have failed to produce any more observations or specimens from this putative population.

Anderson and Arruda (1996) reported on newly discovered localities for this taxon in Bourbon County. Their work, led to the discovery of several additional sites in Bourbon and Crawford counties during this study.

Prior to this study, Spring Peepers were known form 42 unique localities. This study contributed an additional 42 new unique sites. Also, reliable reports of calling Spring Peepers from northeastern Allen County and southeastern Johnson County were received; however these are as yet unsubstantiated. Spring Peeper populations
have a strong foothold in the state. The marked increase in new localities noted in this study is probably attributable to our conducting extended systematic surveys early in the year.

**Observation Type:**
Active, off-road ..................................................6
Chorusing...................................................... 100

**Landcover Type:**
Cropland .........................................................12
Grassland .......................................................98
Other...............................................................1
Residential ........................................................6
Water ..............................................................7
Woodland .......................................................53

**State/Federal Land Records:**
Fort Leavenworth ...............................................1
Hollister Wildlife Area ..........................................4
Marais des Cygnes National Wildlife Refuge ...........18
Marais des Cygnes Wildlife Area............................1
Mined Land Wildlife Area....................................1
Appendix C-6

STRECKER'S CHORUS FROG

_Pseudacris streckeri_, Wright & Wright, 1933

**Distribution:** Map Figure 2-A-6

This taxon, is known from two close but disjunct populations in south-central Kansas, where it is particularly abundant in areas of sand prairie.

**Occurrence Comments:**

Data from 167 occurrences including 97 museum vouchers are available for the Strecker's Chorus Frog in Kansas. This frog was known from 17 unique localities prior this study, and an additional 10 were added during. Six museum vouchers were obtained during the study, and an additional 69 observations were recorded. Tissues were taken and are available from six Kansas specimens.

Chorusing was observed between 25 February and 28 May, however most activity had ceased by late April (Figure 3). Chorusing took place following late winter and early spring rains substantial enough to fill depressions in rangeland, cultivated fields, ditches, and ponds up to three acres. Frogs were occasionally seen moving across roads during spring rains even after chorusing in the area had stopped.

**Status:** _Stable_

Kansas State Threatened Species

Due to the disjunct and ephemeral nature of the breeding sites used by Strecker's Chorus Frogs, specific site designations for critical habitats are not made; however, whenever and wherever they occur, all wetlands and rainwater basins and pools within those portions of Barber and Harper counties located south of U.S. Highway 160, east of U.S. Highway 281, and west of a north-south line beginning at the NE corner of Section 26, T32S, R7W, Harper County and extending due south to the Kansas-Oklahoma border are considered critical habitats.

First reported from the state by Stegall (1977) from central Harper County, subsequent searches since then and prior to this study have expanded its known range into southwest Harper County and adjacent portions of extreme southeastern Barber County. Gray (1982) discovered several new localities for this taxon, and contributed much needed information on its chorusing and breeding activity. Miller (1987) reported discovering two young specimens under boards on sandy soil following a heavy rain Harper County.

While running his Kansas Anuran Monitoring Program (KAMP) route in southeastern Pratt County, Nate Davis discovered a chorus of this species near the Isabel Wildlife Area on 25 March 2004. The following evening, a voucher was secured from several males calling in water filled depression of a winter wheat field. The water covered approximately two hectares and reached a maximum depth of 0.5 meters. Other frogs observed in the same pool were _Spea bombifrons_, _Bufo woodhousii_, and _Pseudacris maculata_. The latter two species were chorusing as well.

Immediately following the initial discovery in Pratt County, an attempt was made to determine the limits of this isolated population by systematically driving nearby roads and listening for calls. All observations from that effort were made in sand prairie habitat in Pratt County and adjacent Barber and Kingman counties. Additionally, attempts were made to locate populations between those in southern Barber and Harper counties and this newly discovered population, albeit unsuccessfully. Thus the two populations are certainly disjunct.

The discovery of this northern population extended the range of this taxon further into the state another 30 miles, and does much to bolster and secure its status. Where it occurs, its distinctive call can be expected for a few weeks in late winter to
early spring (Figure 3). Surveys of additional sand prairies (particularly north of US 54 in Pratt County) may reveal the existence of more populations.

**Observation Type:**
- AOR .................................................................3
- Under cover ......................................................2
- Chorusing........................................................72

**Landcover Type:**
- Cropland .........................................................33
- Grassland..........................................................119

**State/Federal Land Records:**
No observations recorded. However, this taxon was observed and collected within 0.10 kilometers from Isabel Wildlife Area in Pratt, County.
Appendix D-7

CRAWFISH FROG

*Rana areolata*, Baird & Girard, 1852

**Distribution:** Map Figure 2-A-7

This taxon is known primarily from the Neosho, Marais des Cygnes, and northern Verdigris drainages. The northernmost Kansas records from Baker Wetlands and vicinity in Douglas County may be extirpated.

**Occurrence Comments:**

Data on Kansas populations of the Crawfish Frog comes from 474 occurrences of which 338 are museum vouchers. The difference being the 136 observations made during this study, and ten literature reports. Through the efforts of this study, the number of unique localities known for this taxon has more than doubled from 66 to 132. Tissues were taken and are available from 28 Kansas specimens. Chorusing was observed from 7 March through 5 July, however most activity has ceased by late April (Figure 3).

**Status:** Stable

Kansas Species in Need of Conservation (SINC)

Busby (1997) suggested that Crawfish Frogs were locally common in Kansas. And they may be the dominant Ranid in high quality habitat (remnant tallgrass prairie). However, he cautioned that little of this habitat exists compared to pre-settlement times.

No Crawfish Frogs were observed during 2004, despite what seemed to be ideal conditions. However, in 2005, several new localities were discovered, in Greenwood, Chautauqua, Montgomery, Wilson, Neosho, Labette, Bourbon, Linn, and Coffey counties. All of the observations made were in conjunction with breeding activity, by either hearing choruses or intercepting adults moving to a breeding site. Individuals of both sexes would congregate in larger water filled depression and small farm ponds generally (but not always) with some emergent vegetation such as cattails present. Additionally, individuals were regularly observed while attempting to cross roads on rainy nights, but only while chorusing was taking place nearby. In fact, the detection of a frog on the road, more than once revealed the existence of an adjacent chorus that we might otherwise have missed.

The Crawfish Frog is an abundant yet seldom seen component of the Kansas herpetofauna. Reports prior to Busby (1997) were generally isolated and infrequent. The Crawfish Frog’s early and relatively brief breeding season and its secretive habit of remaining in burrows the remainder of the year, creates the perception of rarity.

Despite, our increased understanding of the distribution and natural history of this species in Kansas, a cautionary note is needed. The populations of Crawfish Frogs have been extirpated from a portion of their range along the Wakarusa River near Lawrence by 1979 (von Achen, 1987). There is no apparent explanation for the disappearance, and this example further demonstrates that even the best-studied and managed systems are not exempt from such catastrophes. A repatriation attempt (J. Collins, pers. com.) into the Baker Wetlands of Crawfish Frogs from Anderson County, has not been shown to be successful.

**Observation Type:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOR</td>
<td>3</td>
</tr>
<tr>
<td>AOR</td>
<td>6</td>
</tr>
<tr>
<td>Active, off-road</td>
<td>1</td>
</tr>
<tr>
<td>Chorusing</td>
<td>165</td>
</tr>
</tbody>
</table>
**Landcover Type:**
- Commercial/Industrial ........................................ 53
- Cropland ......................................................... 82
- Grassland ...................................................... 208
- Residential ..................................................... 30
- Urban-Grassland ............................................... 6
- Water .............................................................. 1
- Woodland ....................................................... 55

**State/Federal Land Records:**
- Baker University Wetlands ................................. 63
- Hollister Wildlife Area ......................................... 1
- Marais des Cygnes National Wildlife Refuge ......... 1
- Melvern Wildlife Area ....................................... 1
Appendix D-8

**PICKEREL FROG**

*Rana palustris*, LeConte, 1825

**Distribution:** Map Figure 2-A-8
Known from the Spring River drainage in Crawford and Cherokee counties.

**Occurrence Comments:**
No occurrences of this taxon were documented in the state during this study. Furthermore, those data available from the 3 known vouchers (at 2 unique localities) are insufficient to make meaningful comments of habitat associations. Tissues are available from no Kansas specimens.

**Status:** Unknown
Historically known from three specimens in Kansas (KU 17470-1, Cherokee County, 4 mi N Baxter Springs, 1932, and KU 9488, Crawford County, Cow Creek, Pittsburg, date unknown). Due to the paucity of records, and the great intervening time period since their capture prompted this taxon to be placed on the state's Threatened species list (Platt et al., 1974). Loraine (1983) surveyed unsuccessfully for this species in the Ozark Plateau of Cherokee County. Collins (1993) questioned its existence and continued recognition in the state. Subsequently, Kirk (2001) attempted a repatriation of this taxon by releasing 120 individuals into two areas along Shoal Creek in Cherokee County during 1999 and 2000. He was able to recapture nine of the frogs between 2 and 16 weeks following their initial release and all but one had increased in mass (anywhere from 1.5 to 9 grams). Unfortunately, more recent attempts to follow-up on the status of this repatriation have failed to turn up any Pickerel Frogs.

**Observation Type:**
No observation types were recorded.

**Landcover Type:**
Commercial/Industrial ........................................1
Woodland .........................................................2

**State/Federal Land Records:**
No observations recorded.
Appendix D-9

GREEN FROG

*Rana clamitans*, Latreille, 1801

**Distribution:** Map Figure 2-A-9

This frog is known from the Spring River and its tributaries in Cherokee County. An old record from Miami County (KU 9281, which is now lost) was taken near the Marais des Cygnes River at Osawatomie on 11 July 1911.

**Occurrence Comments:**

This frog is known from 29 occurrence records in Kansas, of which 27 are museum vouchers. This study contributed 3 new vouchers, 2 new observations, and contributed 4 additional unique localities to the 8 already known. Chorusing individuals have rarely been documented in Kansas. The frog has been observed from 23 February through 25 October. Tissues were taken and are available from three Kansas specimens.

**Status:** Stable

Kansas State Threatened Species

Smith (1932) first reported the Green Frog from abandoned strip pits 3-5 miles north of Baxter Springs near the Spring River. From the same locality he also reported *Eurycea spelaeus*, *Eurycea longicauda*, and *Rana palustris*. Habitat for these taxa is marginal at best at the listed locality however established populations 3-5 miles east of Baxter Springs along Shoal Creek are well-documented.

Collins (1982) extensively surveyed the Ozark Plateau for this species without success. He suggested at that time that this taxon be designated as state Endangered Species. Miller (1985) studied this frog in southeastern Kansas, and much of our current understanding is due to his efforts. He was able to document three additional localities for this frog in the Ozark Plateau of southeastern Cherokee County.

Efforts to corroborate the Miami County record were unsuccessful during this study, however suitable habitat does exist along the Marais des Cygnes and many of its tributaries in eastern Kansas. Further support for the possible existence of a northern population is supported by specimens reported by (Daniel and Edmond, 2005) just to the east in Missouri.

This species can be found in the backwaters along the Spring River and Shoal Creek. In certain localities it can be the second most observably abundant anuran (behind the Cricket Frog). However, despite its localized abundance, it is still known from only 11 unique sites in Cherokee County. An extensive survey along the Spring River and its tributaries (Turkey, Shoal, Brush, Shawnee, and Cow creeks) would certainly help to clarify its status in the state.

**Observation Type:**

Active, off-road .................................................5

**Landcover Type:**

Grassland..........................................................3
Residential ........................................................6
Water ...............................................................1
Woodland .......................................................10

**State/Federal Land Records:**

No observations recorded.
Appendix D-10

EASTERN NARROWMOUTH TOAD
Gastrophryne carolinensis, (Holbrook, 1836)

Distribution: Map Figure 2-A-10
This small frog is known only from the extreme southeastern Cherokee County within the Spring River drainage basin. Most records are from the Ozarks Plateau; however several recent records indicate that it follows riparian corridors along Brush, Shawnee and Cow creeks to the north and west.

Occurrence Comments:
Eastern Narrowmouth Toads are known from 64 occurrences of which 37 are museum vouchers. This study contributed 9 additional vouchers, 27 personal observations, and added 32 new unique localities to the 17 already known.
Specimens were observed chorusing from 21 May to 19 July (Figure 3), from ditches, vernal pools, small creeks, and stock ponds.
Most localities were in or within 100 meters of significant woodlands. However, at the two most northern localities (along Shawnee and Cow creeks), only small sparse stands of riparian woodlands existed surrounded by grasslands. Two choruses were observed along roadside ditches within the city limits of Galena.
The species has been recorded from 23 April through 27 September, with most activity having taken place by early June. Tissues were taken and are available from five Kansas specimens.

Status: Stable
Kansas State Threatened Species
Collins (1982) extensively surveyed the Ozark Plateau for this taxon and discovered several new localities, doubling the number of known vouchers at the time (from 3 to 6). He suggested that this taxon be designated as state Endangered Species. Miller (1991) studied this frog in the Ozark Plateau and provided additional information on its distribution and habitat requirements.

During this study, the Eastern Narrowmouth Toad was found to be appreciably more abundant and wide-ranging than previously understood. Further efforts to study these frogs in Kansas should include surveys along Brush, Shawnee, and Cow creeks to better determine the northern and western limits of their range in the state.

Observation Type:
DOR .................................................................5
AOR ...............................................................3
Active, off-road .................................................2
Under cover ......................................................1
Chorusing .......................................................32

Landcover Type:
Grassland .......................................................45
Other ...............................................................1
Residential ......................................................5
Woodland ......................................................13

State/Federal Land Records:
No observations recorded. Specimens are known from within one half mile of the Spring River Wildlife Area, and the taxon undoubtedly occurs there.
Appendix D-11

EASTERN TIGER SALAMANDER
Ambystoma tigrinum, (Green, 1825)

Distribution: Map Figure 2-B-11
Most records were recorded from the Kansas River drainage basin east of Shawnee County. However, based on records from Missouri (Daniels and Edmund, 2005), this species can be expected throughout eastern Kansas.

Occurrence Comments:
The Eastern Tiger Salamander is known from 131 occurrences in the state, of which all are museum vouchers. This study contributed one additional museum voucher and unique locality (in Shawnee County). Additionally, an observation that was made in 1986 from Allen County was compiled. No tissues are available from Kansas specimens.
Specific habitat associations are difficult to make at this point, due to the low number of unique localities it is known from (3) and their overall similarity. Observations have been made from 22 February through 21 November in Kansas. Most observations are made of specimens moving during rainy nights. Occasionally, specimens are discovered under cover objects or in wells.

Status: Stable
The status of this salamander is enigmatic. Most of its known localities are within the Kansas River basin, however, even there, it is uncommon. It is doubtful that landscape changes over past 50 years have had much effect on the distribution of this taxon in Kansas. It is more likely that the populations that do exist are localized, and therefore difficult to sample.
Additional survey efforts are needed to better understand the status of this salamander in Kansas. Activities such as seining small ponds, employing pitfall traps, and road cruising on rainy nights (particularly in the fall) should yield the best results.

Observation Type:
Active, off-road ..................................................2

Landcover Type:
Commercial/Industrial .......................................65
Cropland ..........................................................5
Grassland ..........................................................7
Residential ..........................................................5
Urban-Grassland ................................................2
Water ..............................................................4
Woodland ..........................................................8

State/Federal Land Records:
Baker University Wetlands ...................................1
Clinton Wildlife Area ..........................................2
Fort Leavenworth .............................................1
Appendix D-12

EASTERN NEWT
Notophthalmus viridescens, (Rafinesque, 1820)

Distribution: Map Figure 2-B-12
The Eastern Newt is found along the wooded riparian corridors in the easternmost tier of counties from the Marais des Cygnes drainage basin south.

Occurrence Comments:
This taxon is known from 73 occurrences of which 70 are museum vouchers. This study contributed 7 museum vouchers, 3 observations, and incorporated 9 literature observations. Six new unique localities were added to the 15 known prior to this study. Tissues were taken and are available from four Kansas specimens. Individuals have been recorded from 15 February through 25 October in Kansas, with most observations taking place by late May.
Efts were taken in association with more dense woodlands. Adults have been collected from aquatic areas in association with cropland and grassland; however significant contiguous tracts of woodland habitat greater than five hectares in size were present within 100 meters in each observation.

Status: Stable
Kansas State Threatened Species
In Kansas designated critical habitat is defined as, all suitable wetlands, waters, and moist wooded bottomlands occurring within that portion of Cherokee County lying south and east of a line starting at the Kansas-Missouri border at Kansas Highway 96 in the SE 1/4 Sec. 12, T33S, R25E, then extending west along K-96 to its junction with Kansas Highway 26 at the NE corner Sec. 18, T33S, R25E, then south along K-26 to its junction with U.S. Highway 66 at SE corner Sec. 18, T34S, R24E, then south and west along U.S. 66 to the Kansas-Oklahoma border at Sec. 14, T35S, R24E. All suitable wetlands, water and moist wooded bottomland occurring within 5 air miles of the Marais des Cygnes Wildlife Area, Linn County.
This salamander is unique among Kansas amphibians in having a tri-phasic life cycle. The eggs hatch into larvae during May and June and by September have transformed into their terrestrial eft stage. After two to three years as an eft, the Eastern Newt returns to the water for good as a fully aquatic adult. At localities this species is known to occur, it can be reliably found from year to year. However, few such locations are known across its range in Kansas. Populations are geographically small, localized, and centered on suitable breeding sites.
Irwin and Collins (1994) rediscovered this species in Linn County after a 44 year lapse. They reported several new localities and commented on the breeding condition of several adults.

Observation Type:
Active, off-road ...............................................16
Under cover ......................................................3

Landcover Type:
Cropland ........................................................14
Grassland ..........................................................41
Woodland ..........................................................10

State/Federal Land Records:
Marais des Cygnes Wildlife Area.........................1
Appendix D-13

RED RIVER MUDPUPPY

_Necturus louisianensis_, Viosca, 1938

**Distribution:** Map Figure 2-B-13
This taxon is confined to the Neosho and Verdigris drainage basins in Kansas.

**Occurrence Comments:**
This species is known from 22 occurrences (all museum vouchers) in Kansas. No specimens were collected during this study, however recent specimens are known from the Neosho River at Iola, Emporia, and Neosho Falls, and the Verdigris River at Eureka. Over the past four years repeated trapping attempts were made in Marion, Coffey, Neosho, and Labette counties without success. This taxon is only known from 11 localities in Kansas. No tissues are available from Kansas specimens.

**Status: Unknown**
An obligate aquatic salamander, the Red River Mudpuppy is incapable of surviving for extended periods of time outside of water. As such, they are especially sensitive to environmental changes. The majority of the collections of this salamander were taken prior to 1960, so significant baseline data does exist. The implementation of a continued systematic survey regime at both historic and new localities is needed to adequately assess the status of this salamander in the state.

**Observation Type:**
No observation types recorded.

**Landcover Type:**
- Cropland ..........................................................4
- Grassland ..........................................................4
- Water .............................................................10
- Woodland ........................................................4

**State/Federal Land Records:**
- Flint Hills Wildlife Refuge .................................1
COMMON MUDPUPPY  
*Necturus maculosus*, (Rafinesque, 1818)

**Distribution:** *Map Figure 2-B-14*  
The Common Mudpuppy is confined to the Marais des Cygnes drainage basin in Kansas.

**Occurrence Comments:**  
This species is known from 27 occurrences in the state (all museum vouchers). No specimens were observed during this study. No tissues are available from Kansas specimens.

**Status:** *Unknown*  
Like the Red River Mudpuppy, little is known of this salamander in the state. The only recent records of this taxon in the last 20 years are from a small stretch of the Marais des Cygnes River east of Pomona in Franklin County. Systematic surveying efforts at historic and novel localities are needed to adequately assess the status of this obligate aquatic salamander within the state.

**Observation Type:**  
No observation types recorded.

**Landcover Type:**  
- Commercial/Industrial ........................................2
- Grassland .........................................................4
- Urban-Grassland ...............................................1
- Water ............................................................11
- Woodland .........................................................7

**State/Federal Land Records:**  
Melvern Wildlife Area .............................................1
Appendix D-15

LONGTAIL SALAMANDER
Eurycea longicauda, (Green, 1818)

**Distribution: Map Figure 2-B-15**
This species is known from the Ozark Plateau in extreme southeastern Cherokee County.

**Occurrence Comments:**
The Longtail Salamander is known from 196 occurrences in Kansas, of which 164 are museum vouchers. This study has contributed 5 museum specimens, 32 personal observations, and 6 new localities to the 29 localities already known.
Specimens have been reported from 1 March through 25 October, but those individuals associated with caves can undoubtedly be found year round. Tissues were taken and are available from three Kansas specimens. This species is confined to woodlands and associated leaf litter and rock cover.

**Status:** Stable
Kansas State Threatened Species
In Kansas, designated critical habitat has been defined as, all suitable wetlands, waters, and moist wooded bottom lands occurring within that portion of Cherokee County lying south and east of a line starting at the Kansas-Missouri border at Kansas Highway 96 in the SE 1/4 Sec. 12, T33S, R25E, then extending west along K-96 to its junction with Kansas Highway 26 at the NE corner Sec. 18, T33S, R25E, then south along K-26 to its junction with U.S. Highway 66 at SE corner Sec. 18, T34S, R25E, then south and west along U.S. 66 to the Kansas-Oklahoma border at Sec. 14, T35S, R24E.

Layher (2002) recommended the down-listing of this species to SINC status at such a time it is known from 20 localities and when 16 of those localities are protected in some manner. He further recommended that upon confirmation of the species continued existence at those sites five years later, it be dropped from the SINC list.
This taxon is the most wide-ranging of the Plethodontids in the Ozarkian Plateau of Kansas. This species has doubtfully seen little change in its distribution or relative abundance over the last 50 years.

**Observation Type:**
Active, off-road ...............................................38
Under cover ......................................................2

**Landcover Type:**
Grassland .........................................................7
Woodland ..................................................... 143

**State/Federal Land Records:**
No observations recorded.
Appendix D-16  
CAVE SALAMANDER  
*Eurycea lucifuga*, Rafinesque, 1822  

**Distribution:** *Map Figure 2-B16*  
This taxon is known from the Ozark Plateau of extreme southeastern Cherokee County, principally east of the Spring River and south of Short Creek. A specimen from Douglas County exists (FMNH 103284) and is undoubtedly in error.

**Occurrence Comments:**  
The Cave Salamander is known from 59 occurrences of which 40 are museum vouchers. This project yielded 2 additional vouchers, 19 observations, and 6 unique localities to the 18 already known. Tissues were taken and are available from two Kansas specimens.

The Cave Salamander is more specific in its habitat requirements than the Longtail Salamander. As its name implies, this taxon is usually found in association with caves and moist rock faces. However, on humid nights individuals can be found out among the leaf litter.

**Status:** *Stable*  
Kansas State Endangered Species  
Currently, the following areas are designated critical for Cave Salamanders:  
All caves and associated spring flows within that portion of Cherokee County lying south and east of a line beginning at the Kansas-Missouri border junction with U.S. Highway 66 at Sec. 13, T34S, R25E, then extending westerly and southerly along U.S. 66 to the Kansas-Oklahoma border at Sec. 14, T35S, R24E.

Like the Longtail Salamander this species has doubtfully seen little change in its distribution or relative abundance over the last 50 years. However, in that it is not as wide-spread and is known from fewer localities than the Longtail Salamander, it is also more sensitive to deleterious environmental effects.

Lorraine (1983) surveyed selected sites south of Shoal Creek in Cherokee County, and reported several new localities for this species. A survey of all caves and rock faces in the Kansas Ozark Plateau would help to define the extent of this taxon's range in the state.

Layher (2002) recommended the down-listing of this species to SINC status at such a time it is known from 20 localities and when 16 of those localities are protected in some manner. He further recommended that upon confirmation of the species continued existence at those sites five years later, it be dropped from the SINC list.

**Observation Type:**  
Active, off-road ...............................................20  
Under cover ......................................................1

**Landcover Type:**  
Commercial/Industrial ........................................3  
Grassland ..........................................................9  
Water ...............................................................3  
Woodland ........................................................41

**State/Federal Land Records:**  
No observations recorded.
Appendix D-17

GROTTO SALAMANDER

_Eurycea spelaea_, Stejneger, 1892

**Distribution:** Map Figure 2-B-17

The Grotto Salamander is known only from a few small springs and caves in the Ozark Plateau, along and south of Shoal Creek in extreme southeastern Cherokee County.

**Occurrence Comments:**
The Grotto Salamander is known from 85 occurrences of which 83 are museum vouchers. The vast majority of known occurrences are from the spring pool just outside Schermerhorn Park Cave and from the spring inside the cave itself. This study yielded 10 additional voucher specimens, and 2 observations. Four unique localities were added to the 13 that existed previously, however they were all in close proximity < 100 meters to a preexisting locality. Tissues were taken and are available from nine Kansas specimens.

**Status:** Stable

Kansas State Endangered Species

Until recently, Kansas populations were known as _Typhlotriton spelaeus_. Recently, Bonnett and Chippindale (2004) demonstrated that the continued recognition of _Typhlotriton_ rendered _Eurycea_ paraphyletic (unnatural) and therefore tentatively placed the monotypic genus _Typhlotriton_ into _Eurycea_. Much additional work is needed, and tissues of Kansas specimens have been made available for research in progress.

This species is known only from larvae in Kansas. Repeated attempts to locate adults over the past 50 years in Schermerhorn Park cave have been unsuccessful.

Although, well-represented and documented by specimens in the state the status of the Grotto Salamander remains precarious. While it is known from several localities, many of these sites may ultimately be shown to represent the same underground aquifer. When taken together, its dependence on underground springs, small footprint in the state, and obligate aquatic biology, the Grotto Salamander is especially sensitive to water quality degradation due to environmental contamination.

Layher (2002) recommended the down-listing of this species to SINC status at such a time it is known from 20 localities and when 16 of those localities are protected in some manner. He further recommended that upon confirmation of the species continued existence at those sites five years later, it be dropped from the SINC list.

**Observation Type:**
Active, off-road ..............................................12

**Landcover Type:**
Grassland ..........................................................5
Residential ..........................................................1
Woodland ............................................................74

**State/Federal Land Records:**
No observations recorded.
Appendix D-18

OKLAHOMA SALAMANDER
Eurycea tynerensis, (Cope, 1869)

Distribution: Map Figure 2-B-18
This species is known in Kansas from only four larval specimens collected in 1967, Ireland (1970), three of which are preserved (KU 153033-5). Populations are known to occur within 6 miles to the south and east in Oklahoma and Missouri.

Occurrence Comments:
This taxon is known only from the three occurrences reported above. None of which, occurred during this study. No tissues are available from Kansas specimens.

Status: Unknown
Kansas State Endangered Species
Originally, reported from Kansas as Eurycea multiplicata. Bonett and Chippindale (2004) restricted Eurycea multiplicata to those populations south of the Arkansas River in Arkansas and Oklahoma. Populations occurring north of the Arkansas River are assignable to E. tynerensis. Additional analyses are pending and include larval samples of all available Eurycea from Kansas. The specific identity of those populations in Kansas (should they actually exist) is likely to change again, but without reversion to E. multiplicata.

Additional survey efforts are needed to adequately determine the status of this species in Kansas.
Layher (2002) suggested that the inclusion of this taxon as a member of the state's fauna was based on the misidentification of the aforementioned larval specimens. In the lack of any published findings to the contrary, the Oklahoma Salamander is retained based on Ireland's (1970) report.

Observation Type:
No observation types recorded.

Landcover Type:
Woodland..........................................................3

State/Federal Land Records:
No observations recorded.
Appendix D-19

LESSER EARLESS LIZARD
Holbrookia maculata, Girard, 1851

**Distribution:** Map Figure 2-C-19

This lizard is known from the western two-thirds of the state. The records for Girard, Crawford County (AMNH 1450-1) are dubious and in need of verification. It was not mapped in Collins (1993) without discussion, and is not mapped here. Thirteen specimens from Elk County (KU 200-12) are recorded to county only and are not mapped. Specimens from Greenwood (UCM 5689), Grant (USNM 71509), Graham (KU 237-41, 2159), Lane (KU 10985), Marion (KU 223-6), Osborne (UMMZ 71431, KU 298) and Wilson (AMNH 2682-4) counties are given only to county and are not mapped. Pleistocene fossil specimens are known from Meade County.

**Occurrence Comments:**
The Lesser Earless Lizard is well-documented from 947 occurrences of which 945 are museum vouchers. This project produced only one additional museum voucher, and three observations at three unique localities. The species has been observed from 21 March through 19 October. It is most commonly discovered in association with loose soils and sparse vegetation. Tissues were taken and are available from one Kansas specimen.

**Status:** Declining

Within the past 10 years, this species seems to have disappeared from areas it was formerly abundant. During the course of this study only three definitive observations were made of this species. One on the Smoky Valley Ranch in Logan County and the others along the Arkansas River east of Coolidge in Hamilton County.

The majority of collections east of the Flint Hills, were made prior to 1940, and it is possible that their decline may have begun in this area. The last specimen taken from this region was in Chase County in 1963.

Platt (1985, 1998) noted the decline of this taxon over the 40+ years he monitored reptile populations in Harvey County. Lesser Earless Lizards were regularly observed and caught in traps between 1959 and 1974, however during trapping efforts in 1984, 1985, 1997, and 1998, no specimens were collected, and only one was observed (in 1984). Platt (1998) went on to recommend that more information be collected about the present distribution of this species in Kansas.

No obvious explanation can be made concerning the apparent decline of this species in Kansas, and it may merely represent natural population size fluctuations albeit writ large. Additional survey work is needed to assess the issue before a cause can be determined.

**Observation Type:**
Active, off-road ..................................................1
Under cover ..........................................................2

**Landcover Type:**
Commercial/Industrial ........................................13
Cropland ............................................................233
Grassland ..........................................................351
Other .................................................................1
Residential ..........................................................24
Urban-Grassland .................................................9
Water .................................................................22
Woodland ..........................................................7

State/Federal Land Records:
Big Basin Prairie Preserve ..................................9
Cedar Bluff Wildlife Area ......................................5
Cimarron National Grassland ...............................7
Glen Elder Reservoir ..........................................1
Kanopolis State Park ......................................... 9
Meade State Park ..............................................6
Quivira National Wildlife Refuge .........................36
Smoky Valley Ranch ........................................3
Appendix D-20

TEXAS HORNED LIZARD

*Phrynosoma cornutum*, (Harlan, 1825)

**Distribution:** *Map Figure 2-C-20*

The Texas Horned Lizard is found across the southern half of Kansas, the Flint Hills, and Smoky Hills. East of the Flint Hills the taxon may be locally abundant and consists of scattered relic populations. Pleistocene fossil specimens are known from Meade County.

**Occurrence Comments:**

The Texas Horned Lizard is known 667 occurrences of which 546 are museum vouchers. This study contributed 35 museum vouchers, 121 observations, and added 146 unique localities to the 169 previously known. This species was observed from 1 April through 3 October. It inhabits areas of loose soils (typically sandy) and sparse vegetation. Tissues were taken and are available from 26 Kansas specimens.

**Status:** *Declining*

Over the past 30 years, southern populations of Texas Horned Lizards have been dramatically declining. Although the culprit leading to the declines has yet to be positively identified, a leading theory correlates their disappearance to the spread of the introduced Red Fire Ant (*Solenopsis invicta*). This ant was introduced accidentally into the United States around the 1930s and has steadily spread northward. It was first reported in Kansas in 1998; however there is no evidence that it has become established anywhere in the state.

This study found healthy populations in the Smoky Hills, Permian Prairie, and southern High Plains. However, this taxon was conspicuously absent from the Arkansas River valley, and portions of the Flint Hills east. Platt (1985, 1998) reported the absence of Texas Horned Lizards during his studies of Harvey County populations over 40+ years, despite there being an historic record for the area.

This pattern of disappearance is similar to that shown by the Lesser Earless Lizard, albeit somewhat delayed. Further survey work is needed especially in those areas specimens were not found during this study. The continued monitoring of this species should also be a priority.

**Observation Type:**

DOR ...............................................................51
AOR................................................................91
Active, off-road ...............................................12
Under cover .....................................................1

**Landcover Type:**

Commercial/Industrial .................................26
Cropland ........................................................104
Grassland ......................................................341
Other .............................................................9
Residential ....................................................33
Urban-Grassland .........................................18
Urban-Water ..................................................1
Woodland .....................................................18

**State/Federal Land Records:**

Big Basin Prairie Preserve ............................2
Cedar Bluff Wildlife Area ........................................2
Cimarron National Grassland .................................18
Clark Wildlife Area .............................................3
Fort Riley ..........................................................8
Geary State Fishing Lake and Wildlife Area ..........1
Kanopolis State Park ...........................................4
Meade State Park ...............................................14
Meade Wildlife Area ...........................................12
Smoky Hill Weapons Range .................................3
Wilson Lake Corps Parks .....................................1
Wilson Wildlife Area ...........................................1
Appendix D-21

COAL SKINK
Plestiodon anthracinus, (Baird, 1849)

Distribution: Map Figure 2-C-21
The Coal Skink is found in heavily wooded regions of eastern Kansas, east of the Flint Hills, and south of the Kansas River.

Occurrence Comments:
This taxon is known from 86 occurrences in Kansas, all of which are museum vouchers. No Coal Skinks were observed during this study. Observations have been made from 28 February to 1 October, with most occurring in April and early May. No tissues are available from Kansas specimens.

Status: Stable
This species is a secretive, and thus a seldom-seen and poorly understood lizard. The few records available prevent an accurate description of its habitat, and the possibility can’t be ruled out that this species actually consists of scattered relictual and localized populations in the state. More survey work is needed to so that baseline data exist for future comparisons.

Observation Type:
Under cover ......................................................3

Landcover Type:
Cropland ..........................................................4
Grassland ..........................................................22
Residential ........................................................1
Water ..............................................................5
Woodland .......................................................44

State/Federal Land Records:
Clinton Lake ..................................................... 1
Montgomery State Fishing Lake .........................1
Spring River Wildlife Area ................................. 7
Appendix D-22

BROADHEAD SKINK
Plestiodon laticeps, (Schneider, 1801)

**Distribution:** Map Figure 2-C22
Known from pockets along the Marais des Cygnes, Marmaton, Spring, and lower Neosho river basins in eastern Kansas.

**Occurrence Comments:**
This species is known from 34 occurrences of which 29 are museum vouchers. This project yielded 3 museum vouchers, 5 observations, and increased the number of unique localities from 12 to 16. Tissues were taken and are available from three Kansas specimens.
Broadhead Skinks have been found from 7 March to 18 July, but are undoubtedly active later in the summer and into the fall. They are most commonly found in association with small woodlands (> 1 hectare in size) surrounded by grasslands where they may be discovered prowling around hollow trees or under surface cover.

**Status:** Stable
Kansas State Threatened Species
All of the observations made during this study were from Bourbon County. This species is nowhere observably abundant in the state, but this is probably due to its secretive and wary nature (i.e. the first Linn County specimen was collected only as recently as 1994 [Irwin and Collins, 1994]). Additional surveys are needed to locate new localities and assess historic sites.

**Observation Type:**
Under cover ......................................................8

**Landcover Type:**
Commercial/Industrial ........................................1
Grassland .......................................................18
Woodland .......................................................14

**State/Federal Land Records:**
Hollister Wildlife Area ........................................ 6
Marais des Cygnes National Wildlife Refuge ..........1
Neosho State Fishing Lake ......................................1
Appendix D-23

ITALIAN WALL LIZARD
Podarcis sicula,

Distribution: Map Figure 2-C-23
Populations of this non-native species is well-established in Topeka, Hays, and Lawrence. Reports of isolated populations of this lizard in Oxford await verification.

Occurrence Comments:
The Italian Wall Lizard is known from 123 occurrences of which 16 are museum vouchers. This study produced one additional museum voucher and 107 project observations. The number unique localities this taxon is known from increased from 4 to 108 during this study. Tissues were taken and are available from 106 Kansas specimens.

Status: Increasing
Populations of the Italian Wall Lizard and the Western Green Lacerata are the product of an introduction from the former Quivira Specialties biological supply house of Topeka at 21st and Gage Boulevard (Jim Gubanyi, pers. com.). Subsequently, populations have become established in Hays (since 1998) and Lawrence (north of the Kansas River; since 1999).
Since its introduction, the Italian Wall Lizard has expanded its range within the city limits of Topeka and can now be expected throughout the SW quarter of the city.

Observation Type:
Active, off-road ............................................. 110

Landcover Type:
Commercial/Industrial .................................28
Residential .................................................. 93
Urban-Grassland .............................................2

State/Federal Land Records:
No observations recorded.
Appendix D-24

WESTERN GREEN LACERTA
Lacerta bilineata,

Distribution: Map Figure 2-C-24
This non-native species is found only within the city limits of Topeka, Shawnee County.

Occurrence Comments:
This taxon is known from 15 occurrences of which 8 are museum vouchers. During the course of this study two additional vouchers were collected and 7 observations were made, and the number of unique localities this species was known from increased from six to nine. Tissues were taken and are available from seven Kansas specimens.

Status: Stable
Unlike the Italian Wall Lizard, there is little evidence to show that this species is expanding its range.

Observation Type:
AOR .................................................................1
Active, off-road .................................8

Landcover Type:
Commercial/Industrial .................................3
Residential ........................................12

State/Federal Land Records:
No observations recorded.
Appendix D-25

EASTERN GLOSSY SNAKE

*Arizona elegans*, Kennicott (in Baird), 1859

**Distribution:** Map Figure 2-D-25

The Eastern Glossy Snake is primarily known from Kansas, south and west of the Arkansas River valley. Isolated populations are known from Cheyenne, Gove, and Chase counties. A record for Rice County (KU 188571) exists, but lacks additional data, and therefore, is not mapped.

**Occurrence Comments:**

The Eastern Glossy Snake is known from 146 occurrences of which 117 are museum vouchers. This study contributed and additional 31 voucher specimens, 29 observations, and increased the number of unique localities known from 61 to 109.

This species has been observed from 25 April to 3 October, and inhabits areas with loose soils. It is most commonly associated with sand prairie and sandsage prairie grasslands; however it was often observed in areas surrounded by croplands. Tissues were taken and are available from 11 Kansas specimens.

**Status:** Increasing

Kansas Species in Need of Conservation (SINC)

This species is widely distributed in sandy and native prairie regions of southwestern and extreme northwestern Kansas. The recent discovery of this species along the Smoky Hill River in Gove County, coupled with its continuous distribution throughout eastern Colorado, indicates that the area between the Arkansas and Republican rivers in Kansas may yield additional records.

The type locality for *Arizona elegans blanchardi* (Holotype - CAS 10393) is listed [Klauber, 1946. Trans. San Diego Soc. Nat. Hist 10(17): 311-398] as Cheyenne County, Kansas, 13 miles southeast of Benkelman, Dundy County, Nebraska. This specimen was not listed in the report of specimens we received from CAS, and needs to be investigated as a possible third specimen from the region.

A specimen (MHP 439) was collected in 1963, 20 mi N and 2 mi W of Bird City. This locality is actually just west of Benkelman, Nebraska. The state line is well marked on K 161 north of Bird City, and so we are inclined to believe that the specimen was collected in Kansas, near where the South Fork Republican River enters Cheyenne County from Dundy County, Nebraska.

Greg Sievert and his students at Emporia State University collected an adult specimen under a rock in Chase County during the course of this study. This specimen represents a significant range extension, in what would heretofore be considered sub-marginal habitat. Subsequently they were able to secure another adult at a nearby locality also in Chase County.

This large species was abundant in Sandsage Prairie and Sand Prairie areas of western Kansas. However, they were only observed active at night. During the evenings after exceptionally warm (> 90 F) late summer and fall days, neonates could be observed en masse as they crossed roads. Hunting was especially productive at these times and yielded the majority of the observations obtained during this study. Surprisingly, employing the same methods in the eastern Arkansas River valley failed to yield any specimens.

Platt (1985, 1998) reports that though never observably abundant during his long-term studies in Harvey County, overall observations of this species has decreased. His most recent observations were of two specimens in 1997. He did note that more specimens were collected in pasture type habitats than sand prairie, although not a statistically significant difference.
Future survey efforts are needed along the western Smoky Hill River drainage, the Arkansas River drainage east of Ford County, and the upper Neosho River drainage in Marion and Chase counties.

**Observation Type:**
- DOR ..............................................................26
- AOR ...............................................................35
- Prey item .........................................................1

**Landcover Type:**
- Commercial/Industrial ........................................1
- Cropland ........................................................29
- Grassland .......................................................99
- Other ...............................................................8
- Residential .......................................................2
- Urban-Grassland ............................................... 2
- Water .............................................................. 2

**State/Federal Land Records:**
- Cimarron National Grassland .............................42
- Meade State Park ..............................................4
- Quivira National Wildlife Refuge .........................1
Appendix D-26

WESTERN HOGNOSE SNAKE

*Heterodon nasicus*, Baird & Girard, 1852

**Distribution:** *Map Figure 2-D-26*

This species is known from throughout the western two-thirds of Kansas. Pleistocene fossil specimens are known from Meade and Jewell counties.

**Occurrence Comments:**
The Western Hognose Snake is known from 351 occurrences if which 335 are museum vouchers. This studied contributed 17 museum vouchers, 16 observations, and an additional 31 unique localities. Tissues were taken and are available from two Kansas specimens.

**Status:** *Stable*

Kansas Species in Need of Conservation (SINC)

Observably abundant in the western half of the state in areas with loose sandy soils, this species becomes noticeably scarce toward the east.

Generally secretive and of medium build, this serpent easily goes undetected by the casual observer. However, its rarity is more apparent than real, as evidenced by the relatively large number unique localities (167) it has been reported from.

**Observation Type:**

- DOR ..............................................................23
- AOR ...............................................................13
- Active, off-road .................................................1
- Under cover ......................................................1

**Landcover Type:**

- Commercial/Industrial ......................................12
- Cropland ...................................................... 104
- Grassland ..................................................... 135
- Residential ......................................................32
- Water ..............................................................6
- Woodland .......................................................10

**State/Federal Land Records:**

- Cedar Bluff Wildlife Area .....................................2
- Cimarron National Grassland .................................10
- Fort Riley ..........................................................3
- Glen Elder Wildlife Area .......................................1
- Kirwin National Wildlife Refuge ............................3
- Maxwell Wildlife Refuge ......................................1
- Meade State Park ...............................................2
- Meade Wildlife Area ............................................3
- Quivira National Wildlife Refuge ......................... 7
- Sheridan Wildlife Area ........................................1
Appendix D-27  

EASTERN HOGNOSE SNAKE  
*Heterodon platirhinos*, Latreille (in Sonnini and Latreille), 1801

**Distribution:** *Map Figure 2-D-27*

This species is spottily distributed in the eastern half of Kansas, but is rather well-documented along riparian zones south and west of the Arkansas River valley and in the Smoky Hills. Pleistocene fossil specimens are known from Meade, Rice, and McPherson counties.

**Occurrence Comments:**
This taxon is known from 153 occurrences of which 148 are museum vouchers. This project contributed 11 new museum vouchers, 5 observations, and 14 new unique localities.

The species is known to be active from 1 April through 9 October in Kansas, based on reported observations. Tissues were taken and are available from three Kansas specimens.

**Status:** *Stable*

Kansas Species in Need of Conservation (SINC)

The records from the Flint Hills east are in need of corroboration, particularly the Greenwood County specimen (KU 18115) collected in 1933. Fitzgerald and Nilon (1994) and Ahrens (1997) reported recent examples of this snake from Camp Naish in urban Wyandotte County.

West of the Flint Hills this taxon is locally abundant, particularly in sandy areas, such as alluvial corridors and stabilized dune sands. These areas also support healthy populations of *Bufo woodhousii* and *B. cognatus*, the preferred food of the Eastern Hognose Snake.

**Observation Type:**
DOR .................................................................14
AOR .................................................................7

**Landcover Type:**
Commercial/Industrial ........................................12
Cropland ..........................................................31
Grassland .........................................................68
Other ......................................................................2
Residential .........................................................11
Urban-Grassland ..................................................1
Water .................................................................2
Woodland ............................................................3

**State/Federal Land Records:**
Cedar Bluff Wildlife Area ........................................1
Fort Riley ............................................................2
Meade State Park ..................................................3
Meade Wildlife Area ..............................................1
Quivira National Wildlife Refuge .........................3
Smoky Valley Ranch ..............................................2
Webster State Park ..............................................1
Appendix D-28

NIGHT SNAKE
_Hyposiglena torquata_, (Günther, 1860)

**Distribution:** Map Figure 2-D-28

Known from the rocky areas of the Permian Prairie, however its presence is conspicuously absent from Meade and southeastern Seward counties. This small snake is known from northern Clark County, extreme southeastern Comanche County, and western Barber County. Records from northwestern Oklahoma and southeastern Colorado indicate that this species should be looked for along the Cimarron River, as well as the remainder of the Permian Prairie physiographic province in Kansas.

**Occurrence Comments:**

This taxon is known from 31 occurrences in Kansas, of which 29 are museum vouchers. During this project 3 new vouchers collected, 2 other observations were made, and 4 new unique localities were discovered. This snake is known to be active in Kansas from 7 April through 20 October. Tissues were taken and are available from three Kansas specimens. An inhabitant of typically rocky grassland habitats, it is known from two distinct populations in Kansas. In western Barber and eastern Comanche counties it shows a high affinity for areas with significant gypsum outcropping characteristic of the Blaine Formation of the Nippewalla Group (Permian). The northern Clark County population is found in association with the Cretaceous Kiowa Shale and Cheyenne Sandstone.

**Status:** Stable

Miller (1987) summarized available information and added anecdotal distributional records and natural history information. Rundquist (2002) summarized all known information regarding the natural history and population status of this taxon in the state. Additionally, he contributed substantial new information on this seldom seen and little known species. Those data and his recommendations led to the down-listing of this species, from the state Threatened species list. Rundquist (2002) reported that male/female pairs have been found between 1 May and 26 May. We found a male/female pair (MHP 8260/8261) on 7 April 2004 in central Barber County.

During the 2004 field season, two specimens were collected from a new locality in Barber County. In 2005, a specimen was collected in Clark County (MHP 10783), and regurgitated a freshly consumed Southern Prairie Skink (MHP 10778).

While this taxon is known from relatively few unique localities and actual observations, its rarity is undoubtedly more perceived than actual. The Kansas populations of Night Snakes have probably changed little over the past 50 years. The greatest potential threat to its continued existence is the encroachment of Red Cedar.

**Observation Type:**
Under cover ....................................................12

**Landcover Type:**
Cropland ..........................................................4
Grassland ................................................................27

**State/Federal Land Records:**
Clark Wildlife Area ..............................................2
Appendix D-29

LONGNOSE SNAKE
Rhinocheilus lecontei, Baird & Girard, 1853

Distribution: Map Figure 2-D-29
The majority of the records come from rocky areas in the High Plains and the Permian Prairie. However, records from less easily sampled sandy areas (i.e. Pratt, southern Finney, and Logan counties) indicate that this species may be more widespread (and thus more difficult to collect) than currently understood.

Occurrence Comments:
The Longnose Snake is known from 64 occurrences in Kansas, of which 61 are museum vouchers. This study contributed 7 new museum vouchers and 3 observations. Nine new unique localities were added to the 40 known prior to this study. This species has been observed from 28 February though 27 August in Kansas, with most records coming after mid-May. Tissues were taken and are available from five Kansas specimens.
This taxon prefers fine loose Quaternary soils of alluvium, dune sand, and loess, but is also well-represented from the rockier soils throughout the Permian Nippewalla Group. Most records come from areas of sand sagebrush, and it is infrequently encountered outside of this habitat. Its fossorial habits typically preclude its discovery, and most observations occur as specimens are intercepted attempting to cross roads at night.

Status: Stable
Kansas State Threatened Species
Miller (1987) studied this snake in southwest Kansas, contributing several new localities and habitat observations. This species is known from sporadic records throughout southwestern Kansas. Recently, this species has been found along the Smoky-Hill River corridor in Logan County, Taggart and Schmidt (2002).
Like many other reptiles species along the southwest border of Kansas, there are no easily identifiable environmental threats. Their rarity undoubtedly is a function our ineptness at turning them up and thus is more apparent and perceived than real.

Observation Type:
DOR ................................................................. 8
AOR ................................................................. 3
Under cover ...................................................... 3

Landcover Type:
Cropland .......................................................... 10
Grassland .......................................................... 45
Other ............................................................... 1
Urban-Grassland .................................................. 1

State/Federal Land Records:
Cimarron National Grassland ............................... 8
Meade State Park .............................................. 1
Smoky Valley Ranch .......................................... 1
Appendix D-30

REDBELLY SNAKE
Storeria occipitomaculata, (Storer, 1839)

Distribution: Map Figure 2-D-30
This snake is known from records along the eastern two tiers of counties in Kansas. There is an old record from Phillips County (AMNH 3380, Long Island) that may represent a relictual population. Other relictual populations of this species occur in central Nebraska and in the Black Hills region of South Dakota and Wyoming.

Occurrence Comments:
This species is known from 43 occurrences in the state, of which 43 are museum vouchers. Only one specimen of the Redbelly Snake was collected during this study. It was a juvenile found DOR during a thunderstorm in Cherokee County. Three literature observations were added to the database during the study, and contribute to the total number of known occurrences. Tissues were taken and are available from one Kansas specimen.

Redbelly Snakes have been observed from 15 March through 6 November. This species belongs to the Natricines, a group of snakes that are notoriously cool-hardy; often taking advantage of even warm winter days to become active.

Status: Stable
Kansas State Threatened Species
The Redbelly Snake is small snake; adults seldom exceed 254 mm (10 in) in length. Their small size coupled with secretive habits makes them generally difficult to turn up even during optimal times of the year (most Kansas specimens have been taken in April).

This species has historically been reported to be a denizen of deep woods where it occurs. Most specimens are known from areas with substantial rock outcrops and leaf litter in association with woodlands. However, a few specimens are known from localities several hundred meters to several kilometers from significant woodlands. It is currently unclear whether our understanding of the distribution and habitat of this taxon represents a collector's bias, or if the Redbelly Snake is a more wide-ranging habitat generalists. Future studies that attempt to passively collect this species in a variety of habitats (drift fences and pitfalls) should provide the answer.

Observation Type:
DOR .................................................................1
Under cover ....................................................2

Landcover Type:
Commercial/Industrial .......................................5
Cropland .........................................................2
Grassland .......................................................8
Other ............................................................1
Residential .....................................................1
Woodland ......................................................11

State/Federal Land Records:
Clinton Lake Project Lands .............................1
Crawford State Park ........................................1
Douglas State Fishing Lake and Wildlife Area .......1
Appendix D-31

CHECKERED GARTER SNAKE
*Thamnophis marcianus*, (Baird & Girard, 1853)

**Distribution:** Map Figure 2-D-31

The Checkered Garter Snake is found along the southern Kansas border west of the Chikaskia River, in the Permian Prairie and southern Cimarron Plains.

**Occurrence Comments:**

This taxon is known from 20 occurrences of which all are museum vouchers. No observations were made during this study. No tissues are available from Kansas specimens.

Specimens have been observed in Kansas from 10 February through 23 September. The limited number of specimens available spread thinly along the southern border of Kansas, precludes any meaningful characterization of its habitat associations.

**Status:** Unknown

Kansas State Threatened Species

Perhaps the rarest snake in Kansas it is known only from a few widely spaced records along the Kansas/Oklahoma border from Sumner County through Morton County.

Miller (1987) summarized our knowledge of this species in Kansas, and little information has been obtained since then. He was especially successful in discovering this species in southwest Barber and southwest Sumner counties; however he now reports that they are encountered less frequently in these areas (Larry Miller, pers. comm. 2005). Ball (1992) reports observing 16 specimens in Morton County during the period 1985-1991. He considers them to be locally abundant, however no specimens were collected, and no specific localities were mentioned. The only existing records for Morton County are two specimens collected in 1926. The most recent verified records in the state are from southwestern Barber and southwestern Sumner counties. Future studies will be needed to determine the status of this taxon in Kansas.

**Observation Type:**

AOR.................................................................3
Active, off-road .................................................3

**Landcover Type:**

Commercial/Industrial ........................................2
Cropland .............................................................4
Grassland .............................................................11

**State/Federal Land Records:**

Cimarron National Grassland ................................. 2
Appendix D-32

ROUGH EARTH SNAKE

*Virginia striatula*, (Linnaeus, 1766)

**Distribution:** *Map Figure 2-D-32*

This species is known in Kansas only from the extreme southern Cross Timbers and eastern Cherokee Plain.

**Occurrence Comments:**

The Rough Earth Snake is known from 60 occurrences (all museum vouchers), but only from nine unique localities. This study contributed 2 of those vouchers and one unique locality. Additionally, seven literature observations were included in the total number of reported occurrences. This species has been observed between 25 March and 25 September in Kansas, however the majority of these records are from the early spring. Tissues were taken and are available from three Kansas specimens.

**Status:** *Stable*

Kansas Species in Need of Conservation (SINC)

Records from western Missouri and northeastern Oklahoma indicate that this species may ultimately be discovered along the entire length of the eastern Kansas border.

The Rough Earth Snake is known from a small number of unique localities making it susceptible to the impacts of environmental degradation. While this taxon does have a limited range in Kansas, its small size and secretive nature generally precludes its discovery. The populations in Kansas have probably changed very little over the past 50 years.

**Observation Type:**

Under cover.......................................................9

**Landcover Type:**

Grassland........................................................22
Other..............................................................10
Woodland........................................................25

**State/Federal Land Records:**

No observations recorded.
Appendix D-33

SMOOTH EARTH SNAKE

*Virginia valeriae*, Baird & Girard, 1853

**Distribution:** *Map Figure 2-D-33*

This small snake is known from the Marais des Cygnes and Kansas/Missouri River drainage systems in northeastern Kansas.

**Occurrence Comments:**

Smooth Earth Snakes are known from 55 documented occurrences in Kansas, of which 54 are museum vouchers. This study contributed 2 museum vouchers and one personal observation. An additional three observations were taken from the literature, and included in the total number of occurrences. This study increased the total number of unique localities known for this taxon from 35 to 37.

This species has been reportedly observed from 28 March through 14 October in Kansas. Most observations took place in late April through May. Tissues were taken and are available from one Kansas specimen.

**Status:** *Declining*

Kansas State Threatened Species

Similar in habits and habitat to the Redbelly Snake, the Smooth Earth Snake has a more restricted distribution. It prefers woodland/grassland ecotones and associated leaf litter.

The Smooth Earth Snake is a small fossorial snake whose rarity is undoubtedly more apparent than real. The biggest threat to its continued existence in Kansas is that of commercial and residential development. Fitzgerald and Nilon (1994) and Ahrens (1997) reported examples of this snake from Camp Naish in urban Wyandotte County. There is a need to determine the effect of development on populations, and to greater quantify the most productive habitats so that they can be set aside or mitigated.

Fitzgerald and Nilon (1994) attempted to model habitat utilization, however their results could not be generally validated due to the paucity of information available. Two components (canopy cover and litter) were found to be significant predictors, however a recent specimen collected dead following a prairie burn in Jefferson County by George Pisoni would indicate that Smooth Earth Snakes are not necessarily limited by these factors.

**Observation Type:**

AOR .................................................................1
Active, off-road ..................................................3
Under cover ......................................................4

**Landcover Type:**

Commercial/Industrial ........................................4
Cropland ..........................................................7
Grassland ..........................................................17
Other ..............................................................1
Residential ........................................................2
Water ..............................................................1
Woodland .......................................................16

**State/Federal Land Records:**

Linn County Park ................................................2
Marais des Cygnes National Wildlife Refuge ...........2
Marais des Cygnes Wildlife Area .............................1
Miami State Fishing Lake and Wildlife Area ..........1
Perry Lake Project Lands .................................1
Perry State Park ..........................................1
Perry Wildlife Area ........................................1
Appendix D-34

NEW MEXICO BLIND SNAKE
*Leptotyphlops dissectus*, (Baird & Girard, 1853)

**Distribution:** Map Figure 2-D-34

This taxon is known from the Permian Prairie and Cimarron Plains.

**Occurrence Comments:**
This species in known from 78 occurrences of which 72 are museum vouchers. This study contributed six new museum vouchers and six personal observations. Seven new unique localities were identified during the study in addition to the 35 established prior.

This taxon has been observed from 28 April though 2 September in Kansas. Most observations have taken place from May though mid-June following spring thunderstorms. Tissues were taken and are available from five Kansas specimens.

**Status:** Stable

Kansas State Threatened Species

Miller (1987) studied this snake in southwest Kansas and reports several new localities including the easternmost in Sumner County. He also relayed reports from Marty Capron of New Mexico Blind Snakes being discovered in Cowley County between Arkansas City and Winfield, however no specimens currently exist.

Little is known of the habitat requirements of this taxon in Kansas. It is most frequently discovered under rocks associated with the Permian Nippewalla Group and the Tertiary Ogallala Formation. However, several records have been taken from areas well away from outcropping or surface cover, as they came to the surface following spring and summer thunderstorms. Additionally, specimens have been unearthed in residential gardens.

Populations of New Mexico Blind Snakes in Kansas have probably remained stable over the past 50 years.

**Observation Type:**
Active, off-road .................................................2
Under cover.................................................... 24

**Landcover Type:**
Cropland ..........................................................3
Grassland ..........................................................71
Residential ........................................................1

**State/Federal Land Records:**
Big Basin Prairie Preserve ...................................2
Cimarron National Grassland ...............................4
Clark Wildlife Area ...........................................2
Meade State Park ..............................................1
Meade Wildlife Area .........................................2
Appendix D-35

COTTONMOUTH
Agkistrodon piscivorus, (Lacépède, 1789)

**Distribution:** *Map Figure 2-D-35*

The Cottonmouth is known from the Spring River drainage in Cherokee County, Kansas.

**Occurrence Comments:**

This taxon is known from five occurrences of which all five are museum vouchers. Only two of these five occurrences are thought to be authentic at this point. No Cottonmouths were observed during the course of this study. No tissues are available from Kansas specimens.

**Status:** *Unknown*

This species is a relatively recent addition to the herpetofauna of Kansas. It has a long history in the state however as summarized by Hall and Smith (1947), Collins (1978, 1982, 1993), Rundquist et al. (1978) and Fitch (1984). Less is known about the status of the Cottonmouth within Kansas than any other member of the Kansas herpetofauna. Reports of their occurrence are received regularly, even as far away as Thomas County. Most of these turn out to be any of the various species of harmless water snakes (*Nerodia, Regina*, and *Thamnophis*). However, a reliable, but as yet unverified report, suggests that a population may exist along Snow Creek east of Coffeyville. A focused attempt to systematically survey each of the drainage systems, east of Chautauqua County, as they enter Oklahoma, would help to shed light on the status and distribution of this species in Kansas.

**Observation Type:**

No observation types recorded.

**Landcover Type:**

Cropland* .........................................................2

* Both specimens are from riparian corridors bordered by croplands.

**State/Federal Land Records:**

No observations recorded. However, the specimen from east of Crestline, was 0.5 miles from the Spring River Wildlife Area.
Appendix D-36
WESTERN DIAMONDBACK RATTLESNAKE
*Crotalus atrox*, Baird & Girard, 1853

**Distribution:** *Map Figure 2-D-36*

The only known population of these large serpents is found in the vicinity of Kanopolis State Park in Ellsworth County.

**Occurrence Comments:**
This snake is known from 8 documented occurrences of which 6 are museum vouchers. This study contributed one museum voucher (from Ellsworth County) and incorporated two literature observations. Tissues were taken and are available from two Kansas specimens.

**Status:** *Unknown*


This large rattlesnake is well-documented in Woods and Alfalfa counties in Oklahoma, just across from Barber and Comanche counties in Kansas. Suitable (albeit marginal) habitat for the Western Diamondback Rattlesnake does exist in southwest Barber and southeast Comanche counties in Kansas. Reports of native individuals are known from within 10 miles (Webb, 1970) and 0.75 miles (Hall and Smith, 1947) of Kansas in Woods County, Oklahoma. And all other reported occurrences (Cowley, Lyon, Cherokee, and Crawford counties) are considered non-persistent introductions. No specimens were observed in south-central Kansas during this study, despite extensive searching (> 1,000 hrs) in the area.

Since 1991, at least eight specimens of this taxon have been observed and/or collected in the Horsethief Canyon area at Kanopolis State Park in Ellsworth County. This is almost certainly an introduced population (not relictual) however it is unknown if individuals are reproducing.

**Observation Type:**
Active, off-road ..................................................1

**Landcover Type:**
Cropland ..........................................................3
Grassland ..........................................................5

**State/Federal Land Records:**
Kanopolis State Park ...........................................2
Appendix D-37

TIMBER RATTLESNAKE
Crotalus horridus, Linnaeus, 1758

Distribution: Map Figure 2-D-37

The Timber Rattlesnake is known from the Marais des Cygnes, Kansas and Missouri drainage basins. It enters Kansas from Oklahoma in the Cross Timbers but is conspicuously absent from the Neosho River basin.

Occurrence Comments:
The Timber Rattlesnake is known from 293 occurrences in Kansas, of which 268 are museum vouchers. This study contributed 10 museum vouchers and 29 personal observations. Twelve new unique localities were discovered in addition to the 54 identified previously. Tissues were taken and are available from six Kansas specimens.

This taxon has been observed from 14 January through 29 October in Kansas, with most observations coming from May through mid-July.

The Timber Rattlesnake is most abundant in the woodland/grassland ecotone. Communal denning has been reported many times in Kansas, however it is unclear what portion of any specific population uses the den.

Riedle (1993) presented the only detailed study of the Cross Timbers populations of this species in Kansas. His work has contributed to a greater understanding of the Timber Rattlesnake in Elk, Chautauqua, and Montgomery counties.

Status: Declining
Kansas Species in Need of Conservation (SINC)

Reportedly declining throughout much of its former range, this large, shy snake is generally doing well were it occurs in Kansas. While individually well-camouflaged it is difficult for populations to escape detection, and it is generally a well-known snake where it occurs. Fitch (1984) postulated that prior to settlement, Timber Rattlesnakes were not common and that with greater control of fires and the concomitant increase in forests their populations increased. However over the past 50 years there is ample evidence suggesting an overall decline in numbers and populations.

In less urbanized areas the Timber Rattlesnake is abundant despite its large size and venomous disposition, and populations have probably changed little in the past 50 years. In urban areas, the greatest threat it faces is habitat conversion for development. In these areas (Wyandotte, Johnson, and Douglas counties specifically) populations are certainly declining.

Enough data exist to show that many populations of Timber Rattlesnakes still persist in less developed portions of Johnson, Wyandotte, and Douglas counties. Local extinctions and fragmentation has already occurred, and more is inevitable, however now is the time to ensure that enough of these areas are put away to avoid the regional extinction of this species.

Observation Type:
DOR .................................................................3
Active, off-road ................................................2
Under cover .......................................................8

Landcover Type:
Commercial/Industrial .....................................11
Cropland .........................................................18
<table>
<thead>
<tr>
<th>Land Use</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grassland</td>
<td>116</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
</tr>
<tr>
<td>Residential</td>
<td>3</td>
</tr>
<tr>
<td>Woodland</td>
<td>91</td>
</tr>
</tbody>
</table>

**State/Federal Land Records:**
- Atchison State Fishing Lake and Wildlife Area ....... 7
- Clinton Lake Project Lands ................................3
- Clinton State Park ........................................... 4
- Clinton Wildlife Area ........................................ 5
- Crawford State Park ......................................... 4
- Fort Riley .................................................... 2
- Hollister Wildlife Area ..................................... 4
- Kansas Ecological Reserves ................................. 2
- Miami State Fishing Lake and Wildlife Area ........... 4
- Tuttle Creek Lake Project Lands ........................... 1
- Tuttle Creek Lake Wildlife Area ............................ 14
Appendix D-38

PRAIRIE RATTLESNAKE

*Crotalus viridis*, (Rafinesque, 1818)

**Distribution:** *Map Figure 2-D-38*

The Prairie Rattlesnake is confined to western half of the state although it is apparently absent from much of the Arkansas River drainage east of Ford County. A specimen (KU 2327) from Republic County is not mapped due to its ambiguous locality. Pleistocene fossil specimens are known from Meade and McPherson counties. The McPherson County record is just east of the range of this species as currently defined.

**Occurrence Comments:**

The Prairie Rattlesnake is known from 456 occurrences in Kansas of which 340 are museum vouchers. This study contributed 64 voucher specimens and 116 observations. The number of unique localities was more than doubled during the study from 126 to 268. Tissues were taken and are available from 18 Kansas specimens.

This taxon has been observed in Kansas from 11 February through 12 December. Most of the reports are from May to August, but it is not uncommon for it to bask at the entrance to its brumaculum during sunny and warm winter days.

The Prairie Rattlesnake spends the winter in grassland areas when it seeks refuge from the cold in mammal burrows and rock crevices. From late spring through summer however, it ventures away from these winter retreats and utilizes most available landcover types in search of mates and/or prey.

**Status:** *Stable*

Relying primarily on anecdotal information in Klauber (1956), Fitch (1984) reported 'drastic' population declines over the past 150 years, and further commented that the decrease was accelerating and the species legitimately faced extinction in the state. However, in the same report he discusses the 70 specimens he observed in Morton County in 1984, and reports of 'Snake Hunters' catching and killing 150 in a day and 600 in a season. During this study, the Prairie Rattlesnake is one of the most commonly encountered of all snakes where it occurs, trailing only the Bullsnake in total number of observations within its range. Over time, local populations have certainly experienced fluctuations in the number of individuals and even the distribution of age classes. However, at this point there is no evidence that the Prairie Rattlesnake has experienced a decline in numbers over the past 50, and based on the comments by Fitch (1984), population numbers may actually be increasing.

This species is commercially harvested in Kansas, in conjunction with an organized 'round-up' that has occurred annually since 1991 in Wallace County. The typical harvest of Prairie Rattlesnakes during the round-up is 300-400 specimens per year. This harvest is miniscule with respect to considerable mortality this species experiences annually on Kansas highways alone (an estimate that exceeds 50,000 individuals annually). However, it is unknown what effects the take has on local populations that are repeatedly harvested each year.

Demographic data are needed that would allow us to model these effects, and more effectively manage the harvest. Schmidt and Stark (2002) provide such information for populations in Logan County; however those data are also needed for other populations in the state, specifically those that den communally.

**Observation Type:**
DOR ............................................................ 104
AOR ............................................................... 71
Active, off-road ................................................. 1
Under cover ..................................................... 2

**Landcover Type:**
Commercial/Industrial .................................. 2
Cropland .......................................................... 134
Grassland ....................................................... 242
Other .............................................................. 3
Residential ...................................................... 20
Urban-Grassland .............................................. 4
Woodland ........................................................ 1

**State/Federal Land Records:**
Cedar Bluff Wildlife Area .................................. 2
Cimarron National Grassland ............................. 16
Concannon State Fishing Lake and Wildlife Area 2
Meade State Park ............................................. 4
Meade Wildlife Area ......................................... 1
Scott State Park .............................................. 1
Sherman State Fishing Lake and Wildlife Area .... 2
Smoky Valley Ranch ........................................ 13
Appendix D-39

ALLIGATOR SNAPPING TURTLE

Macrochelys temminckii, (Harlan, 1835)

**Distribution:** Map Figure 2-E-39
The Alligator Snapping Turtle is known from the Neosho, Verdigris, Walnut, and Arkansas River Basins in Kansas.

**Occurrence Comments:**
The Alligator Snapping Turtle is known from 12 occurrences in Kansas of which five are museum vouchers. Seven of the occurrences are literature observations (mostly from Hall and Smith [1947]). This study failed to observe this turtle in the wild, but did add a photographic voucher (MHP 9597) from a specimen taken in Labette Creek in 1938. No tissues are available from Kansas specimens.

**Status: Unknown**
Listed as a Kansas Threatened Species in 1978, populations are now considered Kansas Species in Need of Conservation (SINC). The lack of evidence for a reproducing populations and the insufficient overall documentation in Kansas, is cited as the reasoning behind the decline in status (Shipman et al., 1993; but see Capron, 1975). Based on all accumulated data, Kansas specimens are best considered as transients, with insufficient populations and/or conditions to successfully reproduce.

There has already been considerable effort many knowledgeable individuals (Irwin [1985], Capron [1975, 1986, 1987], and Shipman [1993]) to assess the distribution and status of this turtle in the state. Capron (1986) noted the rapid and extensive movements (usually at night) of the specimen he was radio-tracking, indicating that individuals may be capable of substantial dispersal over their lifetime.

This turtle currently is known in Kansas only from five vouchered specimens collected in the Neosho River, Verdigris River, and Walnut River watersheds in southeastern Kansas from 1885 to 1986. Records from Woods and Kay counties in Oklahoma support the literature records for the Arkansas River drainage in Hall and Smith (1947) and indicate that this species may ultimately be discovered in the Cimarron River drainage system.

Capron (1986) described the habitat of the collection site of the only recently known specimen in Montgomery County, of being mud bottomed and with numerous pools reaching depths of six feet at normal stream levels. Many deadfalls, log jams, and pockets of leaf litter were noted at the site as well. The stream was almost completely shaded by the canopy of adjacent trees. The Spring River and Shoal Creek were evaluated as to their capacity to support this taxon, but was felt to be sub-optimal, (Capron, 1986). Capron (1986) remarked that pollution and the obstruction of low-water dams as likely reasons for the scattered low-density populations that exist in Kansas.

Shipman et al. (1993) radio-tracked the same turtle as Capron, in an effort to better characterize utilized habitat types, determine growth rates, and acquire diet information. They noted that all long-term movements of the turtle over their study were upstream, while short-term movements were not always directed upstream. Short-term movements could be substantial though, as evidenced by a movement that covered 227 meters in less than one hour. All movements were at night. Optimal sites were shown to consist of an overhead canopy, accumulated detritus, muddy substrate, and pools. Shipman et al. (1993) reported an attack by the Alligator Snapping Turtle they were tracking upon two Common Snapping Turtles.

Pritchard (1989) hypothesized that Alligator Snapping Turtles in the northern parts of their range, are older individuals. He postulates that once born, this species...
continually travels upstream. This hypothesis was further supported by the study of Shipman et al. (1993). However, a rigorous field test is warranted. If correct, the implications with respect to the numerous low-water overflow dams and low-water bridges in southeast Kansas may (as Capron, 1986 surmised) be insurmountable barriers to currently migrating individuals and inadvertently trapped existing populations.

**Observation Type:**
No observation types recorded.

**Landcover Type:**
- Commercial/Industrial ........................................1
- Grassland ........................................................2
- Water ..............................................................6
- Woodland .......................................................3

**State/Federal Land Records:**
No observations recorded.
Appendix D-40

COMMON MAP TURTLE
Graptemys geographica, (LeSueur, 1817)

Distribution: Map Figure 2-E-40
The Common Map turtle is known from the Marais des Cygnes, Verdigris, and Caney drainage systems in eastern Kansas. Additional records, KU 3267 Montgomery Co. from 1911 and KU 3285 Wilson Co. from 1911 exist, but are too imprecise to plot on the map. These records are mapped in Collins (1993). A Pleistocene fossil is known from Ellsworth County. This record is outside the currently known distribution of this species.

Occurrence Comments:
The Common Map Turtle is known from 17 occurrences of which 14 are museum vouchers. This study contributed no vouchered specimens, but did add three personal observations at three new unique localities in Chautauqua, Wilson, and Allen counties. It is now known from 9 unique localities in Kansas.

Based on the few observations that exist, this taxon has been observed in Kansas from 25 May through 19 December. Like most other aquatic turtles in Kansas, it is probably most commonly active from April through October. No tissues are available from Kansas specimens.

Status: Unknown
Kansas State Threatened Species
This turtle has been studied in Kansas by Edds (1990, 1991). Formerly considered extirpated (Capron, 1985), the rediscoveries by Edds of six new localities in the Marais des Cygnes drainage, are especially noteworthy. The Common Map Turtle is shy and retiring, usually avoiding the main stem of Kansas' larger rivers, in favor of smaller tributaries with denser canopies.

Observations from Chautauqua and Wilson counties made during this study help corroborate those specimens from the Verdigris River drainage mapped by Collins (1993). However, voucher specimens are much desired from this area, should they ever become available.

There is little evidence to suggest that populations have changed much over the past 50 years. However, because it is known from so few localities, those sites should be monitored regularly and new sites should be surveyed.

Observation Type:
Basking ............................................................1
Active, off-road .................................................2

Landcover Type:
Grassland..........................................................7
Water ..............................................................2
Woodland .........................................................3

State/Federal Land Records:
No observations recorded.
Appendix D-41

FALSE MAP TURTLE complex

Graptemys pseudogeographica, (Gray, 1831)

Distribution: Map Figure 2-E-41

Found in the rivers and streams of eastern Kansas, making it out onto the plains along the Arkansas, Saline, and Solomon Rivers. Localities mapped in Collins (1994) from Coffey County (KU 3287-8) are too imprecise to map. Pleistocene fossils are known from Meade County. This record lies well west of the currently recognized distribution of this species.

Occurrence Comments:
The False Map Turtle complex is known from 163 occurrences in Kansas, of which 121 are museum vouchers. This study yielded five museum vouchers, and 42 personal observations. And increased the number of unique localities this turtle is known from to 93. Tissues were taken and are available from six Kansas specimens.

Status: Stable

There is currently some confusion as to the taxonomy of this complex in Kansas. The work of Vogt (1993) represents the most recent and comprehensive assessment of intra- and interpopulation relationships in this complex. He demonstrated that head marking patterns among individuals were highly variable in this complex, and that they could be explained by changes in incubation temperatures within a single brood. He was able to differentiate the Ouachita Map Turtle from the others using detailed statistical analyses of skull and shell characters, and reported individuals of all three forms in Kansas.

Many of the available specimens from Kansas do not permit examination of the skull or they exist as a shell only. Consequently, we cannot with certainty assign any particular specimen to a species, and have elected instead, to retain the complex which recognizes that separate, but cryptic, species do exist. Genetic analyses coupled with additional morphological examination are needed to adequately address the distribution and status of all three species of this complex in the state.

Observation Type:
Basking .........................................................29
Active, off-road ...........................................17

Landcover Type:
Commercial/Industrial .........................................2
Cropland .....................................................32
Grassland ...................................................41
Other .........................................................3
Residential ..................................................1
Urban-Water ..................................................1
Water ..........................................................52
Woodland ....................................................17

State/Federal Land Records:
Copan Wildlife Area .........................................2
Fort Leavenworth .............................................1
Fort Riley ......................................................1
Glen Elder Reservoir .......................................16
Glen Elder Wildlife Area .................................1
**Appendix D-42**

SMOOTH SOFTSHELL

*Apalone mutica*, (LeSueur, 1827)

**Distribution:** *Map Figure 2-E-42*

Historic records indicate that the Smooth Softshell once occurred statewide.

**Occurrence Comments:**

The Smooth Softshell is known from 247 occurrences of which 247 are museum vouchers. The only specimen observed during this study was a deceased hatchling (MHP 9604) collected on September 2004 at Chaplin Nature Center along the Arkansas River in Cowley County. No tissues are available from Kansas specimens.

**Status:** *Unknown*

Most Kansas specimens were collected from the Kansas River below the low water dam at Lawrence, in association with the doctoral research of Dr. Michael Plummer (Plummer, 1975, 1977, 1977). The remainder of the known occurrences are widely scattered across the state. Despite numerous attempts to document this turtle during the study only one specimen was discovered. Possible reasons for this putative decline are unknown.

**Observation Type:**

- Dead, off-road ..................................................1

**Landcover Type:**

- Commercial/Industrial ...........................................5
- Cropland ...........................................................9
- Grassland .........................................................22
- Other .................................................................8
- Residential ........................................................3
- Urban-Grassland ..................................................5
- Water ............................................................... 183
- Woodland ..........................................................6

**State/Federal Land Records:**

- Byron Walker Wildlife Area ....................................1
- Fort Riley ...........................................................1
- Kanopolis Lake Project Lands ..................................1
- Pomona Lake Corps Parks .......................................1
- Tuttle Creek Lake Project Lands ...............................3
- Tuttle Creek Lake Wildlife Area .................................2
Appendix E  
Kansas Herpetofaunal Ecoregion Descriptions

Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources; they are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components.

1. Central Shortgrass Prairie
In the rain shadow of the Rocky Mountains, this ecoregion is characterized by a semi-arid to arid climate, with annual precipitation ranging from 13 to 20 inches. Higher and drier than the Smoky Hills to the east, much of this region comprises a smooth to slightly irregular plain having a high percentage of dryland agriculture. Potential natural vegetation is dominated by drought tolerant shortgrass prairie and large areas of mixedgrass prairie in the northwest. Center pivot irrigation, relying on ground water from the High Plains Aquifer, has increased dramatically in recent decades. Natural gas deposits, found in the south, yield a majority of natural gas produced in the Midwest.

1a. Dryland farming with areas of irrigated cropland agriculture are extensive throughout the Western Plains ecoregion. Winter wheat is the main cash crop, with smaller acreages in forage crops. The flat to rolling plains of this region are smoother, more level and generally have thicker loess-mantled uplands than other Western High Plains regions. In this region loess deposits are thickest in the north, and thinnest in the south.

1b. The Breaks ecoregion is typified by irregular plains with slopes greater than the surrounding flat and rolling plains of Western Plains. Land use is predominantly rangeland, in contrast to the cropland or mosaic of cropland and rangeland of surrounding ecoregions. Soils are silty and clayey loams, formed from eolian sediments.

1c. The sandy plains and dune areas of the Arkansas River Sandsage Prairie are a divergence from the mostly loess covered plains of adjacent ecoregions. Sandy soils, formed from eolian deposits, support a land use mosaic of primarily rangeland with areas of irrigated agriculture. Sandsage prairie was the potential natural vegetation type, different from the shortgrass and mixedgrass prairie of other neighboring ecoregions in the Shortgrass Prairie Region.

1d. The sandy plains and dune areas of the Arkansas River Sandsage Prairie are a divergence from the mostly loess covered plains of adjacent ecoregions. Sandy soils, formed from eolian deposits, support a land use mosaic of primarily rangeland with areas of irrigated agriculture. Sandsage prairie was the potential natural vegetation type, different from the shortgrass and mixedgrass prairie of other neighboring ecoregions in the Shortgrass Prairie Region.

1e. A land use mosaic of irrigated and dryland agriculture, rangeland, and areas of bare ground are characteristic of the Cimarron Plains. This region has a higher concentration of irrigated cropland and a different mix of crops: more corn, soybeans, and alfalfa than adjacent regions. Soils are formed in eolian material derived from sediments similar to the Western Plains, but sandier and with a thinner loess layer. Those areas adjacent to the Cimarron River consist primarily of moderate relief rangeland and several Ogallala Formation outcrops. South of the Cimarron River, this region is dotted with many localized areas of rolling sand prairies. Cretaceous limestones and sandstones outcrop in southwestern Stanton County.

2. Central Mixedgrass Prairie
This region is slightly lower, receives more precipitation, and is somewhat more irregular than the Shortgrass Prairie Region to the west. Once grassland, dominated by mixedgrass prairie with scattered low trees and shrubs in the south, much of this region is now in cropland, with the eastern boundary of the region marking the
eastern limit of the major winter wheat growing area of the United States. Subsurface salt deposits and leaching contribute to the high salinity found in some streams in the Northern sections. During the Permian Period several thousand feet of brick-red shales, siltstone, sandstones, and gypsum were deposited in the southern portions of this region. Erosion has exposed these deposits giving this area its characteristic red butte and mesa appearance. Unlike adjacent areas, little of this region is in cropland and much of its elevated tableland area is in sub-humid grassland and semiarid rangeland. The region has many spring-fed streams, and stream bottoms tend to be sandy, and the water is more mineralized than in adjacent regions.

2a. The Smoky Hills ecoregion was historically a mixedgrass prairie. Today, a mosaic of cropland agriculture and rangeland occurs throughout the region. Soils are silty, well drained, deep, and moderately permeable; formed in loess on uplands. The dissected plains, with broad, undulating to rolling ridge-tops are a contrast to the smoother Western Plains to the west. The easternmost sections of this region consist of undulating to hilly dissected loess plain with sandstone hills underlain by the Dakota Formation. Average annual precipitation ranges from 24 to 28 inches.

2b. The undulating to rolling sand plains of the Arkansas River Sand Prairie are a contrast to the loess-mantled regions to the north. In the north a mantle of windblown sand, sandy outwash, and dunes supports a potential natural vegetation of sand prairie bunchgrass. Center pivot irrigation is implemented to a greater degree here than in surrounding regions. The flat lowland topography of the south are comprised of loess and river valley deposits which support extensive cropland agriculture of winter wheat and grain sorghum.

2c. Irregular, dissected slopes, bluffs, and gypsum-capped red buttes typify the Red Hills Prairie. Cedar hills prairie and bluestem grama prairie cover much of the rugged landscape. Rangeland and grassland are the dominant land use and land cover with cattle grazing throughout the area. The southwestern and southeastern portions of this region are more level than the irregular slopes to the north. In these more level sections, soils are silty alluvium and more sandy than the reddish-brown silts and loams to the north. Cropland is much more common in this section, with forage crops grown on the level tabletop areas.

3. Southern Tallgrass Prairie

The Tallgrass Prairie Region has a variety of land use types. The potential natural vegetation of the region is a mosaic of tallgrass prairie and increasing oak-hickory forest towards the east. The climate is humid with rainfall averaging 28 to 40 inches per year, most of it falling during the growing season. Surface rocks are Permian to the west, Pennsylvanian and Mississippian to the east, and Quaternary Drift north of the Kansas River.

3a. Once covered with tallgrass prairie, over 90 percent of the Drift Hills are now used for cropland agriculture and much of the remainder is in forage for livestock. A combination of nearly level to gently rolling glaciated till plains and hilly loess plains, ample precipitation mainly in the growing season, and fertile, warm, moist soils make this one of the most productive areas of corn and soybeans in the world. Agricultural practices have contributed to environmental concerns, including surface and ground water contamination from soil erosion, fertilizer and pesticide applications, as well as livestock concentrations.
3b. The greater relief and deep loess hills of the Loess Hills are markedly different from the flat alluvial plain of the Missouri River which defines its eastern most boundary. Dissected hills with deep, silty, well drained soils supported a potential natural vegetation of tallgrass prairie with scattered oak-hickory forests along stream valleys. Cropland agriculture is now common and ample precipitation in the growing season supports dryland agriculture, with only a few areas requiring irrigation. Along the Missouri River alluvial plain soils are deep, silty, clayey, and sandy alluvium. They support extensive cropland, some of it irrigated. Historically the river was meandering, free flowing, and spread across the floodplain. Dams, levees, and stream channelization have profoundly altered the structure and characteristics of the river valley.

3c. The Flint Hills region is the largest remaining intact tallgrass prairie in the Great Plains. This region is characterized by rolling hills composed of shale and cherty limestone, rocky soils, and by humid, wet summers. Average annual precipitation ranges from 28 to 35 inches. Erosion of the softer Permian limestone has left the more resistant chert (or flint) deposits, producing the hilly topography and coarse soils of the area. This rocky surface is difficult to plow; consequently, the region has historically supported very little cropland agriculture. The natural tallgrass prairie still exists in most areas and is used for range and pasture land. However, some cropland agriculture has been implemented in river valleys and along the periphery of the Flint Hills, especially in the northwest corner where the topography is more level.

3d. A dense growth of blackjack oak, post oak, and oak savanna blankets the sandstone hills of the Cross Timbers, separating this region from the tallgrass prairies of the Flint Hills, and the mosaic of oak-hickory forest and tallgrass prairie of the Osage Cuestas to the east. Thick Pennsylvanian-aged sandstone-capped uplands with shale outcrops are common. Soils tend to be sandier, somewhat shallower, and drier than in surrounding regions. Woodland and rangeland are the predominant land cover/land use of this region, a change from the cropland/grassland mix that occurs to the east and the more extensive rangeland found in the Flint Hills to the west.

3g. The Ozark Plateau is a small region in Kansas. Woodlands and oak-hickory forests blanket the area and are supported by the cherty, silty, moist, and acidic soils. These soils are also highly leached, producing the least fertile area of all ecoregions in Kansas. This area is not as agricultural as bordering regions; less than one fourth of the core and half or more of the periphery of this region has been cleared for pasture and cropland. Humid, wet summers are typical and precipitation is generally greater than 40 inches per year. Mississippian-aged rocks, including the Warsaw and Keokuk cherty limestones, are geologically much older than strata in adjacent northern regions. Historically, lead and zinc mining occurred in this part of Kansas evidenced today by large remnant “chat” piles of crushed rock, which still remain where mining occurred.

3e. The Osage Plains region is a gently undulating cuesta plain composed of several alternating layers of sandstone, limestone, and shale. Topography is distinct from the more dramatic rolling hills of the Flint Hills to the west. Potential natural vegetation ranges from a mosaic of mostly tallgrass prairie in the west to a mixture of tallgrass prairie and oak-hickory forest in the east, with floodplain forests along streams. The moist, silty clay loams are formed in material weathered from limestone and shale, and support a land use composite of cropland, woodland, and grassland/rangeland.
The **Ozark Border** is a broad transition region, shifting from a mosaic of prairie and woodland to a more extensive woodland land cover especially in the north. Forest density generally increases from west to east and south to north, and land use reflects this change in the mosaic of woodland, cropland, and grassland/rangeland. The southern end is characterized by a flat erosional plain with more poorly drained and less fertile soils. Hardpan or claypan prairie types are common and found where soils have impermeable or only slightly permeable, silty clayey subsoil below the loamier surface layer. Sites are seasonally wet and usually become extremely dry during the summers. Coal strip mining has been extensive and mine tailings still exist in some areas.