FINAL REPORT

As Required by

THE ENDANGERED SPECIES ACT, SECTION 6

TEXAS
Project No: E-1-4

ENDANGERED AND THREATENED SPECIES CONSERVATION

Job No. 21

Texas Horned Lizard (Phrynosoma cornutum) Status Survey

Project Coordinator: Andrew H. Price

Principal Investigators: Wendy Donaldson
Andrew H. Price
Jack Morse

Larry D. McKinney, Ph.D.
Director
Resource Protection Division

Andrew Sansom
Executive Director
TX Parks and Wildlife Department

February 28, 1993

ABSTRACT

A survey to assess the status of the Texas Horned Lizard (Phrynosoma cornutum) in Texas was conducted in 1992. Museum specimen records were compiled to assess historical distribution and abundance, and 100 sites across the state with adequate historical records were selected and surveyed for current presence and abundance of the species. Interviews were conducted with local residents concerning potential correlative factors to horned lizard occurrence, and an extensive database compiled from 2 sighting surveys distributed by the Horned Lizard Conservation Society was also used for the same purpose. Horned lizards or evidence of their occurrence were detected at 48 of the survey sites and absent from the remaining 52 sites. These results are discussed in relation to current and historic land-use patterns, pesticide use, and the invasion of the Red Imported Fire Ant (Solenopsis invicta). The future of the Texas Horned Lizard as a component of the natural heritage of the state is also discussed. Phrynosoma cornutum serves as an excellent indicator of the general environmental health of terrestrial ecosystems in Texas.

FINAL REPORT

STATE: Texas **PROJECT NO.:** E-1-4

PROJECT TITLE: Endangered and Threatened Species Conservation.

PERIOD COVERED: September 1, 1991 through August 31, 1992.

JOB NUMBER: 21

JOB TITLE: Texas Horned Lizard Status Survey.

JOB OBJECTIVE: To assess the current and historical status of the Texas Horned Lizard (Phrynosoma cornutum) and investigate reasons for potential decline.

ACCOMPLISHMENTS

See attached report.

SIGNIFICANT DEVIATIONS

None.

PREPARED BY: Andrew H. Price, Ph.D. — 23 February 1993 (Date)

Conservation Scientist (Title)

APPROVED BY: Larry D. McKinney, Ph.D. — 2-26-93 (Date)

for Director, Resource Protection Division (Title)

Phrynosoma cornutum (Texas Horned Lizard) Status Survey

Final Report

Date Submitted: 23 February 1993

Authors: Wendy Donaldson[1,2]
Andrew H. Price[3]
Jack Morse[2]

1. Department of Zoology, University of Texas at Austin, Austin, TX, 78712-1064
2. Horned Lizard Conservation Society, PO Box 122, Austin, TX, 78767
3. Texas Parks and Wildlife Department, 4200 Smith School Road, Austin, TX, 78744

Table of Contents

INTRODUCTION

Phrynosoma cornutum, the Texas Horned Lizard, is a Texas state listed threatened species and a Federal category 2 candidate species. It was one of the first animals listed by the state of Texas as threatened, on 18 July 1977 (Texas Parks and Wildlife Code, 1987). Ten years prior to the state's adoption of protective legislation for threatened species, P. cornutum was protected from commercial collection by other state legislation (Bigony, 1981; Lantz, 1992). This protection was originally sought for P. cornutum for reasons including over-collection of specimens for the pet trade, exportation by boy scouts who traded them at national jamborees, and utilization in the curio trade. Historically, the species' range included the entire state of Texas except for the easternmost counties which constitute the Piney Woods (LBJ School of Public Affairs, 1978). Because the species occurs statewide in a variety of ecotypes, it may serve as an indicator of the general environmental health of terrestrial habitats in Texas: another "canary in the coal mine" (Eldredge, 1991).

Although P. cornutum was historically a widespread and abundant species, the current range appears to be contracting. Anecdotal information indicates P. cornutum has disappeared east of a line extending from Fort Worth to Corpus Christi except for a few isolated and introduced populations. Three primary reasons have been suggested for its decline: habitat alteration or

destruction by agriculture and urbanization, use of insecticides and other toxic chemicals on crops and to control Solenopsis invicta (the Red Imported Fire Ant), and other direct or indirect effects incurred with the invasion of Solenopsis invicta (Price, 1990).

The objectives of the Texas Horned Lizard Status Survey are to: (1) assess the historical distribution and abundance of P. cornutum in Texas, (2) assess the current distribution and abundance of P. cornutum in Texas, and (3) assess the potential factors implicated in the reported declines of this species. Funding for the status survey was made possible under Section 6 of the Endangered Species Act, a cooperative project between the Texas Parks and Wildlife Department (TPWD) and the Horned Lizard Conservation Society (HLCS), and an Interagency Cooperative Contract between TPWD and the Department of Zoology, the University of Texas at Austin.

Background on the Biology of Phrynosoma cornutum

Phrynosoma cornutum can be distinguished from the other two species of horned lizards in Texas by a beige or white middorsal stripe, sooty or dark blotches on the dorsal surface of the torso and tail, dark stripes radiating from the ocular region, a double row of abdominal fringe scales, and two elongate occipital horns which are notably sharp (Stebbins, 1985). The species ranged historically from central Kansas, extreme southwestern Missouri,

and the southeastern corner of Colorado southward and westward through most of Oklahoma and Texas, the southeastern half of New Mexico, the southeastern corner of Arizona, and into the Mexican states of Sonora, Coahuila, Nuevo Leon, Tamaulipas, San Luis Potosi, and Zacatecas (Price, 1990). P. cornutum inhabits vegetation associations such as shortgrass prairie, mesquite-grasslands, shrublands, desert scrub, and desert grasslands (Price, 1990).

Individual P. cornutum can be active from late March and early April to late October and early November, and they exhibit two different activity patterns (Potter and Glass, 1931). In early spring and late fall, activity is unimodal and limited to the midday hours; throughout the summer months, activity is bimodal and occurs from morning to early afternoon and again from early evening to sundown (Pianka and Parker, 1975; Creusere and Whitford, 1982). P. cornutum are dormant during the winter months, buried 6 to 12 inches below the soil surface (Peslak, 1985).

P. cornutum are oviparous lizards (Strecker, 1908; Cahn, 1926). Breeding occurs from April through July (Milne and Milne, 1950; Montanucci, 1989). Individuals do not reach sexual maturity until their second year (Howard, 1974; Pianka and Parker, 1975). Eggs are laid in June, July, and August in a tunnel dug at an angle approximately four to five and one half inches below the soil surface (Cahn, 1926; Hewatt, 1937; Howard, 1974). Mean clutch size has been reported as 29 and 23.7

(Ballinger, 1974; Pianka and Parker, 1975), and the range in clutch size as 18-49 (Montanucci, 1989). Hatchlings have been observed from the beginning of June through October (Howard, 1974).

P. cornutum are dietary specialists on harvester ants of the genus Pogonomyrmex (Whitford and Bryant, 1979), which constitute 69% of their diet (Pianka and Parker, 1975). P. cornutum adults must utilize several colonies of harvester ants in one day in order to meet metabolic energy requirements (Munger, 1984). They also feed opportunistically on a variety of other arthropods including grasshoppers, isopods, beetles and beetle larvae (Davis, 1941; Pianka and Parker, 1975; Cohen and Cohen, 1990). Water is obtained metabolically from ingested food, licking dew off rocks, and rain harvesting (Winton, 1917; Montanucci, 1989; Sherbrooke, 1990).

METHODS

Museum Collection Records

Museum collection records of P. cornutum through 1987 were acquired by surveying institutions listed in Edwards (1975) and others, supplemented with additional records from West Texas State University that included records to 1989. Records from the scientific literature were also collected as well as records from biologists across the state. This set of records was used to

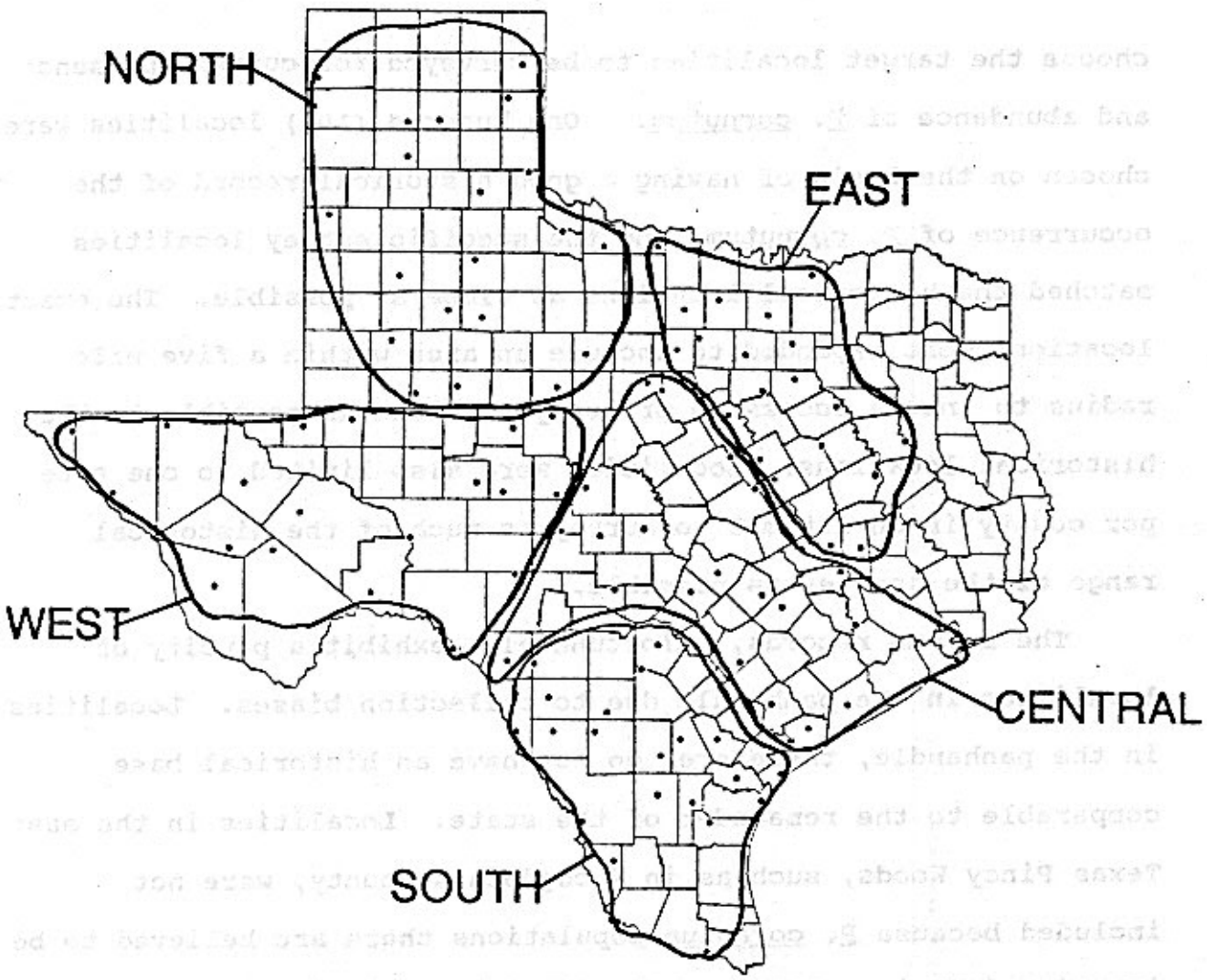


Figure 1: Sites for *Phrynosoma cornutum* Status Survey with Central, East, North, South, and West Areas Delineated. Points represent approximate* site localities.

*Exact localities were difficult to map due to discrepancies in latitude/longitude grids between Atlas Mapmaker and the 1988 County Maps of Texas.

choose the target localities to be surveyed for current presence and abundance of P. cornutum. One hundred (100) localities were chosen on the basis of having a good historical record of the occurrence of P. cornutum, and the specific survey localities matched the historical locations as close as possible. The exact locations were expanded to include an area within a five mile radius to insure access to property as close as possible to the historical locations. Localities were also limited to one site per county in an attempt to survey as much of the historical range of the species as possible.

The museum records, unfortunately, exhibit a paucity of localities in the panhandle due to collection biases. Localities in the panhandle, therefore, do not have an historical base comparable to the remainder of the state. Localities in the east Texas Piney Woods, such as in Nacogdoches County, were not included because P. cornutum populations there are believed to be introduced (Price, 1990). Alternate sites within the same counties as the preferred survey sites were also identified in anticipation of problems obtaining access to private property. The alternate sites were chosen based on the same criteria as the preferred sites. Localities were then assigned to central, east, north, south, and west divisions of the state, twenty (20) sites per area (Figure 1) in order to minimize travel distances. All references to geographic divisions of Texas made in this report will refer to these designated areas.

Sighting Survey

In conjunction with the HLCS, two separate sighting surveys were conducted in an attempt to obtain broad based information on the current and historical abundance of the Texas Horned Lizard. The first of these surveys, hereafter referred to as "survey A" (Appendix 5), was initiated in the spring of 1991 when 30 central Texas newspapers were sent survey forms to be published as a pilot test. Survey A was also distributed to members of HLCS and to individuals requesting information on the group's activities. In August 1992, *Texas Parks and Wildlife Magazine* published the sighting survey (Goin, 1992). The survey was a single page in length and consisted of 2 sections (reduced size for newspapers). In the first section, the respondent was asked the question (query 1), "Have you seen a horny toad in the last 10 years?". In the second section, the respondent was asked (query 2), " Did you used to see horny toads often?". Additional information was requested in the event of a positive answer to either question. Thus, individuals could provide information on recent and/or past sightings of P. cornutum.

The second sighting survey conducted by HLCS, hereafter referred to as "survey B", was initiated in the summer of 1992 to accompany the status survey (Appendix 5). This survey was more limited in scope than the previous survey in that respondents were only queried as to the details of current sightings of P. cornutum. The survey form along with a press release were mailed

to newspapers published in the counties where the status survey was being conducted. A total of 31 of the 197 newspapers which were sent the mailing elected to publish the survey in its original form. In addition, one newspaper published an article on the plight of the Texas Horned Lizard in which a request that sightings of the lizard be reported to the HLCS (Appendix 5). This article was subsequently picked up by the Associated Press and appeared as an AP wire release in at least 5 newspapers across Texas. Responses to this article are included in the data analyzed in this report as they represent a substantial fraction of the responses received in regard to current sightings of P. cornutum.

Data from the survey forms were entered into an electronic database, Alpha Four Version 2. From survey A, the following data were entered: date, time and county of sighting, number and sizes of lizards sighted, comments; and county of origin of the response. From survey B, the data entered included: date, time, county, exact locality, description of area, weather conditions, number and sizes of lizards, behavior of lizards, and additional comments. The database software was then used to compile county by county statistics regarding numbers of sightings of P. cornutum.

Field Survey

Field surveys were conducted using time-constrained search

techniques (Campbell and Christman, 1982). Five biologists surveyed 20 sites each, and each site was to be surveyed 3 times between 25 May and 10 October 1992. Permission to access private property was obtained prior to surveying. Data recorded at each site included: number, size (total body length and snout-to-vent length), sex, weight, and behavior of individual P. cornutum encountered; photograph of individual lizards captured against color standards; toe-clip identification number; air and soil temperatures at point of capture; time of day, date, weather conditions and location of capture. The toe-clipping procedure followed Waichman (1992) with the site identification number included as a prefix. Clipping was limited to 1 toe per foot, and clipped toes were retained and preserved in 95% ethanol for future genetic analysis. Additional information about each site was gathered including habitat characteristics, current and historic land-use practices, relative densities of Solenopsis invicta and Pogonomyrmex spp., and soil samples. Photographs of each locality were also taken. Two additional hours were spent at each site interviewing area residents about land-use and pesticide use (Appendix 3).

RESULTS

Museum Collection Records

A total of 1,629 museum specimen records, representing 207

(81.5%) of Texas' 254 counties, were compiled for P. cornutum. The earliest record is from Galveston in 1862, and continue through 1987. An additional 25 records from WTSU through 1989 were included. These museum records represent a total of 3,262 individual lizards. Unfortunately, museum records lack information about the true abundance of P. cornutum in Texas except for a few locations. A matrix of county-of-distribution X date X abundance was therefore not constructed. Instead, geographical maps were constructed using Atlas Mapmaker, Version 3.51 (Appendix 1, p. 2-11, Figures 1-10). Ten maps were constructed showing the number of lizards collected in each county during each decade, with records predating this century included together in one figure. The largest number of specimens collected was 1,077 from 151 counties in the decade 1960-1969. Of that number, 199 lizards were collected in Tom Green County alone.

The maps show that P. cornutum occurred historically throughout the state except for the far eastern counties, the latter not including counties along the Gulf Coast. P. cornutum does not appear in the far eastern counties prior to 1950. Counties from each designated survey region (Figure 1) are represented in all maps, although the north Texas area has fewer counties represented. P. cornutum is well-represented from Trans-Pecos counties in all maps. South Texas counties, especially near Mexico, also show P. cornutum with a long and continuous history. P. cornutum was collected in Bexar and

Travis counties prior to 1900 and up until 1979. It is difficult to observe any population fluctuations from museum data because the locations and quantities of P. cornutum collected reflect subjective or opportunistic decisions of individual collectors. At first glance the maps appear to show a large increase in P. cornutum during the 1950's and 1960's. These decades, however, represent a time period during which Frank Blair and his students led an active herpetological program at the University of Texas which collected specimens across the state.

Some illustrative data are available, however, for a limited number of localities at specific points in time. For example, 115 P. cornutum were collected in 1969 from the vicinity of Concho Lake, Tom Green County; 18 specimens were collected in one day at College Station, Brazos County, in 1946; 35 were collected east of Lamesa, Dawson County, in 1952; 43 were collected in one month in 1950 east of Stinnet, Hutchinson County; 24 were collected in Lubbock in 1948; 40 and 20 were collected in 1948 and 1960, respectively, from Waco, McLennan County; 14 were collected by one person in one day from Fort Stockton, Pecos County, in 1942; and 26 were collected in Wichita Falls, Wichita County, in 1919.

Horned Lizard Conservation Society Sighting Survey

The two surveys have some distinct biases. Whatever biases accrue to the readership of *Texas Parks and Wildlife Magazine*

necessarily accrue to survey A since the overwhelming number of responses came from this group. Most responses to survey B tended to come from smaller metropolitan areas, and we believe this reflects, in part, the editorial policies of the newspapers to which the survey forms were mailed. Experience has indicated that newspapers in larger metropolitan areas were less willing to publish either of the survey forms in their original format. In addition, the decision of many newspapers in the western section of the state not to print the news release/survey could well be a reflection of the political climate in that region of the state in relation to environmental and land-use issues. Respondents appeared more likely, judging by comments on survey forms, to mail in the survey if they had seen a horned lizard than if they had not seen one.

The survey responses were screened to eliminate any possibly erroneous sightings. For instance, sightings of "horned lizards" in excess of 10 inches in length were discounted as were sightings of "horned lizards" exhibitng uncharacteristic behaviors such as hopping or scurrying up trees. Sightings of horned lizards residing in "shoe boxes" or the like were not included unless the origin of the specimen could be reasonably ascertained. Sightings of dead horned lizards were included.

As the reporting of actual numbers of horned lizards sighted was often imprecise and qualitative, we decided not to attempt to compile those numbers. Instead, a positive response to query 1 or query 2 on survey A was counted as a single "current sighting"

or "historical sighting", respectively, regardless of the number of lizards reported. One such "sighting" was recorded for each county in which the respondent reported seeing or having seen horned lizards. If the number of horned lizards seen and/or other comments by respondents indicated that horned lizards were common in a given county, then the corresponding "sightings" for that county were considered to be "abundant". Responses to survey B were analyzed in a similar manner.

The following data were tabulated for survey A (Table 1, Appendix 2): the number of responses received from each county in Texas (#R); the number of current sightings of P. cornutum within each county during the period 1990-1992 (#CS); the number of current sightings categorized as abundant within each county (#A); the number of historical sightings within each county (#HS). Positive responses to query 1 in which a respondent indicated that their most recent sighting had occurred prior to 1990 were tabulated and are included in a county X decade X sighting matrix (Table 3, Appendix 2) and displayed on maps (Appendix 2, p. 2-10), but are not included in either #CS or #HS.

When the value of at least one of the categories #R, #CS or #HS was 10 or greater within a given county, the following percentages were calculated:

$$\%C = (\#CS / \#R) \times 100$$

$$\%H = (\#HS / \#R) \times 100$$

$$\%D = ((\#HS - \#CS) \times 100) / \#HS$$

These percentages reflect on a countywide basis the proportion of

sightings which are recent and historical, and a measure of the relative decline of P. cornutum, respectively. They were also calculated for total #CS, #HS, and #R for each of the 5 field survey regions.

The following numbers from survey B were tabulated for each county (Table 2, Appendix 2): the number of responses originating from that county (#R); the number of sightings within that county (#S); and the number of sightings within the county categorized as abundant (#A). The percentage of sightings categorized as abundant was also calculated when 10 or more sightings were reported within a given county.

Respondents also provided additional comments on their survey forms. Comments concerning the following categories were noted and tabulated: blood-squirting behavior; interactions with domestic animals; fire ants; harvester ants; land-use; interactions with other wildlife; pesticide use; resurgence in horned lizard populations; horned lizard population trends. It should be noted that respondents were not prompted to make comments on these particular subjects. In each instance, an effort was made to focus on specific comments in the stated categories. For instance, general comments to the effect that the respondent believed pesticide use had contributed to the decline of horned lizard populations were shunned in favor of specific comments concerning applications of pesticides.

A total of 700 responses to survey A from 119 different counties was analyzed. Of these respondents, 121 (17%) indicated

that they had not seen a horned lizard within the past 10 years while living in Texas, 570 (81%) indicated they had seen a horned lizard during this time, 398 (57%) indicated they had seen one since 1990, and 586 (84%) indicated that they used to see horned lizards often. Current and historical sightings by region are summarized as follows:

Region	#R	#CS	#HS	%D
East	175	64	186	66
Central	255	114	215	45
South	101	93	128	27
North	48	70	110	36
West	58	83	101	18

A complete county-by-county summary is included in Table 1, Appendix 2.

Although the "percent decline" (%D) in sightings certainly should not be taken as an absolute measure of the actual decline in horned lizard populations, it is useful as a relative measure of the abundance and trends of sightings between counties or regions. As one might expect, the magnitude of decline represented by sightings was greatest within counties which are home to large metropolitan areas. Bexar, Dallas, Harris, Tarrant and Travis counties had percent declines of 76%, 92%, 100%, 85% and 73%, respectively. In contrast, within the less populated counties of DeWitt, Atascosa, Lubbock and Midland (which nonetheless had a significant number of responses) the percent declines were 17%, 0%, 0% and 18%, respectively.

A total of 338 respondents reported sightings of the Texas Horned Lizard in 1992 via survey B. The sightings for each

county are presented in Table 2, Appendix 2. The results by region are:

Region	#R	#S	%A
East	133	120	28
Central	72	77	25
South	49	53	32
North	48	50	24
West	35	39	20

Except in the category of "abundance" results from the historical and current surveys are combined in the following summary of comments:

Abundance: From the historical survey, 100 of 570 (18%) sightings of the horned lizard within the past 10 years were categorized as abundant. For sightings since 1990, 86 of 398 (22%) were so categorized. For 1992 sightings, 90 of 339 (27%) were so categorized.

Blood-squirting behavior: Only 8 of 1,038 respondents (0.8%) reported having witnessed this behavior by horned lizards.

Domestic animals: Interactions between horned lizards and domestic animals were commented upon by 15 of 1,038 (1.45%) respondents. Most of these involved predation by dogs and cats. One respondent witnessed chickens preying upon horned lizards.

Fire ants: Of the 36 respondents making comments in this category, 13 reported a decline in numbers of horned lizards following an increase in the population of fire ants, 6 noted the presence of horned lizards in their area and the absence of fire ants, and 6 observed the simultaneous occurrence of both horned lizards and fire ants. Most of these latter respondents

indicated that the influx of fire ants was a recent phenomenon. One respondent from Bee County reported a decline in horned lizards prior to the influx of fire ants. Five other respondents remarked on the presence or absence of fire ants in their area without commenting on any trends in horned lizard populations.

Harvester ants: Of the 74 responses on this subject, 52 indicated having observed horned lizards in the presence of harvester ants and 15 noted a decrease in the abundance of harvester ants prior to or simultaneously with a decline in horned lizards. Most of these attributed the decline in harvester ants to active eradication efforts involving pesticides. Seven respondents remarked that harvester ants were present in their area but that horned lizards were not, and 2 remarked simply upon the absence of harvester ants.

Land-use: Comments were received from 26 respondents on this topic; no discernable trend related to horned lizard presence or abundance was apparent. Five (19%) noted a decline in horned lizards when manicured lawns appeared in their neighborhoods, whereas six (23%) noted that horned lizards were locally abundant in yards or vacant lots that were not manicured and retained native grasses. Two respondents (7.7%) noted a decline in horned lizards associated with the paving of roads. Four (15.4%) noted declines associated with cultivation of land for commercial crops such as rice, four (15.4%) noted horned lizards in abundance associated with farm land not currently in production, and three (11.5%) noted a resurgence of the species on fallow cropland.

One person (3.8%) noted a decline in the Houston area and attributed it to the overall sinking of land, creating a wetter habitat and increasing grass cover. Another respondent (3.8%) noted horned lizards were abundant on 20 acres of land cultivated to produce guar.

Other wildlife: Most of the 29 respondents commenting in this category noted predation on horned lizards by roadrunners. Some noted a decline in other wildlife populations. One particularly well presented response discussed the historical and present abundance of the coyote and its apparent effect upon horned lizard populations.

Pesticides: There were 51 respondents to this category who noted pesticide/herbicide use by themselves or other local residents. The majority of these refer to the use of pesticides to combat fire ants and/or harvester ants.

Resurgence: Resurgence of local horned lizard populations within the past few years was attested to by 22 respondents.

Population trends: Most of the 87 respondents commenting on long-term trends in horned lizard populations felt they had witnessed a significant decline in their area.

Field Surveys

The field portion of the Texas Horned Lizard Status Survey was conducted between 25 May and 10 October 1992. Appendix 3 provides a list of all site identification numbers, counties

surveyed, exact localities, survey dates, expected and observed habitat characteristics, current and historic land-use patterns, pesticide use, and additional information. Not all 100 localities originally targeted were completely searched because of weather, problems obtaining landowner permission to survey sites in west and north Texas, and other problems. At 17 original localities, property owners would not allow surveying on their property and were hostile towards the surveyor. At one locality in Presidio County, a surveyor was denied access from all property owners within 5 miles of the site, areas surrounding it, and at an alternate locality. The surveyor ultimately had to find county property to survey. At another site in east Texas, a surveyor was not allowed to resurvey after the initial visit because the landowner was subsequently told by friends to be cautious about letting anyone on his property looking for protected species; remaining visits were done on surrounding property within the 5-mile radius specified in the methods. A total of 78 localities were surveyed all 3 times, 6 were surveyed twice, 13 were surveyed once, 1 locality was surveyed once for only 2 hours, 2 localities were visited but not surveyed, and 1 locality was not visited at all. All 20 localities in central, east and south Texas and 9 localities in both north and west Texas were completely surveyed.

Phrynosoma cornutum encountered during the survey period

A total of 145 individual Phrynosoma cornutum were encountered during the field surveys, including lizards which were captured and marked, found dead, and escaped capture (Table 1, Appendix 4, p. 2-6). These included 46 females, 41 males, and 41 hatchlings and juveniles (escapees and some dead lizards were not sexed). The majority of lizards were found between 8 June and 24 August 1992 (graph 2, Appendix 4, p. 9). Encounters confirm that lizard activity during the summer months is bimodal (graph 1, Appendix 4, p. 8). Lizards were encountered in a variety of situations: 20 on dirt and paved roads, 32 under vegetation (grasses, shrubs, trees), 17 on grass clumps or mowed grass, 14 on bare soil, 3 in vegetable gardens, 1 stuck in a vine-covered piece of chickenwire fence, and 23 on open ground running into thick vegetation. Nineteen lizards escaped capture. Of the 19 dead P. cornutum, 12 were found on roads or roadsides and presumably were killed by vehicular traffic. The cause of death for the 7 remaining is unknown, but is suspected to be natural predation in at least 2 instances.

Ninety-nine P. cornutum were captured and marked at 26 localities: 2 in central Texas, 10 in south Texas, 8 in north Texas, and 6 in west Texas (Figure 11, Appendix 1, p. 12). Only 2 lizards were seen driving between locations, and only 4 were recaptured. One lizard was recaptured twice and 1 was recaptured on the day it was marked while the surveyor was walking to a new

area on the survey site.

Most P. cornutum were found in south Texas where 65 were marked, 2 during a non-survey visit to site #81. Fifty-six percent of the marked P. cornutum (55/99) were found at 5 localities: 19 at site #90 (Zavala Co.), 12 at site #29 (Frio Co.), 10 at site #2 (Aransas Co.), and 7 each at sites #22 and #81 (Duval and Uvalde Counties, respectively). All of these localities are in south Texas. No localities in other regions of the state had as many P. cornutum marked, but 2 came close. At site #92 in north Texas (Dickens Co.) 6 lizards were marked, and at site #23 in central Texas (Eastland Co.), 5 lizards were marked, 2 were found dead, and 1 escaped (Table 2, Appendix 4, p. 7).

An additional 22 localities, 4 each in central and north Texas, 8 in south Texas, and 6 in west Texas, provided evidence that P. cornutum existed, but live lizards were not encountered (Figure 11, Appendix 1, p. 12). Such evidence included fecal samples (scat), dead individuals, and landowners' sightings. At sites #24, #48 and #57 dead lizards and scat were found; only scat was found at sites #11, #14, #17, #38, #43, #50, #64, #71 and #84; scat was found and landowners reported the presence of the species at site #16; only landowners/residents' testimony was available for sites #4, #7, #13, #35, #47, #49, #54, #68 and #77. No live P. cornutum nor evidence of the species' ocurrence were found at the remaining 52 sites.

Relative abundance of Solenopsis invicta and Pogonomyrmex spp.

The size of surveyed areas varied according to habitat conditions present at each site; estimated sizes ranged from 0.83 hectares to 38 hectares. Relative abundance of Solenopsis invicta and Pogonomyrmex spp. were calculated based on the estimated area surveyed and the number of mounds counted at each site. In east Texas, the density of S. invicta was so high that the surveyor opted to record number of mounds encountered per meter along a transect rather than enumerate every mound: at 4 sites fire ant mounds occurred every 1-3 meters. In central Texas, density of fire ant mounds ranged from 0 per hectare (5 sites) to 671 per hectare. No fire ants were reported from the 9 sites completely surveyed in north Texas, and no fire ants were reported from west Texas sites. S. invicta densities in south Texas ranged from 0 per hectare (12 sites) to 281 per hectare. S. invicta was present at only 5 of the 30 localities where individual P. cornutum were marked, found dead, or escaped capture. The densities of S. invicta changed very little throughout the summer. Their activity was considerably reduced in mid and late summer when the ground dried and it was very hot. More time was required to check mounds for activity because the ants were deep underground.

Densities of Pogonomyrmex spp. were also estimated based on the number of nests encountered in each survey area. These estimates are conservative because, in many cases, surveyors

would find wandering foragers but could not locate the nest entrance. This may seem unusual since harvester ants typically clear all vegetation and debris from the nest entrance to form a characteristic circle, but in several cases nests were found without any clearing at all; only a hole in the ground was observed. Alates (winged sexuals) were observed throughout the summer on several sites in central Texas. Densities varied in all areas. In central Texas, nest densities ranged from 0 per hectare (3 sites) to 23.6 per hectare. In east Texas, densities ranged from 0 per hectare to one every 3-6 meters. In north Texas, densities ranged from 7.2 per hectare to 26.4 per hectare. In south Texas, densities ranged from 0 per hectare (1 site) to 38.3 per hectare, and in west Texas from 0 (9 sites) to 24.7 per hectare. The absence of harvester ants from some sites in west Texas is suspect because no mention of harvester ants in field notes was assumed to mean none were seen. Only 3 of the 30 sites that had positive evidence of P. cornutum lacked Pogonomyrmex and all 3 were in west Texas. The maximum density of harvester ant nests on sites with horned lizards was 38.3 per hectare. Pogonomyrmex densities changed at several locations during the course of the survey. At one location in east Texas, 4 nests were found during the last visit that had not existed during prior visits. At two locations in central Texas, 6 nests were taken over by Solenopsis invicta. Evidence of displacement included the dead bodies of harvester ants and the presence of S. invicta in the upper seed chamber of harvester ants' nests.

Resident/Property Owner Interviews: Pesticide Use

Interviews were conducted at approximately 97 localities during the survey period. Many persons were uneasy when asked questions about their property, especially questions about pesticide use. Three landowners refused to answer pesticide use questions entirely. People would also get nervous, and sometimes antagonistic, when asked for their complete names and addresses, expressing concern for retribution. Historic pesticide use is ambiguous in many cases because residents or property owners had only been on the property for 20 to 25 years, and in some cases for even shorter periods (1-5 years).

Current pesticide use is widespread throughout Texas. Pesticide use on or near the property was reported at 76 of 97 (78.4%) survey sites. Only 7 sites (7.2%) reported no pesticide use, and at 14 sites pesticide use was unknown. Pesticides and other chemicals used on insects, crops, and "weeds" included Amdro, Diazinon, diesel fuel, gasoline, Greenlight Fire Ant Killer, Orthene, Logic, Ortho Pest Granules, Spectracide, AG500, Round-up, Mirex, Malathion, Scourge in mineral oil, Resmethrin, TAT ant traps, Dursban, Sodium Silicate in baby powder, Thimet, Ridomil, Sett, Pydrin, Lorsban, Pix, Arsenic dust, 2-4D, Methyl bromide, Sevin dust and liquid, Ortho Flying Insect Spray, KGRO Fire Ant Killer, Paraquat, Valpar, Benylate, Aggie Ant Killer, Treflan, Typersan, Daconil, and Prowl. Methods of application of pesticides vary as well and included hand application on single

ant mounds, dusting entire yards or pastures, spraying small or large areas using tractors, and aerial applications by crop dusters.

Residents at 36 of the 97 localities (37.1%) used pesticides specifically to kill harvester ants. Table 2, Appendix 4, p. 7 presents information on pesticide use at the 30 sites where P. cornutum were marked, escaped or found dead. Of these sites, 22 landowners (73%) used pesticides on their property, 11 (36.7%) used pesticides on Pogonomyrmex spp. nests, and 3 (10%) reported no pesticide use. Current pesticide use at this subset of 30 sites was not appreciably different from the total set of study sites.

Pesticides which have been used in the past included DDT, Calcium Arsenate, Chlordane, and Snake Away. Information about past use is limited because many people could not remember what had been used. Individual counties have been spraying roadsides to control mosquito outbreaks for at least 25 years in some areas. One recurrent comment in the interviews is that cotton crops require the use of a wide array of chemicals. Chemical use on cotton began in the 1930's with Calcium Arsenate, but intense use of chemicals did not begin until after World War II. It is during this time that chemicals began to be used on a large number of other crops as well.

Resident/Property Owner Interviews: Land Use

Land-use in Texas is highly variable, and current land-use patterns do not necessarily reflect historic land-use. As stated previously, many residents interviewed had not lived on their property for longer than 20 or 25 years, making it difficult to gain a historical perspective on land-use. Nevertheless, abundant historical information within the last two decades as well as current information on land-use was obtained. Appendix 3 will give the reader a better understanding about how Texas landscapes have changed throughout this century, and the notes section also provides some interesting insights concerning the interactions of people with horned lizards. This section will describe land-use in 3 parts: sites where P. cornutum were captured, sites where only evidence of lizards was found (scat, dead lizards, or landowner sightings), and sites where no evidence was found.

Land-use at 13 of the 26 sites where P. cornutum were captured and marked consisted primarily of ranch land for grazing cattle. These sites had also been used historically for ranching for 30-100 years. Some ranches have limited areas of agricultural crops surrounding them. Small parcels on ranches are planted in corn, oats, or hay for livestock to eat during the winter. Of the remaining sites, 3 were state parks and 1 was a National Park. Six sites were in small communities or residential areas bordered by ranch land. One site had been a

vegetable farm since 1948 with minimal pesticide use reported (Appendix 3, Site #80). One site was a county airport that rarely received aircraft, and the land-use at the remaining site is unknown because the information was not recorded during the single visit.

Land-use at the 22 sites where only evidence of P. cornutum was found included ranching, small communities, state parks and wildlife management areas (WMA), and a resort community. Eleven sites were ranches, 2 of which had been cropland until 1980, 4 were surrounded by cropland, and 1 was heavily grazed. The ranches had existed for 12 to 40+ years. Three sites were small communities, 1 of which was cropland approximately 30 years ago and 1 of which was surrounded by cropland. Four sites were state parks or WMAs. The WMA was surrounded by cropland, and 1 state park was situated where increasing condominium development had taken place during the last 5 years. One site was a resort community that left the back section undeveloped except for a maze of dirt roads and cut and cleared swaths.

Land-use at the sites where no evidence of P. cornutum was found is more variable. Twelve sites were residential/urban areas. Three sites were small residences with pastures which had existed 7-25 years. Two sites were small communities situated in the middle of cropland. Ten sites were cattle ranches, with unknown use 4-25 years prior to surveys. Four sites were cattle ranches which had previously been cropland. Four sites were cattle or horse ranches with cropland. Four sites were

completely cropland. Two sites were adjacent to county airports, 1 of which was also used to produce hay twice a year. Six sites were state parks and recreational areas. The recreational areas were generally described as high-use.

DISCUSSION

Phrynosoma cornutum populations appear to be robust in south Texas, where individuals were captured and marked at 10 localities, and evidence of the presence of P. cornutum was found at an additional 8 localities. The Texas Horned Lizard also appears to be doing fairly well in north and west Texas; however, the inability to completely survey some sites in both areas render the results somewhat ambiguous. West Texas, in particular, should have produced better results, since the species is historically common and none of the putative factors influencing populations of this species are known to be operating there. The field survey confirms that the greatest decline of P. cornutum has occurred in east Texas where no individuals were found. Central Texas also shows an apparent loss of populations; only 6 sites show positive evidence that lizards were still there, and lizards were actually captured at only 2 of these sites. At the remaining 4 sites, lizards had only been seen rarely by property owners or only scat were found.

Pesticide use does not seem to be a strong correlate to the presence or absence of P. cornutum since the percentage of sites

with positive evidence of the lizard and use of pesticides is similar to that for all sites. Pesticide use information is qualitative, however, and the assumption that pesticides play no part in declining P. cornutum populations should be viewed with caution. Results show that 37% of property owners are currently using pesticides to kill Pogonomyrmex; since the Texas Horned Lizard specializes on these ants for food, eliminating them will have a negative effect on populations in the future. It is also not known how P. cornutum may be affected if individual lizards eat poisoned ants. Hibernating or aestivating lizards and incubating eggs may also be susceptible to applied chemicals that leach through the soil. Pesticide use did not become widespread in Texas until the late 1940's-early 1950's, and pesticides are used in larger quantities on cropland than land with other uses.

In the scope of this study, land-use is the primary indicator for the presence or absence of P. cornutum. Agriculture seems to be the primary correlate with the absence of P. cornutum populations on the study sites, with urbanization running a close second. Agricultural activities can directly lead to declining populations through several different avenues. Since horned lizards hibernate or aestivate at soil depths routinely disturbed by plowing or tilling, such activity may kill them directly or indirectly by exposing lizards to harsh climatic conditions they seek to avoid. If plowing occurs in the summer, incubating P. cornutum eggs could be destroyed. Plowing land also destroys the habitat of P. cornutum, forcing lizards into

surrounding, often sub-optimal habitats as witnessed by several property owners questioned during this survey. Crops also tend to promote the use of chemicals in the area. Several persons interviewed said that P. cornutum were abundant around and in cotton fields in the 1930's and 1940's, when pesticide use was low and cotton was hand-picked instead of being harvested by using defoliants and machines.

The impact of Solenopsis invicta on P. cornutum is unclear. Many areas where this ant species occurs in high densities are also areas subject to landscape disturbances (Porter and Savignano, 1990). Five reports of P. cornutum swarmed by ants were reported, but the lizards were already dead, and their deaths cannot be directly linked to fire ants. S. invicta may impact P. cornutum in a variety of ways, however. It is unknown whether horned lizards can forage and develop normally on a diet consisting of S. invicta when other ant species become rare. Evidence that fire ants kill other arthropods including Pogonomyrmex spp. was recorded during this status survey, and their negative impacts on the diversity and abundance of native arthropods have been well documented (Porter and Savignano, 1990). Such impacts may decrease the availability of adequate food resources to the Texas Horned Lizard. Another feature of S. invicta which may affect P. cornutum is the subterranean foraging tunnel system these ants construct below their mounds (Markin et al., 1975). In areas of high S. invicta densities, it may be impossible for horned lizard eggs to incubate or individuals to

hibernate successfully.

PROJECTED OUTLOOK FOR *PHRYNOSOMA CORNUTUM* IN TEXAS

Populations of *Phrynosoma cornutum* in south and far west Texas will probably remain stable unless landscape-scale changes occur in land use. *Solenopsis invicta* is not expected to invade most of south Texas because of the hot, dry climate, but probably will invade urban and residential areas as it has in west Texas (Drees and Vinson, 1991). We suspect the remaining disjunct populations in east and central Texas will continue to decline with continued agricultural activities and urbanization, with the ongoing invasion of *Solenopsis invicta* a contributing factor. Populations in north Texas may also be expected to decline in areas where these factors operate.

Conservation measures to restore *Phrynosoma cornutum* to areas where the species has declined or disappeared should address the re-establishment of native vegetation communities, and the maintenance of vegetation corridors which remain unplowed and untreated with broadcast chemicals. Domestic animals such as dogs and cats should be controlled as well to reduce predation pressure. Conservation measures should also seek to prevent the invasion of *Solenopsis invicta*, or to control this species while minimizing impacts to native arthropod communities. It should perhaps go without saying that commercial trade in this species should be curtailed and existing regulations to that effect

enforced.

ACKNOWLEDGEMENTS

We would like to thank field assistants Mark Brogley, Scott Burt, and Matthew Reid for all of their hard work. This project would not have been successful without the additional help of Randy Donaldson who was instrumental in coordinating communications with field assistants and the design of the choroplethic maps. Melanie Typaldos and John Smith were also key persons who organized and mailed out the Horned Lizard Conservation Society sighting surveys. Eric Pianka was helpful in many ways, and his longstanding interest in horned lizards was inspirational in this study. Finally we wish to thank all of those citizens who responded to our various entreaties, thereby demonstrating their genuine concern for the natural heritage of Texas.

BIBLIOGRAPHY

Ballinger, Royce E. 1974. Reproduction of the Texas Horned Lizard, Phrynosoma cornutum. Herpetologica 30(4):321-327.

Bigony, Mary-Love. 1981. When was the last time you saw a horned lizard? Texas Parks and Wildl. Mag. 39(2):28-31.

Cahn, Alvin R. 1926. The breeding habits of the Texas horned toad, Phrynosoma cornutum. Amer. Nat. 60:546-551.

Campbell, Howard W. and Steven P. Christman. 1982. Field techniques for herpetofaunal community analysis, p. 193-200. In Norman J. Scott, Jr. (ed.), Herpetological communities. U. S. Dept. Interior, Fish Wildl. Serv., Wildl. Res. Rep. (13):iv + 239 p.

Cohen, Allen C. and Jacqueline L. Cohen. 1990. Ingestion of blister beetles by a Texas Horned Lizard. Southwest. Nat. 35(3):369.

Creusere, F. Michael and Walter G. Whitford. 1982. Temporal and spatial resource partitioning in a Chihuahuan Desert lizard community, p. 121-127. In Herpetological communities, op cit.

Davis, David E. 1941. Food of an introduced horned lizard. Herpetologica 2(3):70.

Drees, Bastiaan M. and S. Bradleigh Vinson. 1991. Fire Ants and their Management. Texas Agri. Ext. Serv., Texas A&M Univ., College Station.

Edwards, Stephen R. (ed.). 1975. Collections of preserved amphibians and reptiles in the United States. SSAR Herp. Circ. (3):1-22.

Eldredge, Niles. 1991. The Miner's Canary. Prentice Hall Press, New York.

Goin, Jim. 1992. Requiem or recovery? Texas Parks and Wildl. Mag. 50(8):28-35.

Hewatt, Willis G. 1937. Courting and egg-laying habits of Phrynosoma cornutum. Copeia 1937(4):234.

Howard, C. Wayne. 1974. Comparative reproductive ecology of horned lizards (genus Phrynosoma) in southwestern United States and northern Mexico. J. Arizona Acad. Sci. 9(3):108-116.

Lantz, John. 1992. Correcting horned toad myths. Abilene Reporter-News. 13 September 1992.

LBJ School of Public Affairs. 1978. Preserving Texas' natural heritage. LBJ School Pub. Aff., Pol. Res. Proj. Rept. (31):ix + 34 p.

Markin, George P., J. O'Neal, and J. Dillier. 1975. Foraging tunnels of the Red Imported Fire Ant, Solenopsis invicta (Hymenoptera, Formicidae). J. Kansas Entomol. Soc. 48(1):83-89.

Milne, Lorus J. and Margery J. Milne. 1950. Notes on the behavior of horned toads. Amer. Midl. Nat. 44(3):720-741.

Montanucci, Richard R. 1989. Maintenance and propagation of horned lizards (Phrynosoma) in captivity. Bull. Chicago Herpetol. Soc. 24(12):229-238.

Munger, James C. 1984. Optimal foraging? Patch use by horned lizards (Iguanidae: Phrynosoma). Amer. Nat. 123(5):654-680.

Peslak, John, Jr. 1985. Texas Horned Lizard. Texas Natural History, Summer 1985:17-22.

Pianka, Eric R. and William S. Parker. 1975. Ecology of horned lizards: a review with special reference to Phrynosoma platyrhinos. Copeia 1975(1):141-162.

Potter, George E. and H. Bentley Glass. 1931. A study of respiration in hibernating horned lizards, Phrynosoma cornutum. Copeia 1931(3):128-131.

Porter, Sanford D. and Dolores A. Savignano. 1990. Invasion of

polygyne fire ants decimates native ants and disrupts arthropod community. Ecology 71(6):2095-2106.

Price, Andrew H. 1990. Phrynosoma cornutum. Cat. Amer. Amphib. Rept.:469.1-469.7.

Sherbrooke, Wade C. 1990. Rain-harvesting in the lizard, Phrynosoma cornutum: behavior and integumental morphology. J. Herpetol. 24(3):302-308.

Stebbins, Robert C. 1985. A field guide to western reptiles and amphibians. Second edition. Houghton Mifflin Co., Boston.

Strecker, John K. 1908. Notes on the breeding habits of Phrynosoma cornutum and other Texas lizards. Proc. Biol. Soc. Washington 21:165-170.

Texas Parks and Wildlife Code. 1987. 31 T.A.C. Sec. 65-171-65.177.

Whitford, Walter G. and Martha Bryant. 1979. Behavior of a predator and its prey: the horned lizard (Phrynosoma cornutum) and harvester ants (Pogonomyrmex spp.). Ecology 60(4):686-694.

Waichman, Andrea V. 1992. An alphanumeric code for toe clipping amphibians and reptiles. Herpetol. Rev. 23(1):19-21.

Winton, W. M. 1917. Habits and behavior of the Texas Horned Lizard, Phrynosoma cornutum, Harlan, II. Copeia (39):7-8.

Appendix 1

Pages 2-11: Maps Representing Museum Collection Records:

Choroplethic maps were constructed from the data available from museum collection records. The data were compiled for each county by decade except for pre 1900 collections. On each map occurs a legend which provides additional information. Each county where *Phrynosoma cornutum* were collected is shaded with a symbol representing the number of individuals taken during that decade, the number categories are given to the right. The histograms show how many different counties are listed in the records for each category, and those quantities are given on the left. Additional information about each decade is also provided: total number of counties reporting, total number of lizards collected, and the range in quantity of lizards collected.

Page 12: Map of Results from Status Survey:

A choroplethic map was constructed from the data obtained during the 1992 *Phrynosoma cornutum* Status Survey. The study sites are approximately represented by each •. These are approximations because the latitude/longitude coordinate systems between Atlas Mapmaker and the 1988 County Maps of Texas are different. The same data is given for the status survey results as is given for the museum collection records.

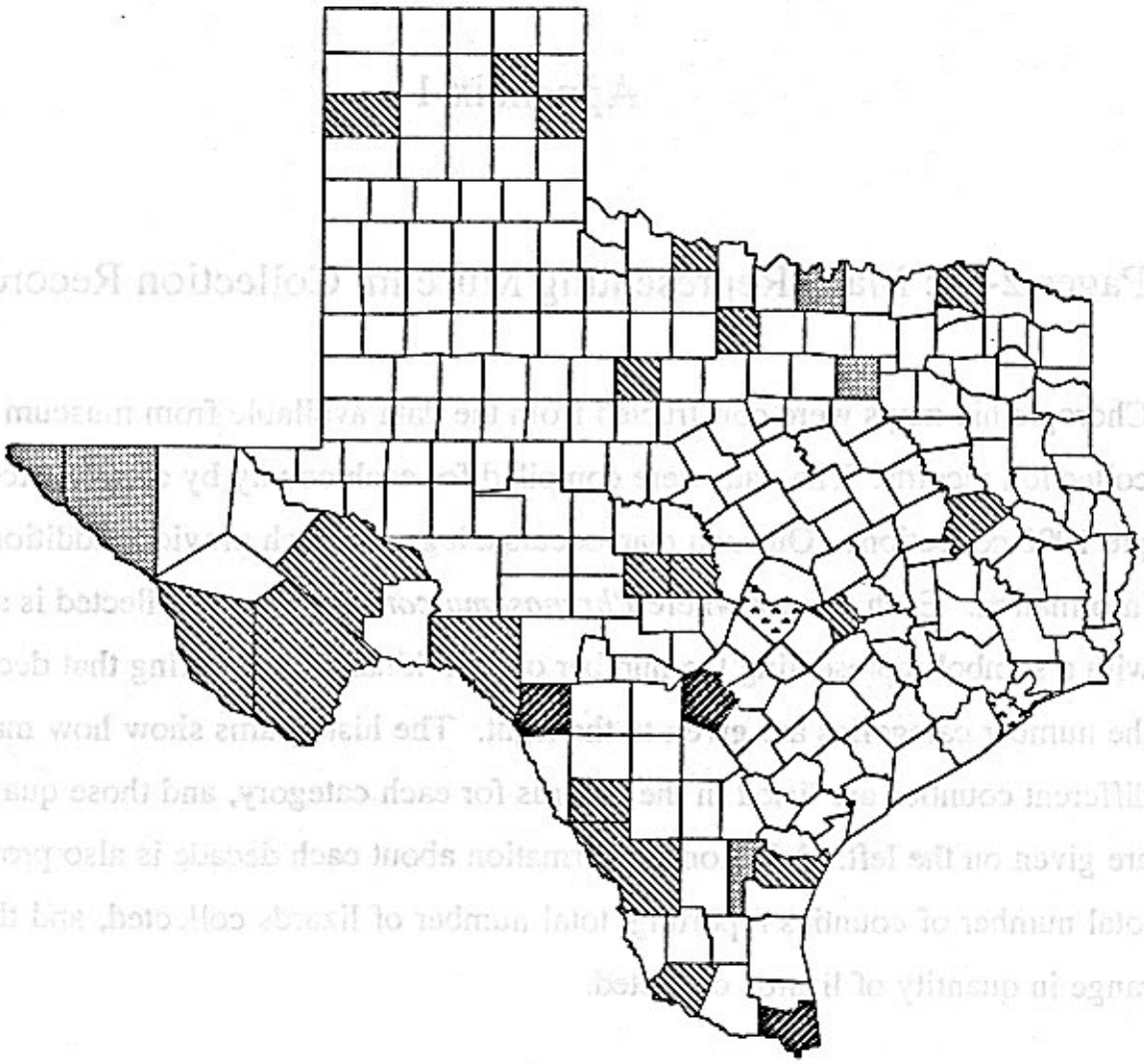


Figure 1: Museum Collection Records For *Phrynosoma cornutum*. Pre 1900

Number of Counties Reporting	Number of Lizards Collected
19	1 to 2
5	3 to 4
2	5 to 6
0	7 to 10
3	11 to 25
0	26 to 50
0	51 to 100
0	101 to 199

Total Number Counties Reporting: **29**

Total Lizards Collected: **93**

Range of Lizards Collected: **1 - 16**

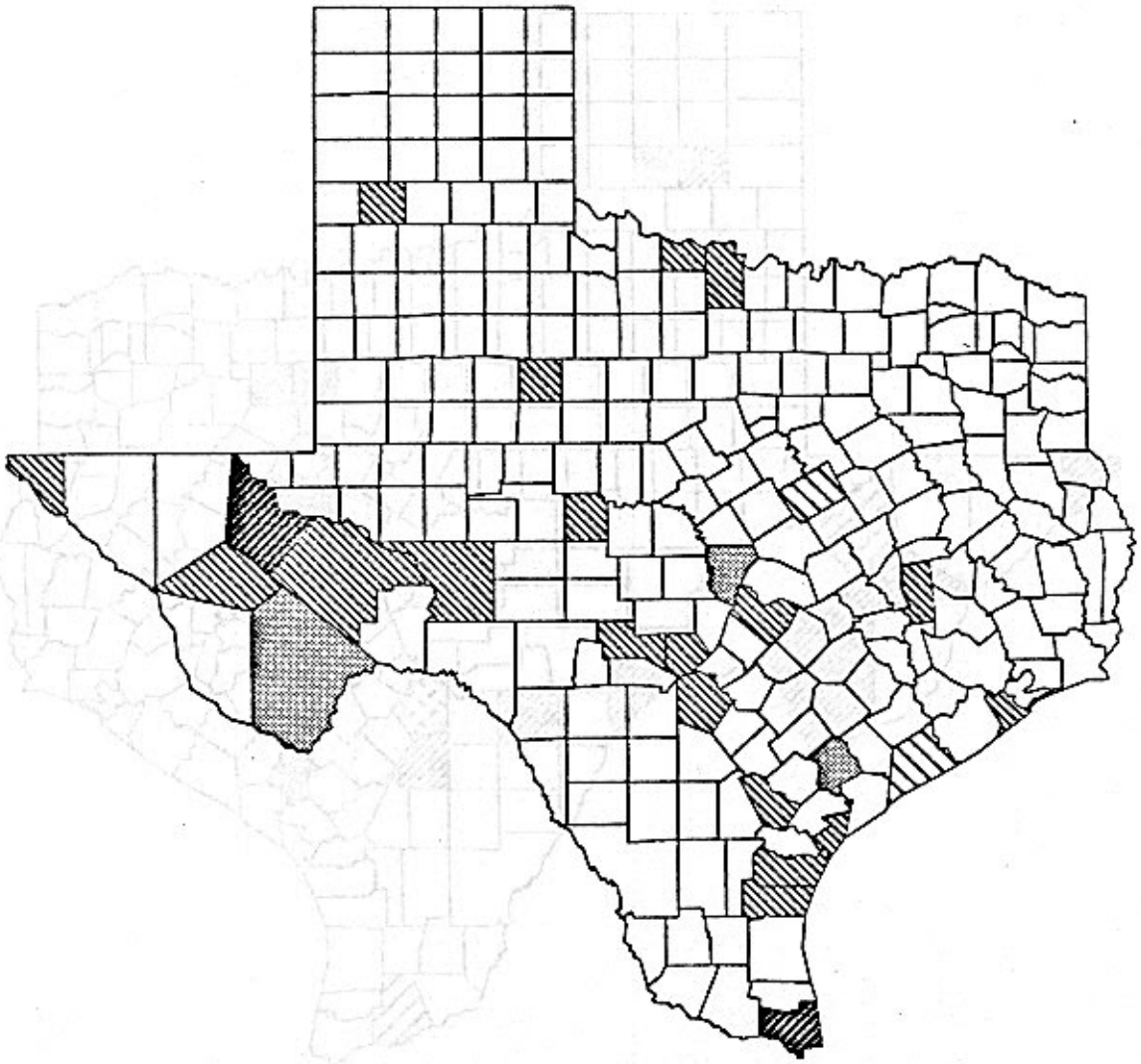


Figure 2: Museum Collection Records For *Phrynosoma cornutum*: 1900-1909

Number of Counties Reporting	Number of Lizards Collected
19	1 to 2
3	3 to 4
0	5 to 6
2	7 to 10
2	11 to 25
0	26 to 50
0	51 to 100
0	101 to 199

Total Number Counties Reporting: **26**

Total Lizards Collected: **83**

Range of Lizards Collected: **1 - 21**

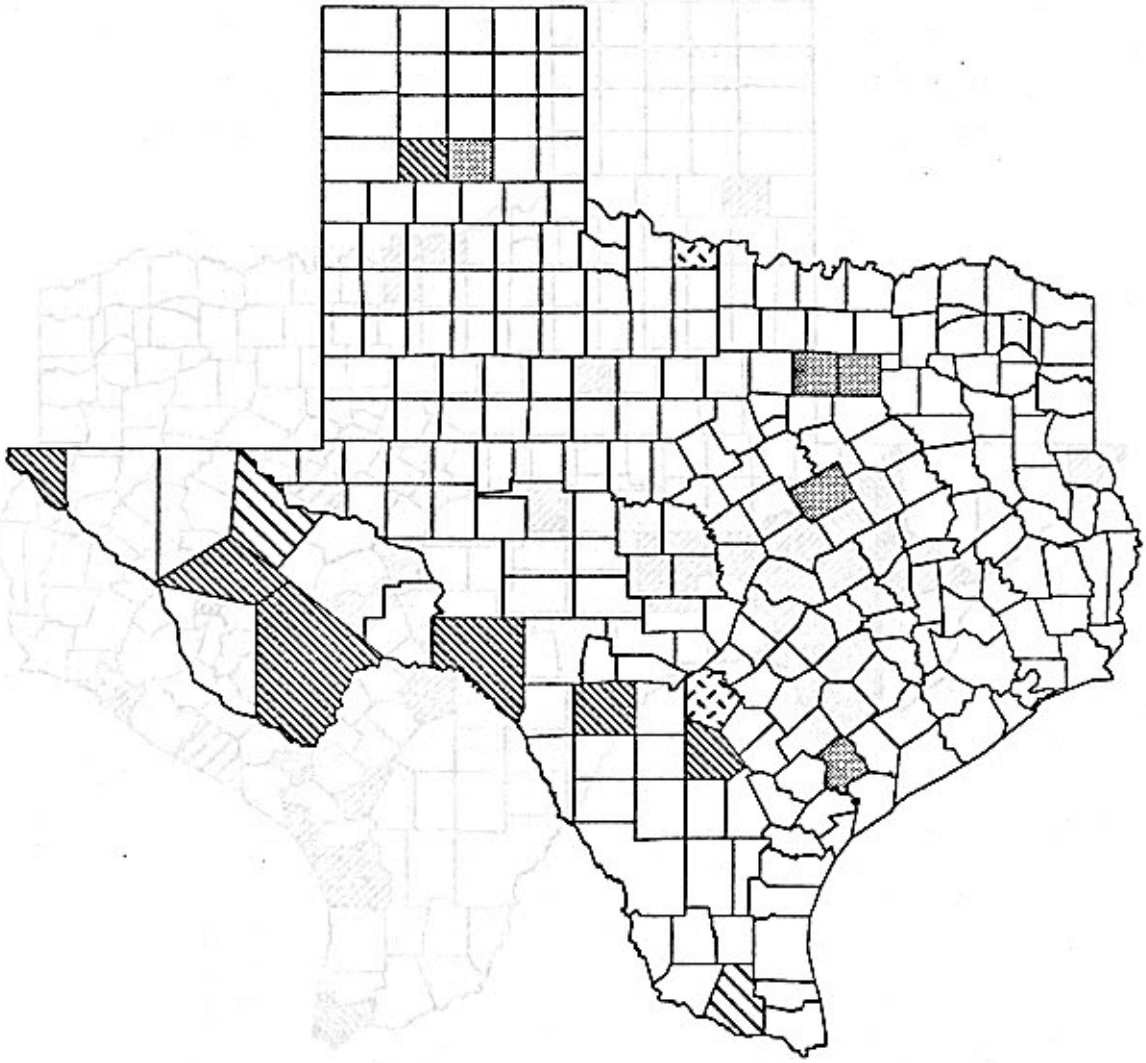


Figure 3: Museum Collection Records For *Phrynosoma cornutum*: 1910-1919

	Number of Counties Reporting	Number of Lizards Collected
	7	1 to 2
Total Number Counties Reporting: **16**	5	3 to 4
	0	5 to 6
Total Lizards Collected: **117**	2	7 to 10
	0	11 to 25
Range of Lizards Collected: **1 - 48**	2	26 to 50
	0	51 to 100
	0	101 to 199

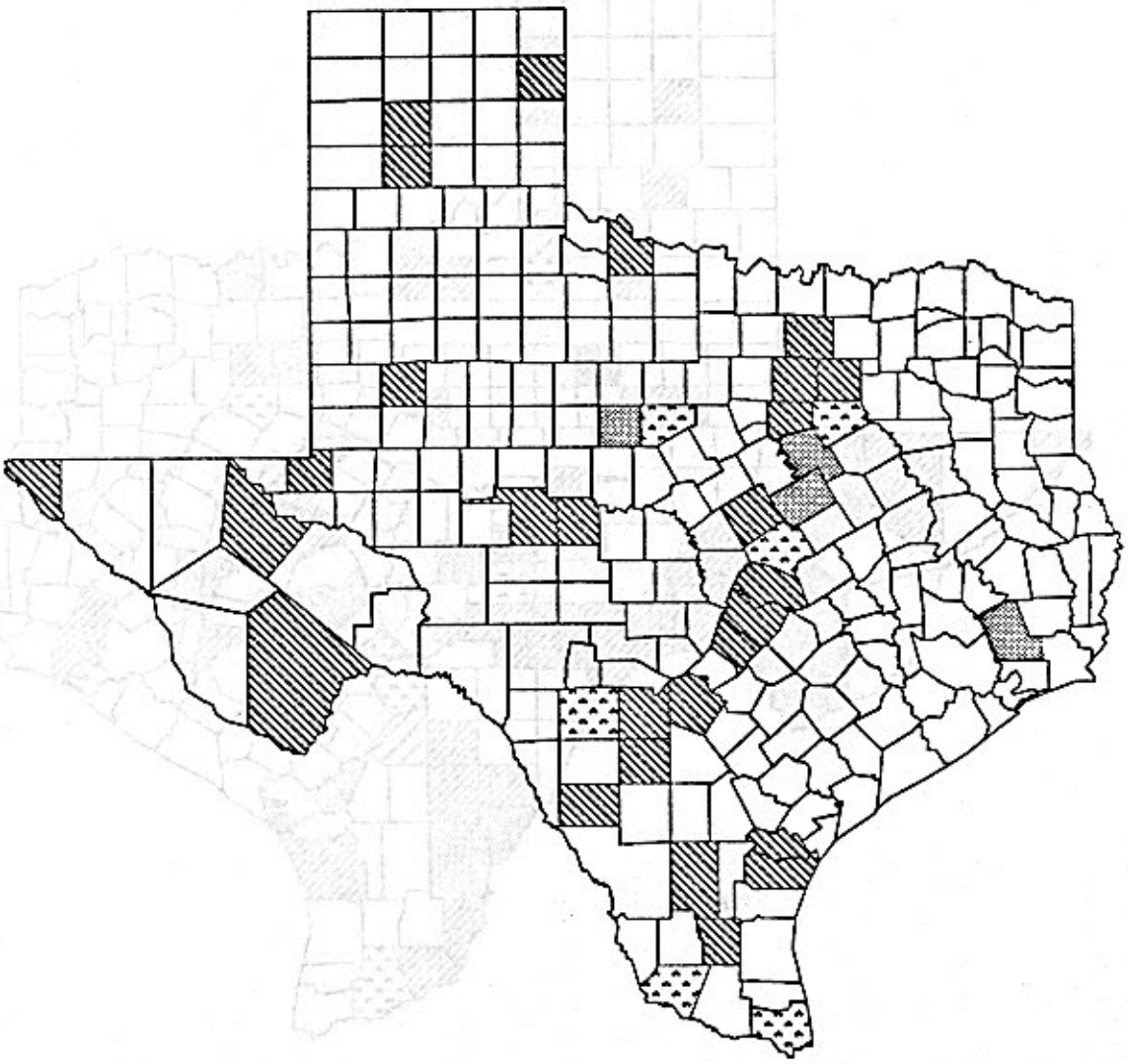


Figure 4: Museum Collection Records For *Phrynosoma cornutum*: 1920-1929

Number of Counties Reporting	Number of Lizards Collected
27	1 to 2
4	3 to 4
6	5 to 6
0	7 to 10
0	11 to 25
0	26 to 50
0	51 to 100
0	101 to 199

Total Number Counties Reporting: **37**

Total Lizards Collected: **80**

Range of Lizards Collected: **1 - 6**

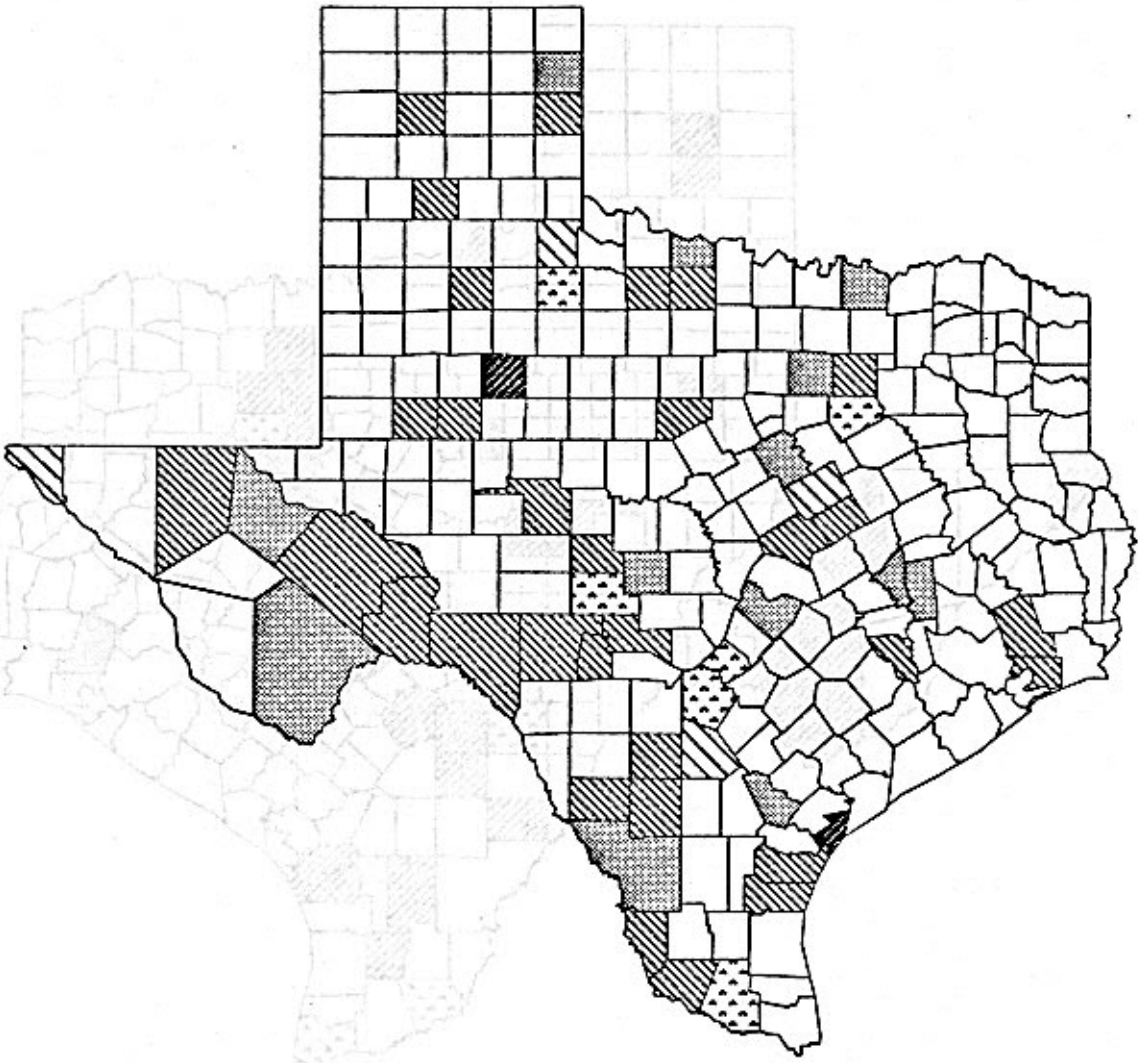


Figure 5: Museum Collection Records For *Phrynosoma cornutum*: 1930-1939

Number of Counties Reporting	Number of Lizards Collected
31	1 to 2
13	3 to 4
6	5 to 6
4	7 to 10
2	11 to 25
0	26 to 50
0	51 to 100
0	101 to 199

Total Number Counties Reporting: **56**

Total Lizards Collected: **175**

Range of Lizards Collected: **1 - 14**

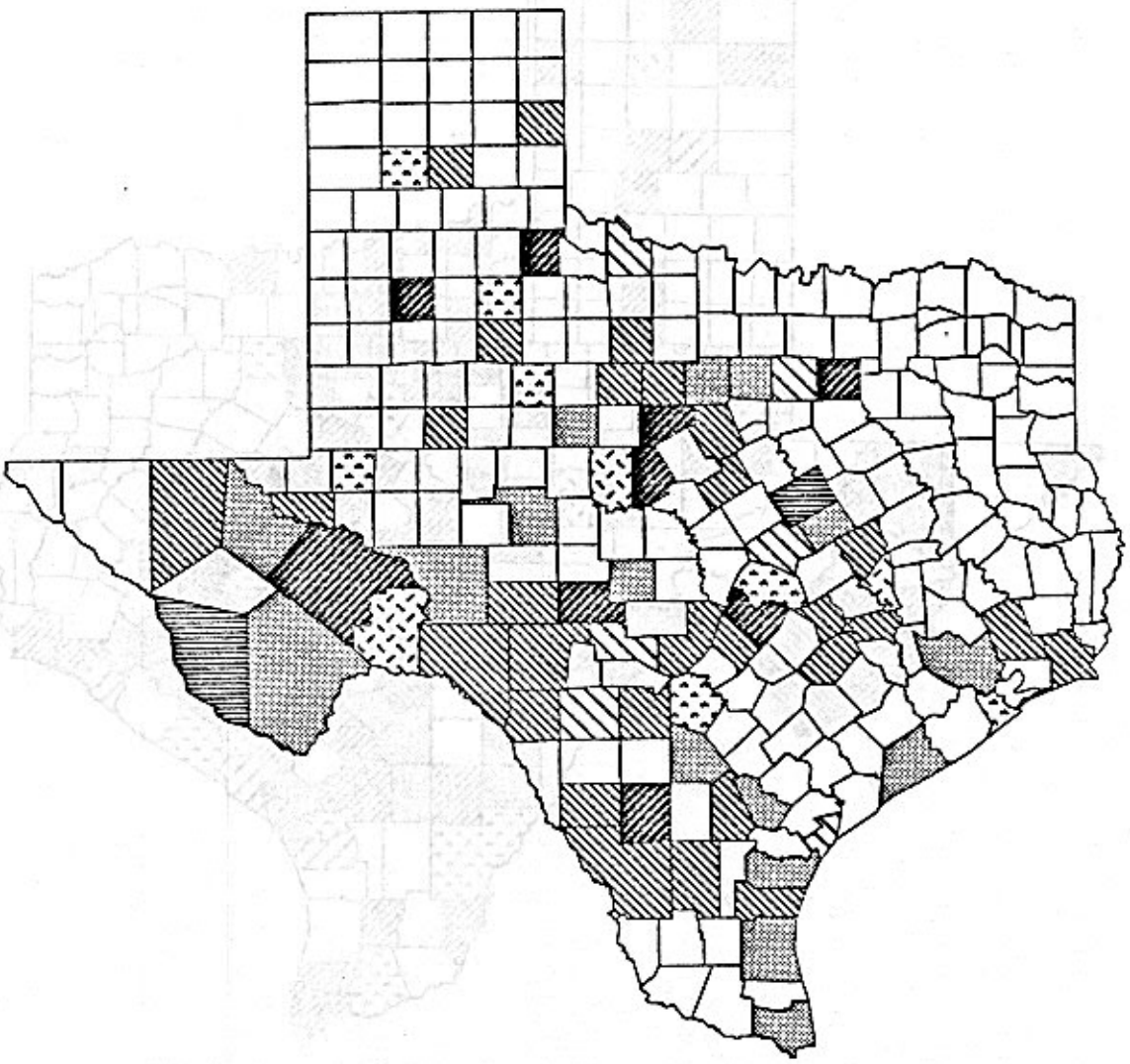


Figure 6: Museum Collection Records For *Phrynosoma cornutum*: 1940-1949

Number of Counties Reporting	Number of Lizards Collected
30	1 to 2
16	3 to 4
7	5 to 6
6	7 to 10
9	11 to 25
3	26 to 50
2	51 to 100
0	101 to 199

Total Number Counties Reporting: **73**

Total Lizards Collected: **552**

Range of Lizards Collected: **1 - 75**

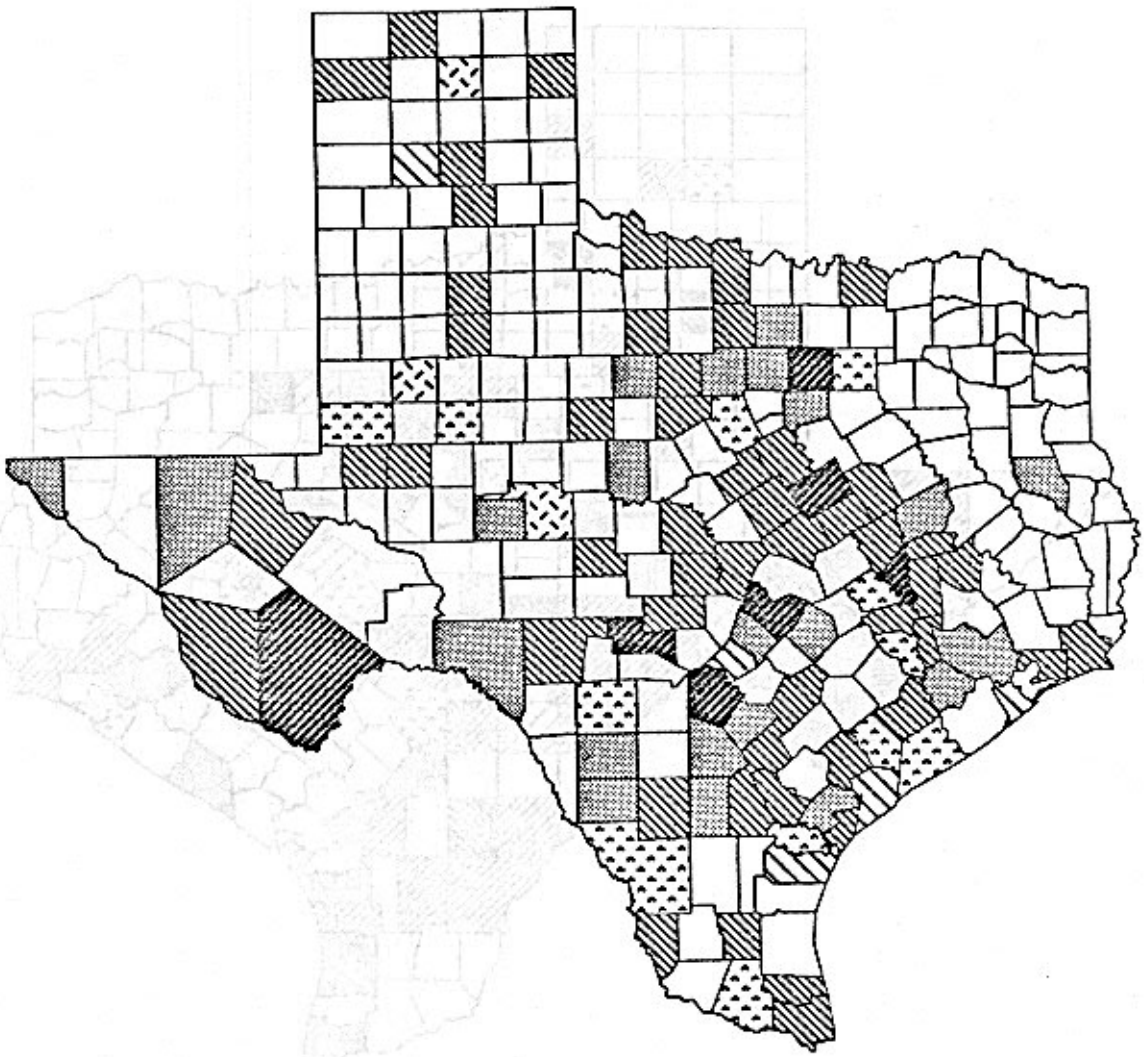


Figure 7: Museum Collection Records For *Phrynosoma cornutum*: 1950-1959

Total Number Counties Reporting: **101**

Total Lizards Collected: **501**

Range of Lizards Collected: **1 - 43**

Number of Counties Reporting	Number of Lizards Collected
52	1 to 2
22	3 to 4
12	5 to 6
5	7 to 10
7	11 to 25
3	26 to 50
0	51 to 100
0	101 to 199

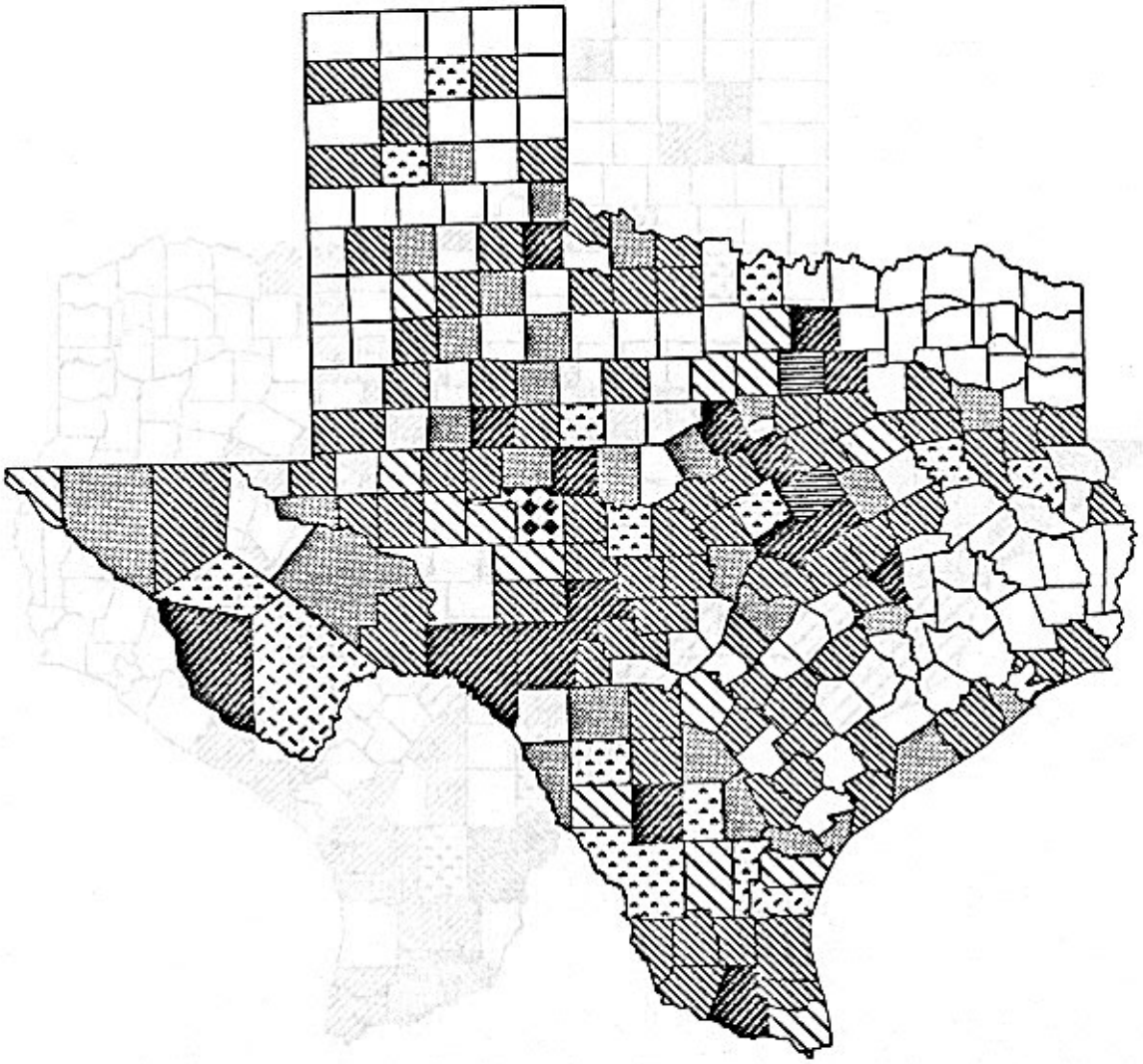


Figure 8: Museum Collection Records For *Phrynosoma cornutum*: 1960-1969

Number of Counties Reporting	Number of Lizards Collected
73	1 to 2
29	3 to 4
12	5 to 6
15	7 to 10
16	11 to 25
3	26 to 50
2	51 to 100
1	101 to 199

Total Number Counties Reporting: **151**

Total Lizards Collected: **1077**

Range of Lizards Collected: **1 - 199**

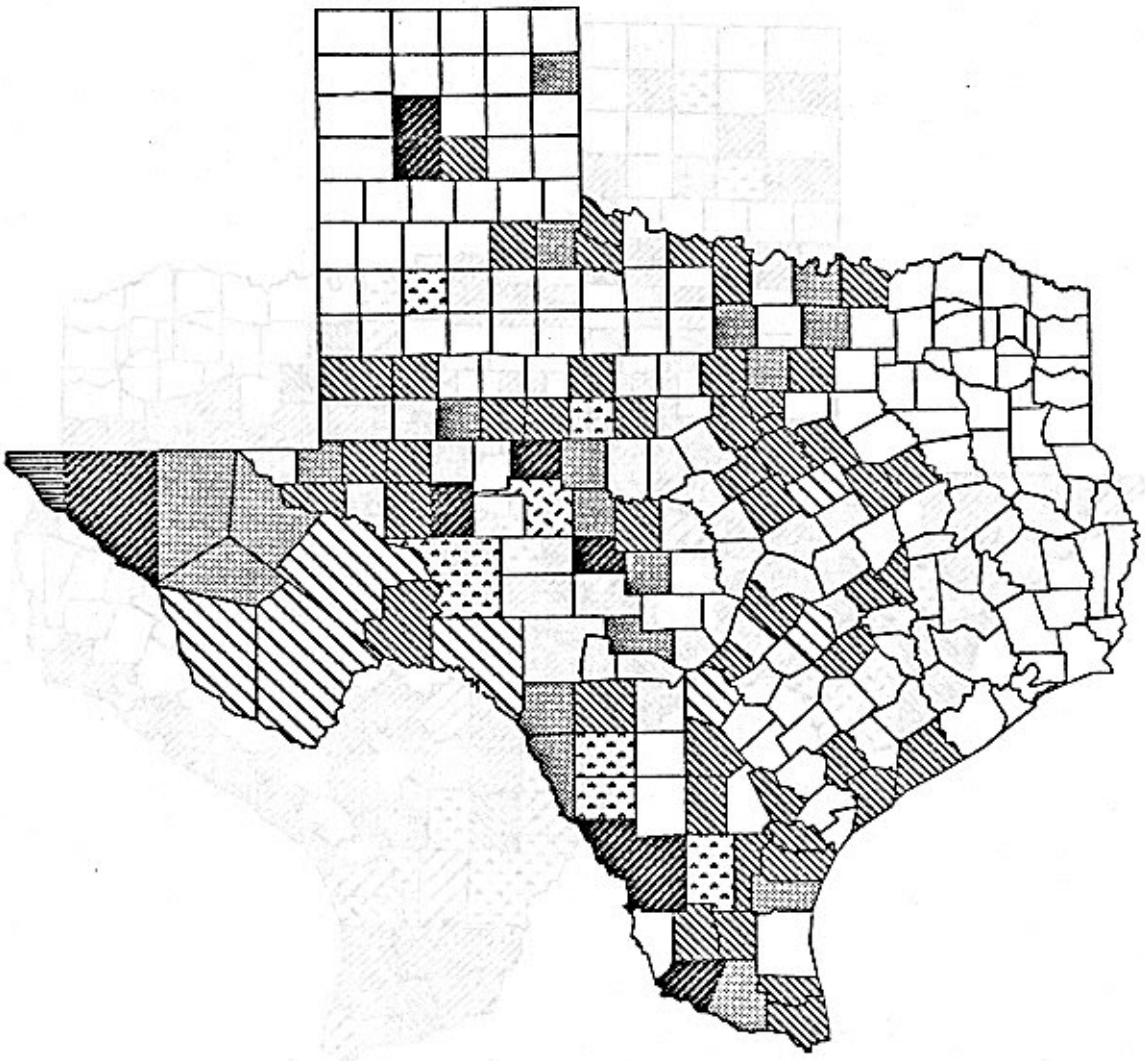


Figure 9: Museum Collection Records For *Phrynosoma cornutum*: 1970-1979

Number of Counties Reporting	Number of Lizards Collected
49	1 to 2
19	3 to 4
6	5 to 6
7	7 to 10
8	11 to 25
1	26 to 50
1	51 to 100
0	101 to 199

Total Number Counties Reporting: **91**

Total Lizards Collected: **418**

Range of Lizards Collected: **1 - 57**

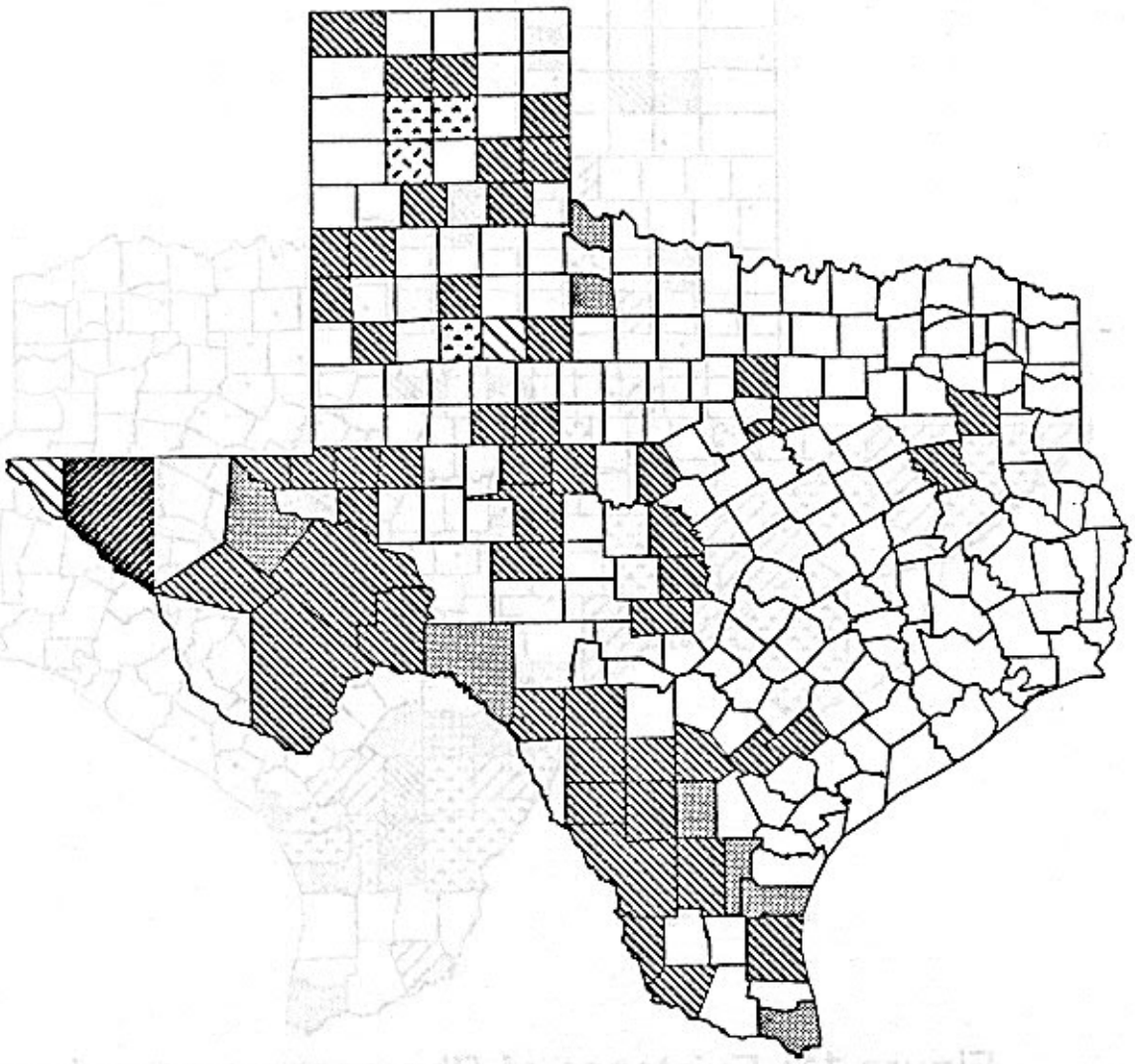


Figure 10: Museum Collection Records For *Phrynosoma cornutum*: 1980-1989

Number of Counties Reporting	Number of Lizards Collected
52	1 to 2
8	3 to 4
3	5 to 6
2	7 to 10
1	11 to 25
1	26 to 50
0	51 to 100
0	101 to 199

Total Number Counties Reporting: **67**

Total Lizards Collected: **166**

Range of Lizards Collected: **1 - 28**

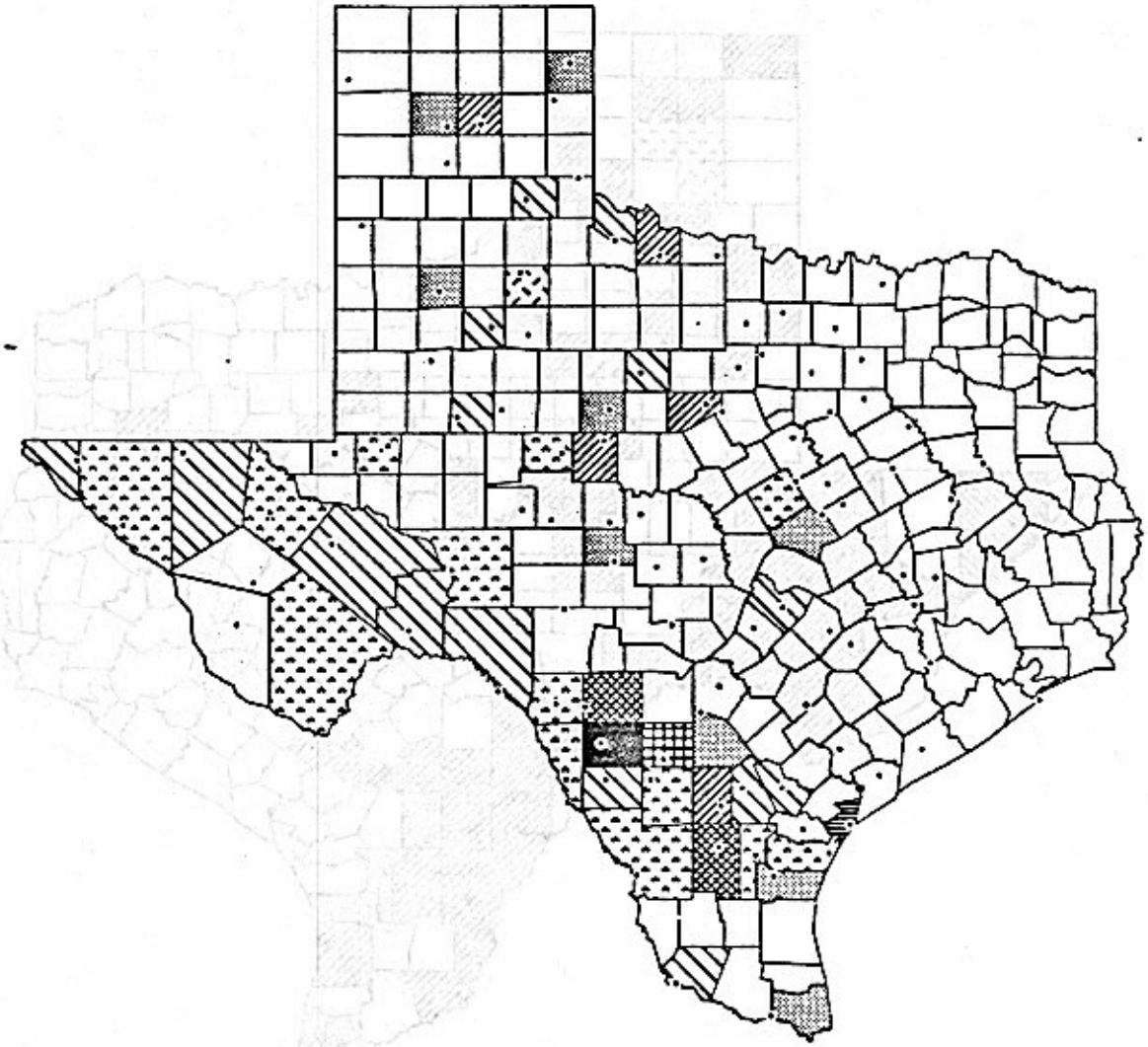


Figure 11: Existence of *Phrynosoma cornutum* at Study Sites: Summer 1992

Total Number Sites: **100**

Total Lizards Marked: **99**

Range of Lizards Marked: **1 - 19**

Number of Sites	Number of Lizards Marked
52	No Evidence Found
9	Resident Report
13	Dead and/or Scat
15	1 to 2
5	3 to 4
1	5 to 6
2	7 to 8
1	9 to 10
1	11 to 12
1	19

Appendix 2:

Horned Lizard Conservation Society Sighting Survey Results:

Pages 2-10: Choroplethic maps of the data collected by HLCS from the summer of 1991 to 31 December 1992. The survey data were compiled for each county by decade, 1910-1989, and one map only shows data 1990-1992. On each map occurs a legend which provides additional information. The data provided are the same as the museum collection records except each survey response is counted as one occurrence instead of each *P. cornutum* collected.

Pages 11-22:

Table 1: Results from Sighting Survey A

Table 2: Results from Sighting Survey B

Table 3: County X Decade X Number of Reports Table

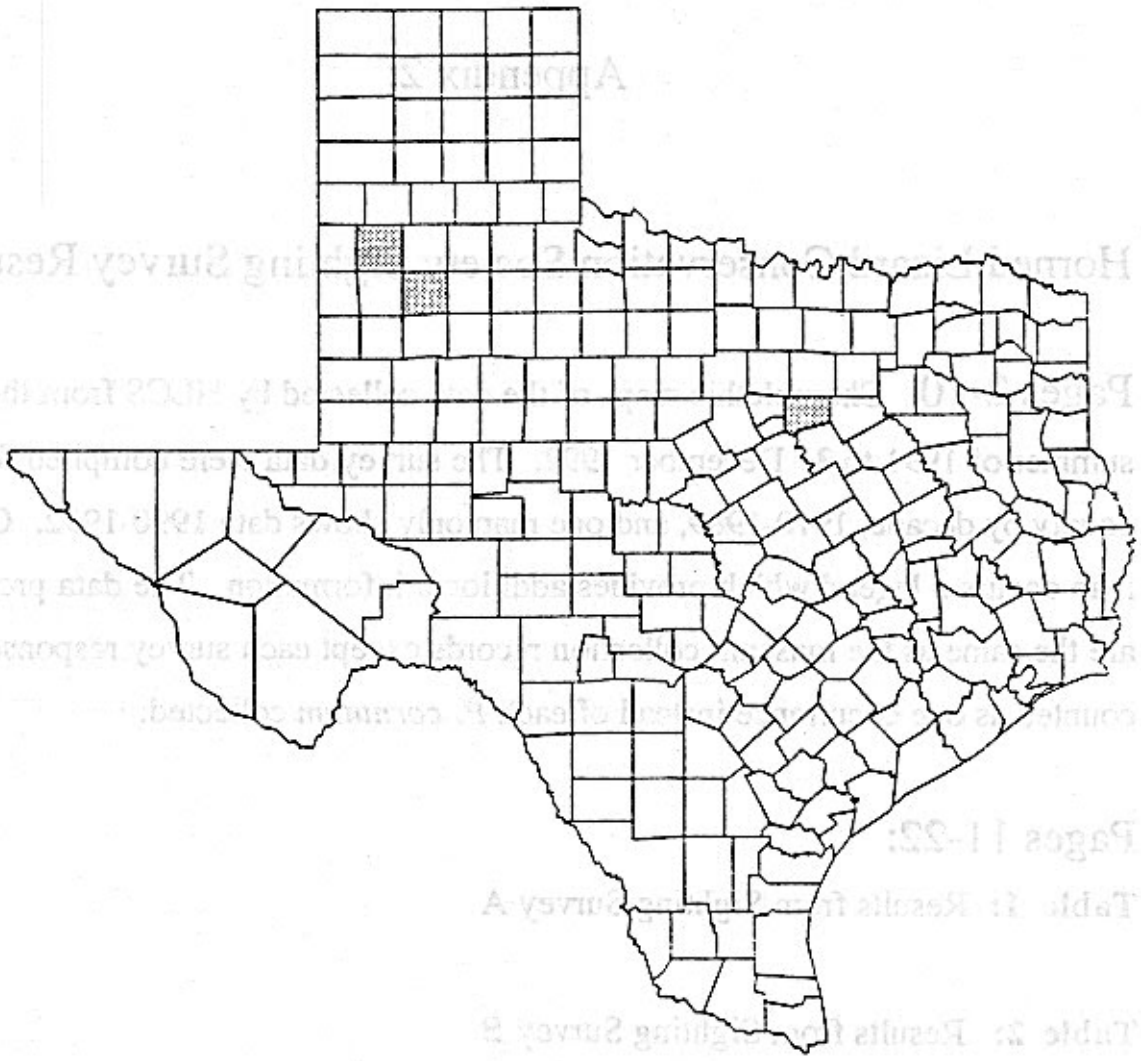


Figure 1: Texas Horned Lizard Sighting Survey Results: 1910 - 1919

Number of Counties Responding	Number of Positive Responses
3	1 to 2
0	3 to 4
0	5 to 6
0	7 to 10
0	11 to 15
0	16 to 20
0	21 to 26

Total Number Counties Responding: **3**

Total Positive Responses: **3**

Range of Positive Responses Compiled: **1**

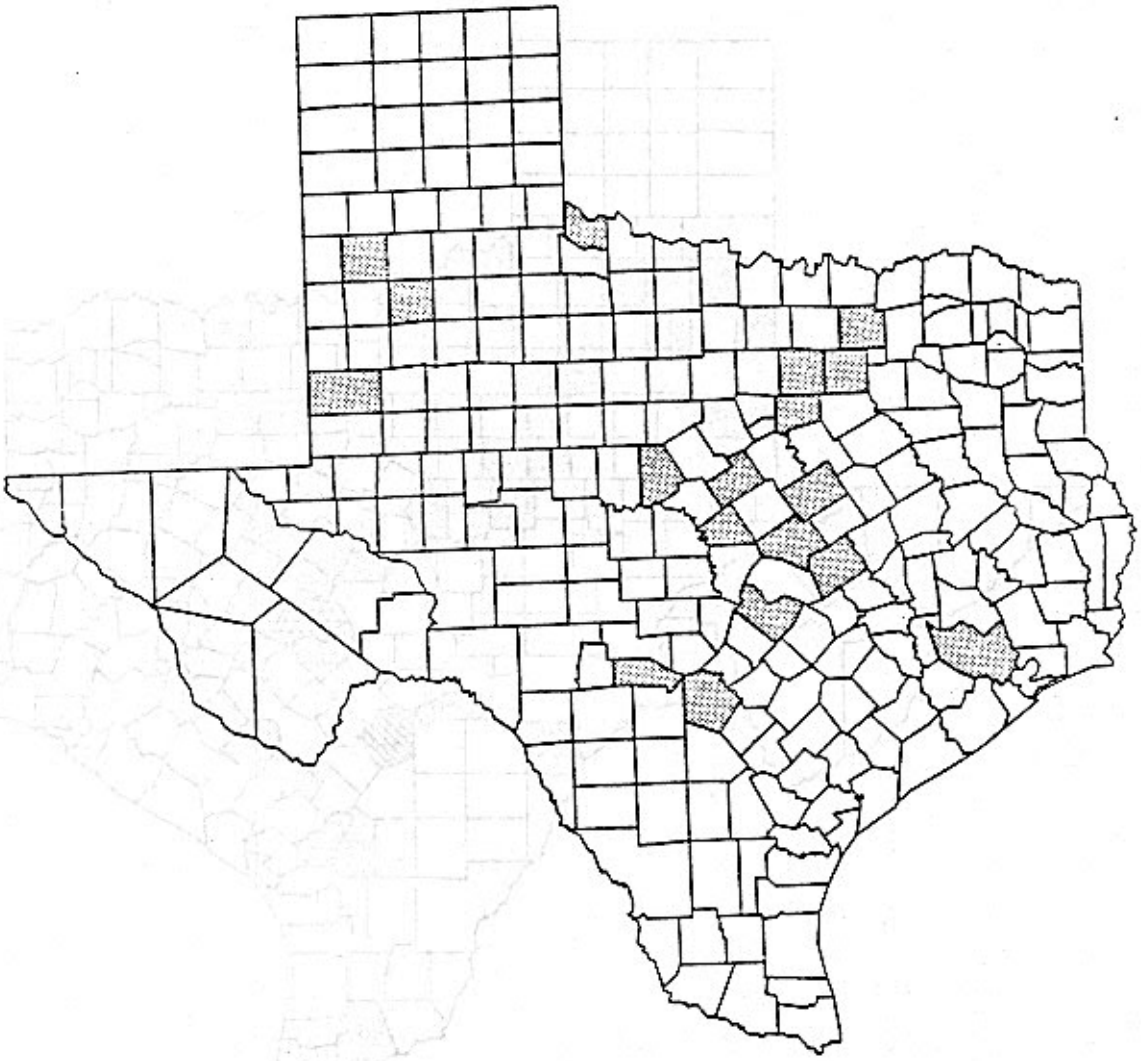


Figure 2: Texas Horned Lizard Sighting Survey Results: 1920 - 1929

Number of Counties Responding	Number of Positive Responses
18	1 to 2
0	3 to 4
0	5 to 6
0	7 to 10
0	11 to 15
0	16 to 20
0	21 to 26

Total Number Counties Responding: **18**

Total Positive Responses: **18**

Range of Positive Responses Compiled: **1**

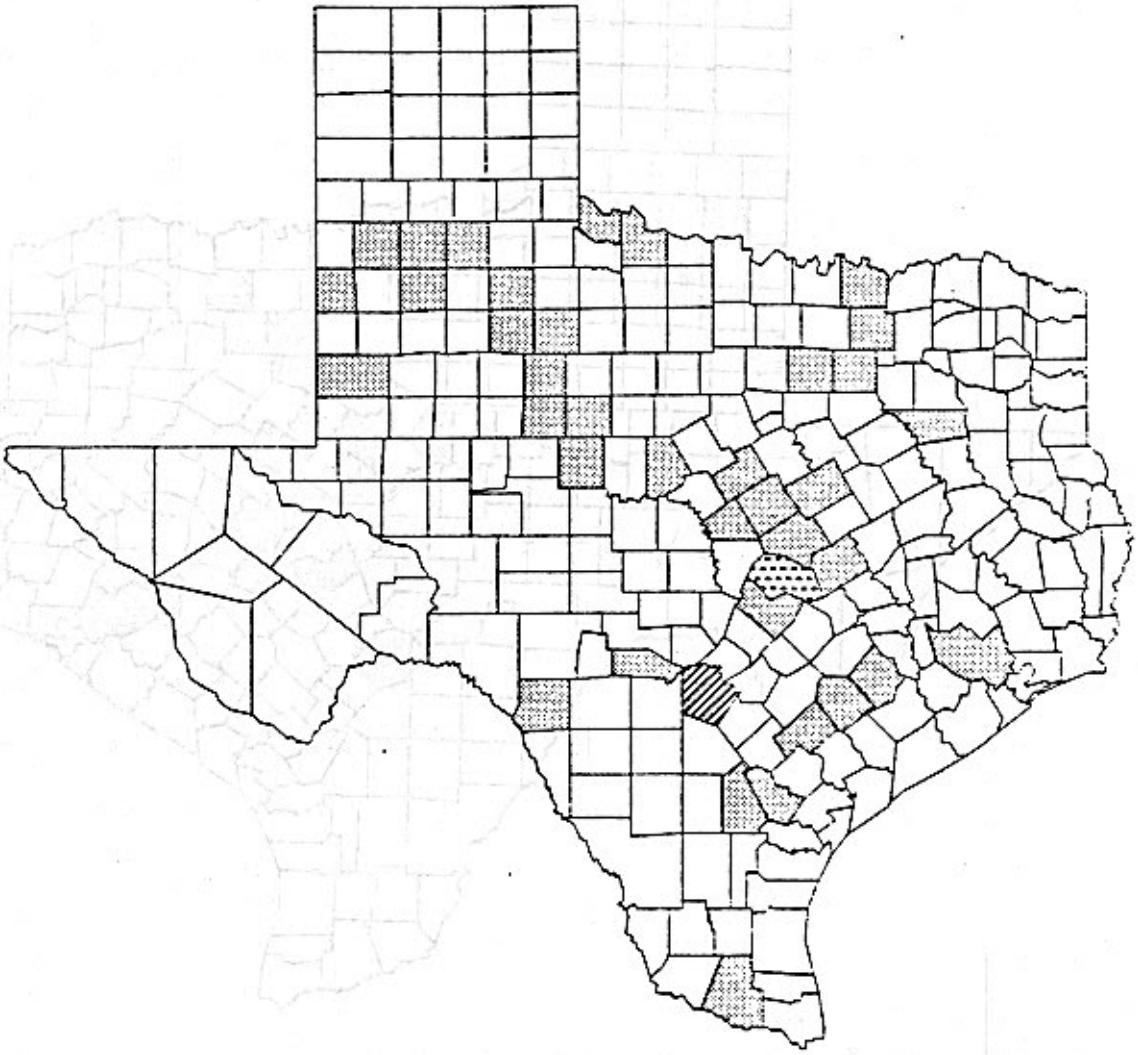


Figure 3: Texas Horned Lizard Sighting Survey Results: 1930 - 1939

Number of Counties Responding	Number of Positive Responses
37	1 to 2
1	3 to 4
1	5 to 6
0	7 to 10
0	11 to 15
0	16 to 20
0	21 to 26

Total Number Counties Responding: **39**

Total Positive Responses: **51**

Range of Positive Responses Compiled: **1 - 5**

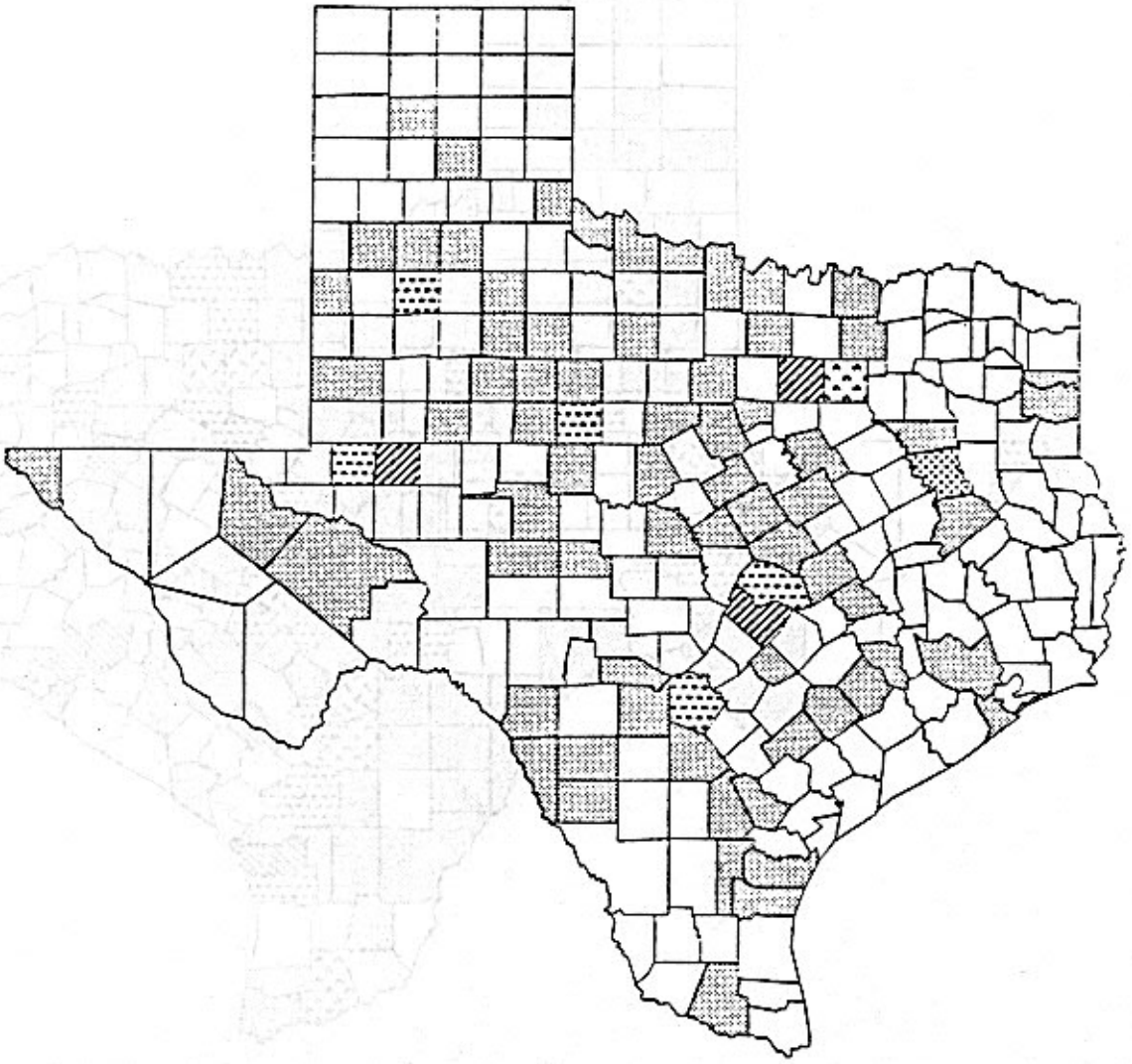


Figure 4: Texas Horned Lizard Sighting Survey Results: 1940 - 1949

Number of Counties Responding	Number of Positive Responses
71	1 to 2
5	3 to 4
3	5 to 6
1	7 to 10
0	11 to 15
0	16 to 20
0	21 to 26

Total Number Counties Responding: **80**

Total Positive Responses: **123**

Range of Positive Responses Compiled: **1 - 7**

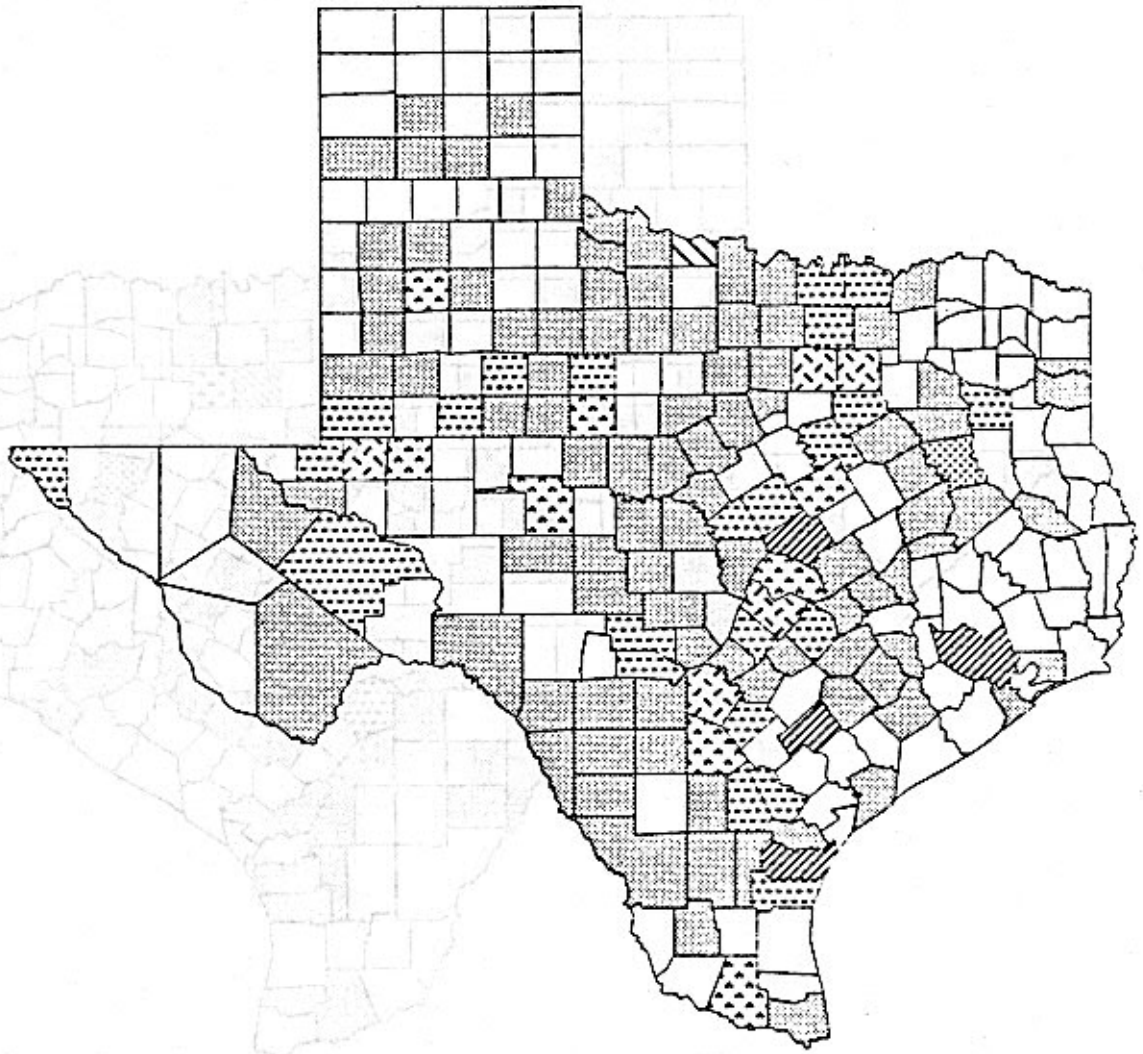


Figure 5: Texas Horned Lizard Sighting Survey Results: 1950 - 1959

Number of Counties Responding	Number of Positive Responses
95	1 to 2
23	3 to 4
4	5 to 6
8	7 to 10
1	11 to 15
5	16 to 20
0	21 to 26

Total Number Counties Responding: **136**

Total Positive Responses: **402**

Range of Positive Responses Compiled: **1 - 19**

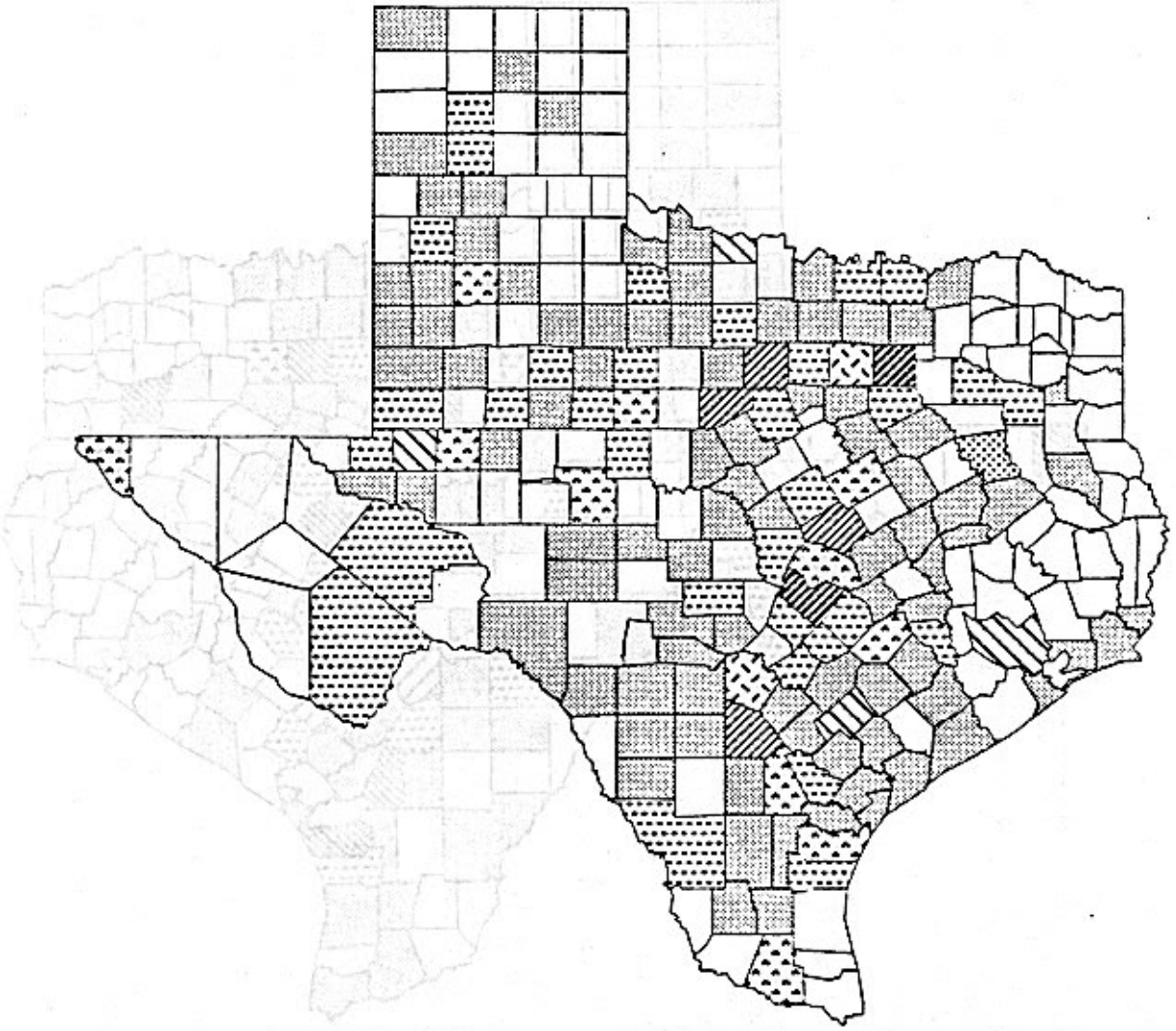


Figure 6: Texas Horned Lizard Sighting Survey Results: 1960 - 1969

Number of Counties Responding	Number of Positive Responses
90	1 to 2
32	3 to 4
4	5 to 6
11	7 to 10
4	11 to 15
2	16 to 20
2	21 to 26

Total Number Counties Responding: **145**

Total Positive Responses: **480**

Range of Positive Responses Compiled: **1 - 25**

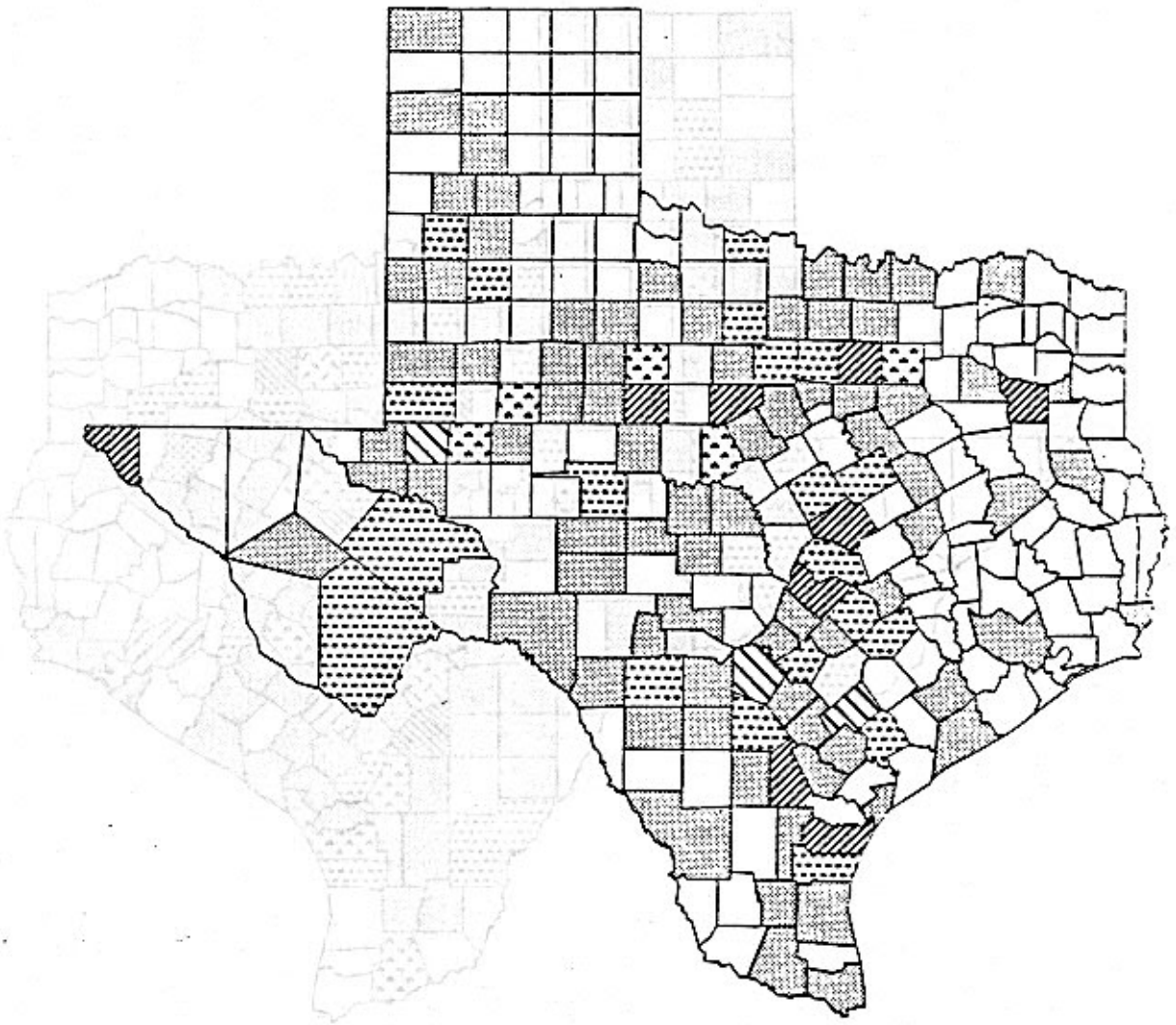


Figure 7: Texas Horned Lizard Sighting Survey Results: 1970 - 1979

Number of Counties Responding	Number of Positive Responses
78	1 to 2
20	3 to 4
9	5 to 6
5	7 to 10
3	11 to 15
0	16 to 20
0	21 to 26

Total Number Counties Responding: **115**

Total Positive Responses: **290**

Range of Positive Responses Compiled: **1 - 13**

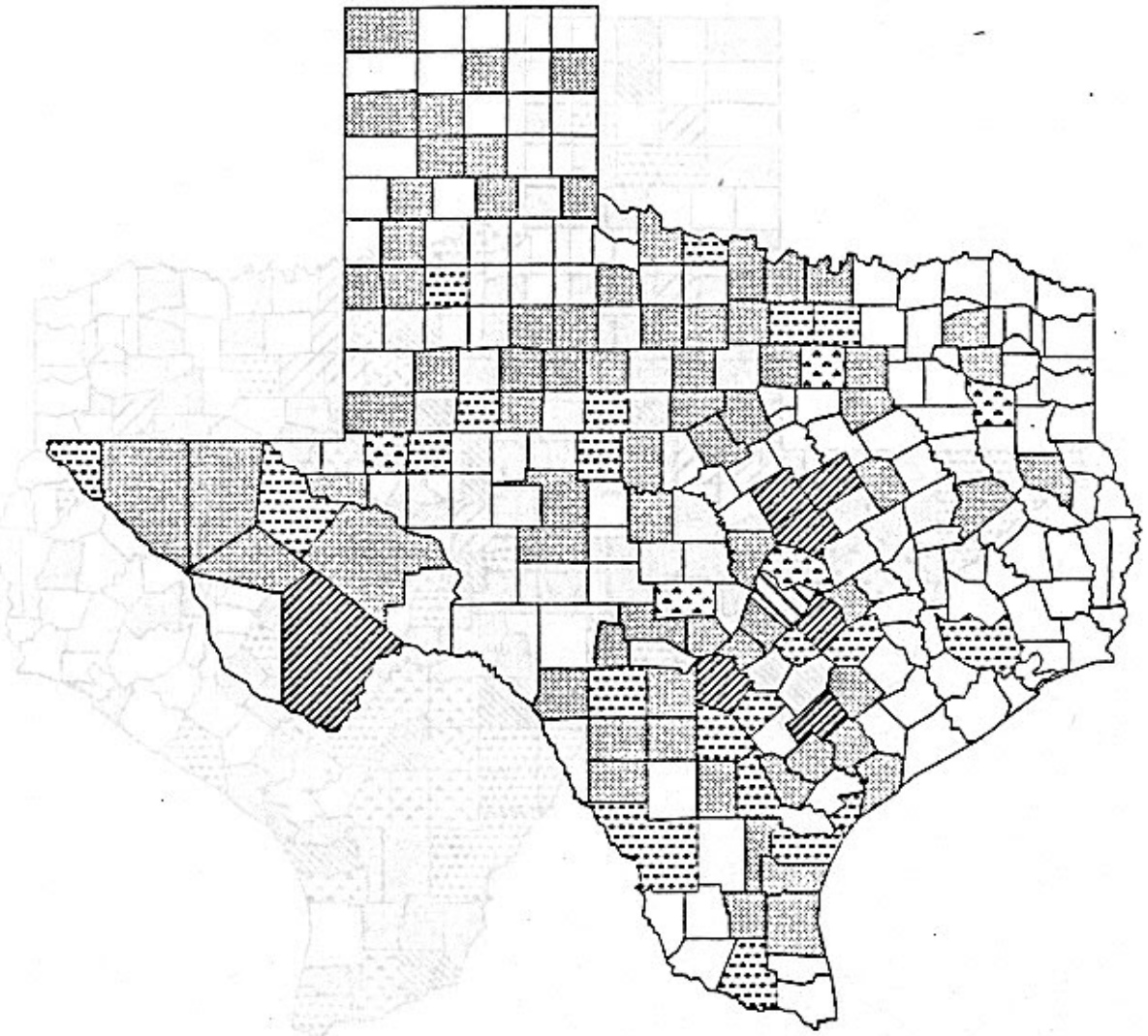


Figure 8: Texas Horned Lizard Sighting Survey Results: 1980 - 1989

Number of Counties Responding	Number of Positive Responses
72	1 to 2
21	3 to 4
7	5 to 6
5	7 to 10
1	11 to 15
0	16 to 20
0	21 to 26

Total Number Counties Responding: **106**

Total Positive Responses: **249**

Range of Positive Responses Compiled: **1 - 13**

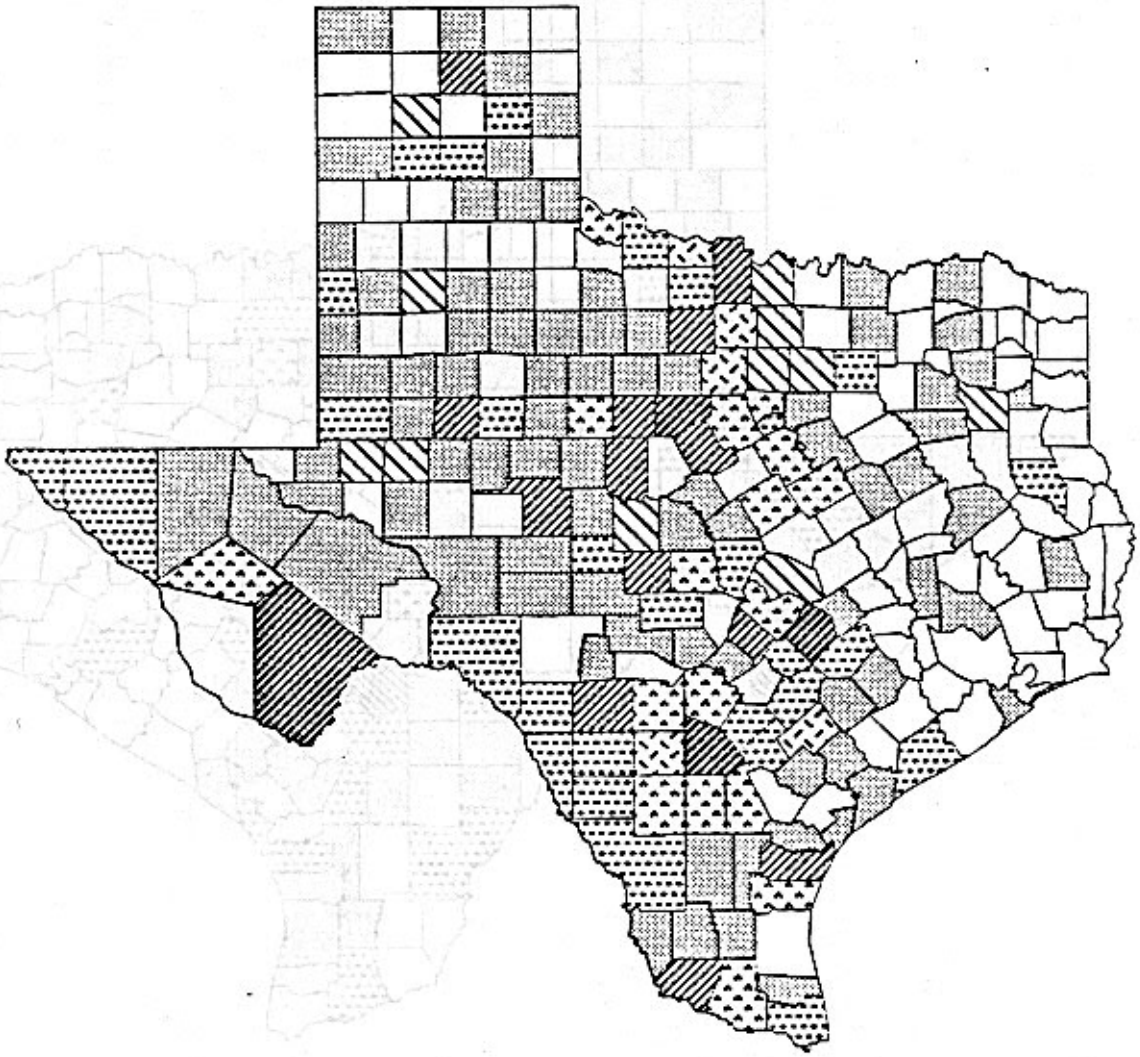


Figure 9: Texas Horned Lizard Sighting Survey Results: 1990 - 1992

Number of Counties Responding	Number of Positive Responses
82	1 to 2
29	3 to 4
13	5 to 6
17	7 to 10
11	11 to 15
5	16 to 20
4	21 to 26

Total Number Counties Responding: **161**

Total Positive Responses: **750**

Range of Positive Responses Compiled: **1 - 26**

Table 1

Results of Sighting Survey A

East Texas	#R	#CS	#A	#HS	%C	%H	%D
Anderson	0	0	0	2			
Angelina	0	0	0	1			
Archer	1	2	1	0			
Bosque	0	3	0	0			
Brazos	0	0	0	2			
Chambers	0	0	0	1			
Clay	1	1	0	1			
Collin	2	1	0	2			
Cooke	3	0	0	2			
Dallas	38	3	0	37	8%	97%	92%
Denton	3	1	0	4			
Ellis	0	0	0	5			
Fannin	0	0	0	2			
Freestone	0	0	0	1			
Grayson	3	1	0	3			
Gregg	3	1	0	2			
Hardin	2	0	0	0			
Harris	34	0	0	14	0%	41%	100%
Harrison	0	0	0	1			
Henderson	1	0	0	1			
Hill	2	1	0	3			
Hood	4	5	0	2			
Hopkins	1	1	1	1			
Houston	2	1	1	3			
Jack	1	1	0	2			
Jefferson	1	0	0	1			
Johnson	2	1	0	2			
Lamar	3	0	0	1			
Limestone	1	0	0	3			
Madison	1	0	0	1			
Marion	0	0	0	1			
Montague	2	5	0	2			
Montgomery	2	2	0	0			
Nacogdoches	1	1	1	2			
Navarro	0	0	0	2			
Orange	1	0	0	1			
Palo Pinto	4	6	1	8			
Parker	3	1	0	6			
Robertson	0	0	0	1			
Rockwall	1	0	0	0			
Smith	7	7	5	9			
Somervell	1	2	1	0			
Tarrant	30	4	0	27	13%	90%	85%
Tyler	2	2	0	0			
Van Zandt	1	1	0	3			
Wichita	5	5	1	16	100%	100%	69%
Wise	1	1	1	4			
Wood	1	1	0	0			
Young	4	3	2	4			
Totals:	**175**	**64**	**15**	**186**			

Central Texas	#R	#CS	#A	#HS	%C	%H	%D
Austin	1	0	0	4			
Bandera	0	0	0	3			
Bastrop	9	9	3	9	100%	100%	0%
Bell	7	4	0	11	57%	100%	63%
Brazoria	2	0	0	0			
Brown	2	5	0	3			
Burleson	0	0	0	1			
Burnet	2	2	0	3			
Caldwell	8	4	1	5			
Calhoun	1	1	0	2			
Colorado	1	1	0	3			
Comal	1	0	0	2			
Comanche	0	2	0	1			
Coryell	2	2	1	5			
DeWitt	25	15	3	18	60%	72%	17%
Eastland	1	5	1	7			
Erath	5	3	1	5			
Fayette	9	2	0	11	22%	100%	82%
Galveston	6	2	0	3			
Gillespie	2	3	0	4			
Gonzales	1	2	0	2			
Guadalupe	3	0	0	5			
Hamilton	0	0	0	1			
Hays	19	4	0	4	21%	21%	0%
Kendall	2	1	0	1			
Kerr	6	2	1	5			
Kimble	1	0	0	1			
Kinney	0	3	1	2			
Lampasas	0	0	0	4			
Lavaca	0	0	0	2			
Lee	1	0	0	2			
Llano	2	3	0	0			
Mason	0	0	0	2			
Matagorda	1	2	0	1			
McLennan	8	3	2	11	38%	100%	73%
Milam	1	0	0	3			
Mills	0	2	0	1			
Real	1	2	0	2			
San Saba	1	2	0	2			
Travis	95	9	0	33	9%	35%	73%
Uvalde	1	4	0	8			
Victoria	3	2	0	4			
Washington	0	0	0	1			
Wharton	0	0	0	2			
Williamson	25	13	1	17	52%	68%	24%
Totals:	**255**	**114**	**15**	**215**			

South Texas	#R	#CS	#A	#HS	%C	%H	%D
Aransas	2	1	0	1			
Atascosa	10	17	8	8	100%	80%	0%
Bee	2	0	0	3			

Bexar	37	9	1	37	24%	100%	76%
Brooks	0	1	1	2			
Cameron	3	2	0	3			
Dimmit	0	2	1	3			
Duval	0	1	0	2			
Frio	2	5	1	2			
Goliad	0	2	0	3			
Hidalgo	8	7	1	13	88%	100%	46%
Jim Hogg	0	2	0	1			
Jim Wells	0	2	0	2			
Karnes	0	2	1	1			
Kenedy	0	0	0	1			
Kleberg	2	2	0	6			
LaSalle	1	4	0	0			
Live Oak	4	8	2	10	100%	100%	20%
Maverick	3	3	3	2			
McMullen	1	6	3	3			
Medina	0	1	1	3			
Nueces	18	5	0	11	28%	61%	55%
Refugio	0	0	0	1			
San Patricio	0	0	0	1			
Starr	2	5	1	0			
Webb	1	2	0	3			
Wilson	1	2	0	3			
Zapata	1	1	0	0			
Zavala	3	1	0	3			
Totals:	**101**	**93**	**24**	**128**			

North Texas	**#R**	**#CS**	**#A**	**#HS**	**%C**	**%H**	**%D**
Andrews	3	2	1	4			
Armstrong	0	2	1	1			
Baylor	0	0	0	1			
Borden	0	2	1	0			
Briscoe	1	2	0	0			
Callahan	0	1	0	0			
Castro	0	0	0	1			
Childress	0	0	0	1			
Cochran	1	1	1	2			
Crosby	0	2	1	1			
Dallam	0	0	0	1			
Dawson	0	2	0	3			
Deaf Smith	0	1	0	1			
Dickens	0	2	1	1			
Donley	0	1	1	0			
Fisher	1	2	1	1			
Floyd	0	0	0	1			
Foard	0	0	0	2			
Gaines	0	1	0	2			
Garza	0	1	1	0			
Gray	0	0	0	2			
Hale	0	0	0	3			
Hardeman	0	1	0	1			
Haskell	0	1	0	2			
Hemphill	0	0	0	1			

Hockley	2	1	1	3			
Howard	3	5	1	4			
Hutchinson	1	0	0	3			
Jones	1	1	0	4			
Kent	0	2	1	1			
Knox	0	1	0	3			
Lamb	0	0	0	3			
Lubbock	14	12	5	11	86%	79%	0%
Martin	0	0	0	1			
Mitchell	1	4	2	2			
Nolan	0	1	1	4			
Oldham	0	0	0	1			
Potter	7	5	0	4			
Randall	0	1	0	4			
Scurry	1	0	0	5			
Stephens	0	1	0	1			
Stonewell	0	1	1	1			
Swisher	0	0	0	1			
Taylor	11	10	2	15	91%	100%	33%
Terry	0	0	0	2			
Throckmorton	1	1	1	2			
Wilbarger	0	0	0	2			
Yoakum	0	0	0	1			
Totals:	**48**	**70**	**24**	**110**			
	#R	**#CS**	**#A**	**#HS**	**%C**	**%H**	**%D**
West Texas							
Brewster	13	12	1	5	100%	38%	0%
Coke	0	1	0	0			
Coleman	1	4	1	1			
Crane	0	0	0	1			
Crockett	0	2	0	0			
Ector	10	10	4	23	100%	100%	57%
El Paso	2	3	0	9			
Glasscock	1	1	0	1			
Hudspeth	0	3	0	0			
Jeff Davis	2	6	1	2			
McCulloch	1	2	0	2			
Menard	0	3	0	1			
Midland	10	14	5	17	100%	100%	18%
Pecos	1	2	0	5			
Presidio	1	0	0	0			
Reeves	0	2	0	4			
Runnels	2	1	2	4			
Schleicher	1	2	0	2			
Sterling	0	1	0	0			
Sutton	2	2	0	2			
Tom Green	5	4	0	11	80%	100%	64%
Val Verde	2	4	0	3			
Ward	2	1	1	4			
Winkler	2	3	1	4			
Totals:	**58**	**83**	**16**	**101**			

Table 2
Results of Sighting Survey B

East Texas	#R	#S	#A	%A
Archer	0	2	2	
Bosque	4	4	0	
Clay	6	4	2	
Dallas	4	1	0	
Denton	3	2	0	
Freestone	1	1	0	
Grayson	1	1	0	
Grimes	3	2	0	
Harris	4	0	0	
Henderson	1	1	1	
Hood	4	5	0	
Houston	1	0	0	
Jack	15	18	5	28%
Johnson	1	1	0	
Lamar	1	1	0	
Limestone	2	1	0	
Montague	7	7	2	
Montgomery	2	0	0	
Nacogdoches	3	3	0	
Palo Pinto	11	14	6	43%
Parker	9	12	2	17%
San Jacinto	1	1	0	
Smith	5	4	1	
Somervell	1	1	0	
Tarrant	17	9	2	
Van Zandt	1	1	0	
Wichita	13	11	8	73%
Wise	10	11	3	27%
Young	2	2	0	
Totals:	**133**	**20**	**34**	

Central Texas	#R	#S	#A	%A
Bastrop	13	13	4	31%
Bell	2	2	0	
Brazoria	2	0	0	
Brown	1	2	0	
Burnet	0	1	0	
Comal	2	1	0	
Comanche	1	3	0	
Coryell	4	5	3	
DeWitt	2	2	1	
Eastland	14	16	4	25%
Erath	3	5	1	
Fayette	2	2	1	
Gonzales	0	1	1	
Guadalupe	1	0	0	
Hamilton	1	0	0	

Hays	2	1	0
Kimble	0	1	1
Kinney	0	1	0
Lampasas	2	2	0
Lavaca	2	1	0
Llano	4	5	1
Mason	4	5	0
Matagorda	1	1	1
McLennan	5	5	0
Real	1	0	0
Travis	2	1	0
Uvalde	0	1	1
Victoria	1	0	0
Totals:	**72**	**77**	**19**

South Texas	**#R**	**#S**	**#A**	**%A**
Aransas	0	1	1	
Atascosa	3	4	0	
Bexar	4	1	0	
Cameron	1	1	0	
Dimmit	0	1	0	
Frio	13	14	5	36%
Hidalgo	2	2	0	
Karnes	2	2	1	
Kleberg	5	5	3	
LaSalle	2	4	2	
Live Oak	1	1	0	
McMullen	0	1	1	
Medina	9	9	4	
Nueces	1	0	0	
San Patricio	1	1	0	
Starr	1	1	0	
Webb	2	2	0	
Willacy	1	1	0	
Wilson	1	1	0	
Zavala	0	1	0	
Totals:	**49**	**53**	**17**	

North Texas	**#R**	**#S**	**#A**	**%A**
Andrews	1	1	0	
Armstrong	2	2	0	
Bailey	0	1	0	
Callahan	5	5	1	
Castro	1	0	0	
Childress	2	2	2	
Cochran	2	2	1	
Dallam	1	1	1	
Donley	0	1	0	
Gray	4	3	0	
Hall	0	1	0	

Hansford	1	1	0
Hardeman	6	6	1
Hutchinson	6	6	1
Lamb	1	0	0
Lubbock	1	1	0
Moore	1	0	0
Nolan	1	1	0
Potter	7	7	2
Randall	1	2	0
Roberts	0	1	0
Shackelford	1	1	0
Stephens	1	1	1
Wheeler	1	1	1
Wilbarger	2	3	1
Totals:	**48**	**50**	**12**

West Texas	**#R**	**#S**	**#A**	**%A**
Brewster	14	14	3	21%
Coleman	0	2	0	
Concho	0	1	0	
Culberson	1	2	0	
Ector	1	1	0	
Hudspeth	0	1	0	
Jeff Davis	4	4	2	
McCulloch	10	9	3	
Menard	1	1	0	
Midland	1	1	0	
Tom Green	1	1	0	
Upton	2	2	0	
Totals:	**35**	**39**	**8**	

Table 3: Decade by decade breakdown of sightings of *P. cornutum* obtained from HLCS surveys

County	Decades									
	10s	20s	30s	40s	50s	60s	70s	80s	90s	Total
Anderson	0	0	0	1	2	1	0	0	0	4
Andrews	0	0	0	0	3	3	3	2	3	14
Angelina	0	0	0	0	1	0	0	0	0	1
Aransas	0	0	0	0	0	1	1	3	2	7
Archer	0	0	0	0	0	0	0	0	4	4
Armstrong	0	0	0	1	1	0	0	1	4	7
Atascosa	0	0	0	1	7	5	3	3	21	40
Austin	0	0	0	2	2	4	0	0	0	8
Bailey	0	0	0	0	0	0	0	0	1	1
Bandera	0	1	1	1	3	1	0	0	0	7
Bastrop	0	0	0	0	3	3	3	5	22	36
Baylor	0	0	0	0	1	1	0	0	0	2
Bee	0	0	1	1	3	3	1	2	0	11
Bell	0	1	1	1	6	5	5	0	6	25
Bexar	0	1	5	4	16	20	12	6	10	62
Blanco	0	0	0	0	0	0	0	0	0	0
Borden	0	0	0	0	0	0	0	0	1	1
Bosque	0	0	0	0	0	0	0	0	7	7
Bowie	0	0	0	0	0	0	0	0	0	0
Brazoria	0	0	0	0	0	0	0	0	0	0
Brazos	0	0	0	0	1	2	0	0	0	3
Brewster	0	0	0	0	1	4	3	5	26	38
Briscoe	0	0	0	0	0	0	0	1	2	3
Brooks	0	0	0	0	0	1	2	1	1	5
Brown	0	1	1	1	2	2	0	0	7	14
Burleson	0	0	0	1	1	0	0	0	0	2
Burnet	0	0	0	0	1	3	0	1	3	8
Caldwell	0	0	0	1	1	3	1	3	4	13
Calhoun	0	0	0	0	1	2	0	1	1	5
Callahan	0	0	0	0	0	0	0	0	6	6
Cameron	0	0	0	0	2	0	1	0	3	6
Camp	0	0	0	0	0	0	0	0	0	0
Carson	0	0	0	0	0	0	0	0	0	0
Cass	0	0	0	0	0	0	0	0	0	0
Castro	0	0	0	0	0	1	1	1	0	3
Chambers	0	0	0	0	1	1	0	0	0	1
Cherokee	0	0	0	0	0	0	0	0	0	0
Childress	0	0	0	1	1	0	0	1	2	5
Clay	0	0	0	1	1	0	0	1	5	8
Cochran	0	0	1	1	0	1	1	1	3	8
Coke	0	0	0	0	0	0	0	0	1	1
Coleman	0	0	0	0	1	0	0	1	6	8
Collin	0	1	2	2	2	1	0	0	1	9
Collingsworth	0	0	0	0	0	0	0	0	0	0
Colorado	0	0	1	2	2	2	0	0	1	8
Comal	0	0	0	0	1	0	1	1	1	4
Comanche	0	0	0	0	1	1	1	1	5	9
Concho	0	0	0	0	0	0	0	0	1	1
Cooke	0	0	0	0	3	3	1	1	0	8
Coryell	0	0	1	2	4	4	3	5	7	26
Cottle	0	0	0	0	0	0	0	0	0	0

Crane	0	0	0	0	0	1	1	0	0	2
Crockett	0	0	0	0	0	0	0	0	2	2
Crosby	0	0	0	0	1	1	0	0	2	4
Culberson	0	0	0	0	0	0	0	1	2	3
Dallam	0	0	0	0	0	1	1	1	1	4
Dallas	0	1	1	7	18	25	8	1	4	65
Dawson	0	0	0	0	2	2	2	1	2	9
Deaf Smith	0	0	0	0	1	1	0	0	1	3
Delta	0	0	0	0	0	0	0	0	0	0
Denton	0	0	0	0	3	2	1	0	3	9
DeWitt	0	0	1	2	6	13	11	5	17	55
Dickens	0	0	1	1	0	0	0	0	2	4
Dimmit	0	0	0	1	2	2	0	1	3	9
Donley	0	0	0	0	0	0	0	0	2	2
Duval	0	0	0	0	2	2	0	0	1	5
Eastland	0	0	0	1	2	6	5	2	21	37
Ector	0	0	0	3	17	15	13	9	11	68
Edwards	0	0	0	0	0	0	0	0	0	0
El Paso	0	0	0	1	4	7	5	4	3	24
Ellis	0	0	0	0	4	3	1	1	0	9
Erath	0	0	0	1	1	4	1	2	8	17
Falls	0	0	0	0	0	0	0	0	0	0
Fannin	0	0	0	0	1	1	0	0	0	2
Fayette	0	0	0	0	2	9	4	3	4	22
Fisher	0	0	1	1	1	1	1	1	2	8
Floyd	0	0	1	1	0	0	0	0	0	2
Foard	0	0	0	0	1	2	0	0	0	3
Fort Bend	0	0	0	0	0	0	0	0	0	0
Franklin	0	0	0	0	0	0	0	0	0	0
Freestone	0	0	0	0	1	0	0	0	1	2
Frio	0	0	0	0	2	1	1	1	19	24
Gaines	0	1	1	2	2	1	1	0	1	9
Galveston	0	0	0	1	2	2	0	0	2	7
Garza	0	0	0	0	0	0	0	0	1	1
Gillespie	0	0	0	0	2	4	0	9	3	18
Glasscock	0	0	0	0	0	1	1	0	1	3
Goliad	0	0	0	0	0	1	2	1	2	6
Gonzales	0	0	0	0	0	1	0	0	3	4
Gray	0	0	0	0	1	2	0	0	3	6
Grayson	0	0	1	2	3	3	1	0	2	12
Gregg	0	0	0	0	0	1	1	0	1	3
Grimes	0	0	0	0	0	0	0	0	2	2
Guadalupe	0	0	0	0	1	3	3	0	0	7
Hale	0	0	1	2	1	1	1	0	0	6
Hall	0	0	0	0	0	0	0	0	1	1
Hamilton	0	1	1	1	0	0	0	0	0	0
Hansford	0	0	0	0	0	0	0	0	1	1
Hardeman	0	1	1	1	1	0	0	0	7	11
Hardin	0	0	0	0	0	0	0	0	0	0
Harris	0	1	1	1	6	11	2	3	0	25
Harrison	0	0	0	1	1	0	0	0	0	2
Hartley	0	0	0	0	0	0	0	0	0	0
Haskell	0	0	0	0	2	2	0	0	1	5
Hays	0	0	0	0	3	3	2	2	5	15
Hemphill	0	0	0	0	0	0	0	1	0	1
Henderson	0	0	1	1	1	0	0	0	1	4
Hidalgo	0	0	1	1	9	8	2	3	9	33
Hill	0	0	0	1	3	2	2	0	1	9

Hockley	0	0	0	0	1	2	2	1	1	7
Hood	0	0	0	1	1	2	1	0	10	15
Hopkins	0	0	0	0	0	0	0	1	1	2
Houston	0	0	0	1	1	1	1	1	1	6
Howard	0	0	0	1	3	3	7	3	5	22
Hudspeth	0	0	0	0	0	0	0	1	4	5
Hunt	0	0	0	0	0	0	0	0	0	0
Hutchinson	0	0	0	0	0	1	0	1	6	8
Irion	0	0	0	0	0	0	0	0	0	0
Jack	0	0	0	0	2	1	1	1	19	24
Jackson	0	0	0	0	0	0	0	0	0	0
Jasper	0	0	0	0	0	0	0	0	0	0
Jeff Davis	0	0	0	0	0	0	1	1	10	12
Jefferson	0	0	0	0	0	1	0	0	0	1
Jim Hogg	0	0	0	0	1	1	0	0	2	4
Jim Wells	0	0	0	1	2	1	1	1	2	8
Johnson	1	1	0	0	0	1	1	0	2	6
Jones	0	0	0	1	4	4	7	1	1	18
Karnes	0	0	0	0	0	1	1	0	4	6
Kaufman	0	0	0	0	0	0	0	0	0	0
Kendall	0	0	0	0	1	1	0	1	1	4
Kenedy	0	0	0	0	0	0	1	1	0	2
Kent	0	0	1	1	1	1	1	1	2	8
Kerr	0	0	0	0	4	2	1	2	2	11
Kimble	0	0	0	0	1	0	0	0	1	2
King	0	0	0	0	0	0	0	0	0	0
Kinney	0	0	1	1	1	2	2	1	4	12
Kleberg	0	0	0	1	4	4	4	2	7	22
Knox	0	0	0	0	1	3	2	1	1	8
Lamar	0	0	0	0	0	0	1	0	1	2
Lamb	1	1	1	1	2	3	3	2	0	14
Lampasas	0	1	1	1	3	2	0	0	2	10
LaSalle	0	0	0	0	0	0	0	0	8	8
Lavaca	0	0	1	1	1	1	0	1	1	6
Lee	0	0	0	0	2	2	1	2	1	8
Leon	0	0	0	0	1	1	0	0	0	2
Liberty	0	0	0	0	0	0	0	0	0	0
Limestone	0	0	0	0	0	1	2	2	1	4
Lipscomb	0	0	0	0	0	0	0	0	0	0
Live Oak	0	0	1	1	4	7	6	3	9	31
Llano	0	0	0	0	0	0	0	0	8	8
Loving	0	0	0	0	0	0	0	0	0	0
Lubbock	1	1	2	3	7	8	4	4	13	43
Lynn	0	0	0	0	0	0	0	0	0	0
Madison	0	0	0	0	1	1	0	0	0	2
Marion	0	0	0	1	1	0	0	0	0	2
Martin	0	0	0	0	0	0	0	0	1	1
Mason	0	0	0	0	1	1	1	0	5	8
Matagorda	0	0	0	0	0	1	1	0	3	5
Maverick	0	0	0	1	2	0	0	0	3	6
McCulloch	0	0	0	0	1	0	1	1	11	14
McLennan	0	1	2	2	9	9	3	6	8	40
McMullen	0	0	0	0	1	1	2	1	7	12
Medina	0	0	0	1	2	1	1	1	10	16
Menard	0	0	0	1	1	1	1	0	4	8
Midland	0	0	0	5	7	10	9	4	15	50
Milam	0	1	1	1	2	1	0	0	0	6
Mills	0	0	0	0	1	1	0	0	2	4

Mitchell	0	0	0	0	1	2	2	2	4	11
Montague	0	0	0	1	1	2	2	2	12	20
Montgomery	0	0	0	0	0	0	0	0	2	2
Moore	0	0	0	0	0	0	0	0	0	0
Morris	0	0	0	0	0	0	0	0	0	0
Motley	0	0	0	0	0	0	0	0	0	0
Nacogdoches	0	0	0	0	0	1	1	2	4	8
Navarro	0	0	0	0	0	2	0	0	0	4
Newton	0	0	0	0	0	2	0	0	0	0
Nolan	0	0	1	1	2	3	1	0	2	10
Nueces	0	0	0	1	6	8	5	3	6	29
Ochiltree	0	0	0	0	0	0	0	0	0	0
Oldham	0	0	0	0	0	0	1	1	0	2
Orange	0	0	0	0	0	1	1	0	0	2
Palo Pinto	0	0	0	0	1	2	5	4	0	20
Panola	0	0	0	0	0	0	4	0	0	32
Parker	0	0	0	0	0	2	0	3	2	0
Parmer	0	0	0	0	0	2	4	0	13	24
Pecos	0	0	0	0	1	3	0	3	0	0
Polk	0	0	0	0	0	3	3	0	1	20
Potter	0	0	0	0	1	2	0	2	0	0
Presidio	0	0	0	0	0	0	3	0	2	12
Rains	0	0	0	0	0	0	0	0	0	0
Randall	0	0	0	0	0	1	3	1	2	3
Reagan	0	0	0	0	0	0	0	0	0	10
Real	0	0	0	0	0	0	0	2	1	2
Red River	0	0	0	0	0	0	0	0	0	5
Reeves	0	0	0	0	0	2	0	0	4	2
Refugio	0	0	0	0	1	0	1	0	0	2
Roberts	0	0	0	0	0	0	0	0	0	1
Robertson	0	0	0	0	0	0	1	1	0	1
Rockwall	0	0	0	0	0	0	0	0	0	0
Runnels	0	0	0	0	0	0	1	0	0	0
Rusk	0	0	1	1	2	3	0	2	4	1
Sabine	0	0	0	0	0	0	0	0	0	14
San Augustine	0	0	0	0	0	0	0	0	0	0
San Jacinto	0	0	0	0	0	0	0	0	0	0
San Patricio	0	0	0	0	0	0	0	0	0	0
San Saba	0	0	0	0	0	1	0	0	0	0
Schleicher	0	0	0	0	1	2	1	1	0	1
Scurry	0	0	0	0	1	2	2	1	1	0	3
Shackelford	0	0	0	0	1	2	1	2	0	2	8
Shelby	0	0	0	0	2	3	4	1	0	2	8
Sherman	0	0	0	0	0	0	0	0	0	1	12
Smith	0	0	0	0	0	0	0	0	0	0	1
Somervell	0	0	0	0	0	0	0	0	0	0	0
Starr	0	0	0	0	0	0	0	0	0	0	0
Stephens	0	0	0	0	0	3	3	5	7	11	29
Sterling	0	0	0	0	0	0	0	0	0	3	3
Stonewell	0	0	0	0	0	0	0	0	0	6	6
Sutton	0	0	0	0	0	0	0	1	0	2	5
Swisher	0	0	0	0	0	0	1	0	1	1	1
Tarrant	0	0	1	1	0	1	2	1	1	2	7
Taylor	0	0	0	0	0	0	1	1	0	0	5
Terrell	0	0	0	0	0	0	1	1	0	1	2
Terry	0	0	0	0	0	0	2	1	7	13	73
Throckmorton	0	0	0	0	0	0	1	0	3	9	41
Titus	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	1	0	0	0	3
	0	0	0	0	0	0	1	0	1	0	7
	0	0	0	0	0	0	0	0	0	0	0

Tom Green	0	0	0	2	9	8	4	1	5	29
Travis	0	1	2	5	18	25	6	13	10	80
Trinity	0	0	0	0	0	0	0	0	0	0
Tyler	0	0	0	0	0	0	0	0	2	2
Upshur	0	0	0	0	0	0	0	0	0	0
Upton	0	0	0	0	0	0	0	0	2	2
Uvalde	0	0	0	0	2	1	4	4	5	16
Val Verde	0	0	0	0	2	1	1	0	4	8
Van Zandt	0	0	0	0	1	3	2	0	2	8
Victoria	0	0	0	0	0	2	3	1	2	8
Walker	0	0	0	0	0	0	0	0	0	0
Waller	0	0	0	0	0	0	0	0	0	0
Ward	0	0	0	0	1	2	1	1	1	6
Washington	0	0	0	0	0	1	0	0	0	1
Webb	0	0	0	0	2	3	2	3	4	14
Wharton	0	0	0	0	1	2	1	0	0	4
Wheeler	0	0	0	0	0	0	0	0	1	1
Wichita	0	0	0	2	15	12	4	3	16	52
Wilbarger	0	0	1	1	1	1	0	1	3	8
Willacy	0	0	0	0	0	0	0	0	1	1
Williamson	0	0	3	3	9	9	4	8	13	49
Wilson	0	0	0	0	3	2	2	3	3	13
Winkler	0	0	0	0	3	3	1	0	2	9
Wise	0	0	0	1	1	2	2	3	12	21
Wood	0	0	0	0	0	0	0	1	1	2
Yoakum	0	0	0	0	0	1	0	0	2	3
Young	0	0	0	0	2	3	3	2	5	15
Zapata	0	0	0	0	0	0	0	0	1	1
Zavala	0	0	0	1	2	2	2	1	4	12
Total per Decade	3	17	51	122	403	480	283	240	776	2375

Appendix 4:

Lizard Data

Table 1: Data on Texas Horned Lizards Encountered: Summer 1992

Data on all THL encountered during the status survey are presented here: date; site ID (identification) number; Lizard ID: the toe-clip identification if possible, dead on road, dead, or escaped capture; R: if column has a Y, then the lizard caught was a recapture, if column is blank, the lizard was a first time capture; Sex: sex of adults are given, J represent Juveniles that were not positively sexed, H represents hatchlings; the SVL (snout-to-vent length) and the total length of each THL captured is given in millimeters; behavior of individuals; air and soil temperatures are given in Celsius for each point location where THL were encountered; weather conditions; and time of capture (Central Standard Time).

Table 2: Pesticide information for thirty sites where *P. cornutum* were captured escaped capture or were found dead is provided here.

Graph 1: Lizard Activity during Status Survey: Summer 1992. Bimodal activity of *P. cornutum* is confirmed from the data collected during the summer 1992.

Graph 2: Number of THL Encountered During Status Survey: Summer 1992. The number of *P. cornutum* encountered each day during the course of the survey period. All Texas horned lizards (THL) were caught between 20 May 1992 and 11 September 1992.

Data on Horned Lizards Encountered: Summer 1992

Date	Site ID	Lizard	R	Sex*	size	(mm)	Weight	Tair	Tsoil	Weather	Time	Behavior/Notes
	Number	ID			SVL	Total	(g)	(C°)	(C°)	Conditions	(CST)	
21-Jun-92	2	2-A5		F	79	114	20	32.2	43.3	ptly cldy, no wind	10:19	frozen under weeds
21-Jun-92	2	2-B5		F	66	94	12.5	32.8	36.7	clr, lt winds	18:06	heard scurry under thick weed cover
21-Jun-92	2	esc		J	-	-	-	-	-	-	18:32	ran into thk vegetation
21-Jun-92	2	esc		A	-	-	-	-	-	-	19:08	ran into thk vegetation
16-Jul-92	2	2-C5		F	69	91	16	32.2	39.4	ptly cldy, lt winds	10:41	frozen by weed clumps/broken tail-heeled
16-Jul-92	2	2-D5		M	78	112	19	31.1	36.7	mstly clr, brzy w/ gusts	19:10	running under weeds in a dry mud pit
16-Jul-92	2	2-A1		F	73	106	18	30.6	37.2	mstly clr, brzy w/ gusts	19:33	frozen under 2 ft tall weeds
16-Jul-92	2	2-B3		M	99	153	32	29.4	30.6	mstly clr, brzy w/ gusts	19:54	frozen in shade of an Agarita bush
16-Jul-92	2	DOR		F	50	75	-	-	-	-	09:25	DOR-fresh tire tracks, viscera protruding,
												swarmed by Solenopsis invicta
16-Jul-92	2	esc		A	-	med-sz	-	32.2	37.8	ptly cldy, brzy	09:55	esc in brush
16-Jul-92	2	esc		H	-	htchlng	-	32.2	37.8	ptly cldy, brzy	10:22	esc under 1 ft tall weeds
16-Jul-92	2	esc		H	-	htchlng	-	32.2	37.8	mstly clr, brzy w\ gusts	18:40	esc under 1-2 ft tall weeds
16-Jul-92	2	dead		-	-	-	-	-	-	-	-	dead, only bones found
18-Aug-92	2	2-B1		H	34	49	2.5	27.8	35.0	clr, lt wind	11:10	ran under ragweed by road
18-Aug-92	2	2-C1		H	32	44	3	30.6	38.9	clr, 10 mph brz	19:02	flinched-under ragweed
18-Aug-92	2	2-D1		H	25	38	1	29.4	36.7	clr, 10 mph brz	19:14	running on bare ground
18-Aug-92	2	DOR		F	95	-	-	-	-	-	-	recent road kill, swarmed by Sinv,
18-Aug-92	2	2-A2		F	81	113	23	27.8	29.4	clr, 10 mph brz	19:40	frozen in grassy center strip of dirt road
18-Jul-92	6	6-B5		F	99	140	38	30.6	32.2	mstly clear, brzy	19:45	frozen on top of grass on side of road
14-Aug-92	6	DOR		M	-	med-sz	-	-	-	-	-	described as "long-dead" on road
22-Jun-92	6	6-A5		F	116	167	62	31.1	45.6	ptly cldy, no wind	10:23	frozen in middle of road
10-Jul-92	39sub.	39-C1		F	54	71	10	30.0	26.7	cmplty cldy, lt brz	10:56	moving through some weeds
10-Jul-92	39sub.	39-C2		J	45	65	7	30.6	35.5	-	12:10	basking on caliche road
10-Jul-92	39sub.	39-C5		J	46	61	6	31.1	35	-	12:25	basking in center of caliche road
12-Jul-92	18	18-C12345		M	55	81	12.5	29.4	31.1	mstly clr	20:55	ran across trail/missing hind-right foot
15-Jul-92	92	92-C1		M	83	123	36	32.2	43.3	sunny, wndy	13:19	in grass next to a pasture
15-Jul-92	92	92-C5		M	56	81	10.5	36.7	36.7	sunny, hot, wind	16:36	in shadow of barrels
15-Jul-92	92	92-D1		M	79	117	33	33.9	41.1	sunny, hot, wind	17:37	basking in grass
15-Jul-92	92	92-D5		M	69	93	12.5	33.3	34.4	ptly cldy, wndy	18:10	on bare patch of soil in the shade
15-Jul-92	92	92-C2		F	84	112	37	32.2	-	ptly cldy, wndy	18:36	basking in grass/right occipital horn broken
15-Jul-92	92	92-D2		F	62	83	13	-	-	ptly cldy, wndy	19:00	still on dirt driveway next to grass edge
12-Jun-92	21	esc		A	-	-	-	-	-	-	18:35	ran under bush-could not capture
12-Jun-92	21	esc		H	-	htchling	-	26.7	29.4	clear, occ. brz	8:30	ran under thk veg & escaped
12-Jun-92	21	dead		M	-	med-lg	-	-	-	-	-	dead near chain link fence/covered with ant
8-Jul-92	21	dead		H/J	-	sm sz	-	-	-	-	-	skeleton found by fence

Data on Horned Lizards Encountered: Summer 1992

Date	Site ID	Lizard	R	Sex*	size	(mm)	Weight	Tair	Tsoil	Weather	Time	Behavior/Notes
	Number	ID			SVL	Total	(g)	(C)	(C°)	Conditions	(CST)	
6-Aug-92	21	21-A5		M	109	162	53	33.9	36.7	clr, lt brz	11:53	frozen at corner of garden
26-Jun-92	22	22-A5		M	84	129	29	31.7	41.1	mstly clear	10:58	frozen in mowed grass under mesquite tree
17-Jul-92	22	22-B5		M	81	117	19	33.3	43.3	ptly cldy, brzy	11:00	running across mowed debris of rodside
17-Jul-92	22	22-C5		M	72	106	16	38.9	41.7	clr, windy w/ gusts	17:20	frozen (?) by piles of junk in a backyard
17-Jul-92	22	22-D5		M	77	121	20	36.7	37.8	clr, windy w/ gusts	17:40	frozen by 2-3 ft Amaranth weeds
17-Jul-92	22	22-A1		F	80	113	24	37.2	40.0	clr, windy w/ gusts	18:10	still under thin creeping ground vines
17-Jul-92	22	esc		A	-	med-sz	-	36.1	48.3	mstly clr, brzy w\ gusts	12:25	rinning, crawled over bricks, under house
12-Aug-92	22	22-B1		M	83	119	24	35.0	37.8	mstly cldy, no wind	18:45	flinched, darted under a mesquite tree
12-Aug-92	22	22-C1		H	26	37	1	35.6	41.7	mstly cldy, no wind	19:00	flinched under canopy of thin, short grass
12-Aug-92	22	DOR		H/J	-	small	-	-	-	-	-	DOR-had been dead awhile
20-Jun-92	23	esc		J	-	-	-	32.2	44.4	ptly cldy, occ lt brz	10:50	basking in mowed area, lost in thick veg
20-Jun-92	23	DOR		J	-	-	-	-	-	ptly cldy, occ lt brz	10:26	DOR on FM 571 right in front of home
20-Jun-92	23	23-B5		J	46	64	6.5	31.7	37.8	ptly cldy, occ lt brz	12:30	in shade under a peach tree in garden
20-Jun-92	23	23-A5		J	51	70	8.5	31.7	34.4	mstly clear, brzy	13:23	sitting in shade of oaks/shedding
20-Jun-92	23	23-A1		F	103	133	62	32.2	36.7	mstly clear, brzy	14:00	under shade of Rose bush/Gravid
20-Jun-92	23	23-A34D4		J	53	71	9.5	33.3	32.2	mstly clear, occ brz	14:35	ran under shade of oaks, 5 m from 23-B5
20-Jun-92	23	dead		F	93	125	-	-	-	-	-	death due to predation
17-Jul-92	23	23-A34D4	Y	M	65	90	19	33.9	30	mstly cldy, lt brz	13:48	basking in sm. patch of sun under oaks
17-Jul-92	23	23-A5	Y	M	63	82	17.7	31.1	36.7	mstly-ptly cldy, lt brz	15:05	moved, under peach tree on E side of garde
30-Aug-92	23	23-A34D4	Y	M	69	99	26	33.3	33.9	ptly cldy, brzy w/ gusts	16:25	flattened on soil, ran to other side of fence
4-Jul-92	24	dead		-	-	-	-	-	-	-	-	dead, found a skin and skeleton
14-Jul-92	26	26-D5		F	89	126	41	36.7	-	clear, hot	18:58	ran under bush, buried itself in dirt
												near a Pogo mound, Pogos were biting Pc
8-Jun-92	29	29-A5		F	89	126	37.5	33.9	39.4	ptly cldy, occ.lt brz	17:50	frozen in mowed field
8-Jun-92	29	29-B5		M	94	135	52.5	33.9	39.4	ptly cldy, occ.lt brz	18:10	ran into tall weeds from open are
8-Jun-92	29	29-C5		F	81	115	27	33.9	39.4	ptly cldy, occ.lt brz	18:12	in mowed field
8-Jun-92	29	29-D5		M	92	134	42	32.2	35.6	ptly cldy, occ.lt brz	19:17	frozen under tall weeds near thicket
8-Jun-92	29	esc		-	-	-	-	-	-	-	-	ran into thick veg.
8-Jun-92	29	esc		-	-	-	-	-	-	-	-	ran into thick veg.
8-Jun-92	29	29-A1		F	101	140	48.5	30.6	31.7	ptly cldy, occ.lt brz	20:02	frozen in opening surrounded by tall weeds
2-Jul-92	29	29-B1		F	93	128	43	30.0	33.3	clear, lt winds	8:50	under sm. grass clump, 6' from Pogo nest
2-Jul-92	29	29-C1		M	82	128	29	32.2	35.6	clear, lt gusts	11:30	ran under vegetation/1 other Pc present, esc
2-Jul-92	29	29-D1		F	83	122	28	37.8	44.4	few sct clds, wndy	18:54	flinched in thin grasses
2-Jul-92	29	esc		-	-	-	-	32.2	35.6	clear, lt gusts	11:30	ran into thk vegetation
30-Jul-92	29	29-A2		F	97	121	34	28.3	28.9	ptly cldy, brzy-wndy	8:40	frozen within grass clumps/tip of tail gone
30-Jul-92	29	29-B2		H	30	42	1	35.6	40	ptly cldy, brzy-wndy	18:05	running under grass in recently mowed area

Data on Horned Lizards Encountered: Summer 1992

Date	Site ID	Lizard	R	Sex*	size	(mm)	Weight	Tair	Tsoil	Weather	Time	Behavior/Notes
	Number	ID			SVL	Total	(g)	(C)	(C°)	Conditions	(CST)	
30-Jul-92	29	29-C2		H	22	33	1	35.6	40	ptly cldy, brzy-wndy	18:12	running in thin grass, 30ft from
												29-B2/other hatchling present,but esc
30-Jul-92	29	29-D2		M	90	131	32	36.7	37.8	ptly cldy, brzy-wndy	18:25	snagged in old, vine covered chicken wire
30-Jul-92	29	DOR		A	-	med-sz	-	-	-	-	-	DOR-in grass beside road
30-Jul-92	29	esc		J	-	-	-	33.9	47.8	ptly cldy, lt brz	11:30	ran under tall and thk veg
30-Jul-92	29	esc		H	-	htchling	-	35.6	40	ptly cldy, brzy-wndy	18:12	runnings in thin grass,
30-Jul-92	29	DOR		J	-	sm-sz	-	-	-	-	20:00	long-dead DOR/found after surveying
11-Jun-92	32	32-C12345D4		H	47	65	6	29.4	43.3	sunny, no clouds, lt brz	12:45	found on the road-don't know which road
11-Jun-92	32	32-C4		M	80	123	27.5	30.6	37.8	sunny, no clouds, lt brz	12:00	standing in middle of US hwy 380
24-Jun-92	103	103-C1		J	52	71	9.5	28.9	34.4	clear, lt brz	10:00	basking in dirt drive
21-Jul-92	36	-		-	-	small	X	28.9	35.6	ptly cldy, gusty winds	12:05	in tire tracks of mowed trail of thin grass
21-Jul-92	36	36-C1		F	92	130	36.5	34.0	46	ptly cldy, brzy	11:55	sitting on grass next to park road
27-Jun-92	37	37-C1		M	76	112	27	30.0	35.6	sunny, ptly cldy, wndy	10:36	basking
27-Jun-92	48	dead		J	58	89	-	-	-	-	-	middle of dirt road/predation ground squirre
17-Jun-92	52	52-A5		F	58	80	10.5	28.9	33.1	mstly clear, lt brz	9:22	flinched
5-Aug-92	57	dead		H	-	htchlng	-	-	-	-	-	mangled and dead in grass beside dirt road
16-Jun-92	60	60-A5		F	106	155	42	33.9	34.4	ptly cldy, gusts	17:35	flinched on thin, short grass under mesquite
16-Jun-92	60	DOR		-	-	-	-	-	-	-	-	dead quite some time, carcass not collected
11-Jul-92	60	60-B5		H	22	31	1	26.7	28.3	overcast, lt winds	8:20	scurrying on top of grass by fence/R occ.
												horn broken and still bleeding
8-Aug-92	60	60-C5		H	23	34	1	37.8	46.7	ptly cldy, brzy w/ gusts	17:50	running under samll clump of thin weeds
8-Aug-92	60	60-D5		F	130	182	73	35.6	41.7	ptly cldy, brzy w/ gusts	18:55	frozen in dirt
22-May-92	NA	*		F	83	120	23.5	30.0	-	cloudy	14:35	dodging autos, chased off rd, caught in veg.
23-Jul-92	67	67-C5		M	54	83	16.7	29.2	26.2	mstly-ptly cldy, wndy	18:55	running on ground, covered in mud
22-Jun-92	72	72-D1		J	54	69	8.5	31.5	33	nny, clr-ptly cldy, lt brz	15:38	still, no movement/caught near a fence line
22-Jun-92	72	72-C1		J	40	53	5	33.0	35	sunny, hot	16:45	running away/caught near pile of old tires
3-Aug-92	72	72-D1	Y*	F	79.5	102	22.5	33.9	41.3	ptly cldy, hot, lt brz	17:32	Recap. was on same day while walking to
												another area to survey
3-Aug-92	72	*		H	24.5	31	1.3	32.8	35.8	ptly cldy, warm, lt brz	19:14	"scampering around"/*no toe clip was mad
3-Aug-92	72	72-C4		F	71.5	96.5	24.5	31.0	31.9	ptly cldy, warm, lt brz	19:34	basking, caught near newly built hay "pens"
28-Jun-92	74	74-C2		F	61	77	11	27.8	32.8	sunny, no clds, lt brz	11:05	basking on dirt road
28-Jun-92	74	74-C5		F	87	122	52	29.4	38.9	sunny, no clds, lt brz	11:30	flattened against fine gravel at side of drt rd
21-Aug-92	75	75-A5		H	25	35	1	26.7	27.2	clear, lt brz	08:36	running in bare ground by cemetery plot
21-Aug-92	75	75-B5		H	42	58	5	33.3	35.6	ptly cldy, lt brz	17:07	running by sparse weeds of old cemetery
10-Jun-92	NA	esc		-	-	-	-	-	-	-	-	running across Hwy 67 and through a fence

Data on Horned Lizards Encountered: Summer 1992

Date	Site ID	Lizard	R	Sex*	size	(mm)	Weight	Tair	Tsoil	Weather	Time	Behavior/Notes
	Number	ID			SVL	Total	(g)	(C)	(C°)	Conditions	(CST)	
7-Jul-92	78	78-C3		M	55	91	13	32.2	-	clear, brzy	20:23	"calmly" walking about
12-Jun-92	79	DOR		-	-	-	-	-	-	-	-	DOR
15-Jun-92	80	80-B5		F	82	113	52.5	33.3	44.4	mstly clear, brzy	12:02	elevated app. 7cm from ground in grass in
												the shade of green beans/ gravid
10-Jun-92	81	81-D*		F	99	133	53.5	36.1	44.4	clear, lt brz	13:10	frozen under tall weeds/* no Toe clip ID
10-Jun-92	81	81-A5		M	76	111	20	32.8	33.9	clear, lt brz	18:45	startled in grass in shade of peach trees
10-Jun-92	81	esc		-	-	-	-	-	-	-	13:45	ran into v. thick veg.
5-Jul-92	81	81-B5		M	82	114	20	37.2	40.6	clear, lt brz	18:00	on a pile of drying hay/dried blood between
												eyes, 2nd lgest horn broken
5-Jul-92	81	81-C5		F	100	135	43	33.9	34.4	clear, lt brz	19:40	frozen under weed just inside horse pen
												lacks horns on side of head
5-Jul-92	81	81-D5		F	84	119	20	32.2	33.3	clear, lt brz	20:35	frozen on side of dirt road
4-Aug-92	81	dead		M	100	-	-	-	-	-	-	dead 2ft from caliche road
23-Aug-92	81	81-A1		H	22	30	1	36.1	38.9	clear, lt brz	18:55	flinched in short grass
23-Aug-92	81	81-B1		M	90	128	32	36.1	38.3	clear, lt brz	19:10	frozen by roadside in grass
30-Jun-92	82 sub	82-C2		F	69	89	14	27.0	29	cool, wndy, ptly cldy	7:00	running on ground near campsite 19
29-Jun-92	82 sub	82-D2		F	81	106	29	35.0	37	windy, ptly cldy	20:05	feeding on Pogos near camping bathroom
8-Jul-92	82 sub	82-C2	Y	F	-	-	-	-	-	-	morn	caught near campsite 19/not during survey
22-Jul-92	87	87-C1		M	82	111	28.5	28.0	35	ptly cldy, strg brz	9:35	on a dirt road
22-Jul-92	87	87-D1		F	84	110	35	29.0	38	ptly cldy, wndy	10:34	basking, just defecated
22-Jul-92	87	87-C5		J	63	92	11	33.0	39	ptly cldy, brzy	18:21	covered in dirt on rd, ran out when pursued
11-Sep-92	87	87-C23		F	111	146	40	23.3	26.7	mstly cldy, occ lt brz	15:10	frozen <5' from Pogo nst on side of dirt
												road/toes already missing
11-Sep-92	87	dead		J	-	small	-	-	-	-	-	long dead/only torso found
13-Jun-92	90	90-A5		M	102	147	42	33.3	37.8	cldy, wndy	11:10	frozen on open grnd, 10 ft from 90-B5
13-Jun-92	90	90-B5		F	72	104	28	33.3	37.8	cldy, wndy	11:10	frozen on open grnd, 10 ft from 90-A5
13-Jun-92	90	90-C5		M	75	96	23	37.2	41.7	ptly cldy, wndy	12:17	frozen in an open area by tall weeds
13-Jun-92	90	90-D5		M	95	145	45	36.7	44.4	ptly cldy	12:37	frozen, by weeds in a large opening
13-Jun-92	90	90-A1		M	76	124	22	36.1	48.9	ptly cldy	12:50	scurried from under canopy of 2 ft tall weed
13-Jun-92	90	90-B1		F	80	114	21.5	32.2	33.3	clear, lt wind	18:55	scurried from under canopy of tall weeds
6-Jul-92	90	90-C1		M	85	129	25	32.8	42.8	ptly cldy, gusty wind	11:30	by dirt road in sparse weed and grass cover
												traces of dried blood around eyes
6-Jul-92	90	90-D1		M	112	168	58	37.8	44.4	clear, gusts to 25mph	18:15	frozen, ran to short weeds on side of drt rd
6-Jul-92	90	90-A2		F	111	154	43	39.4	43.3	clear, gusts to 25mph	18:37	frozen in open ground by road edge
6-Jul-92	90	90-B2		F	101	142	51	35.6	35.6	clear, gusts to 25mph	20:00	frozen by roadside, on bare ground

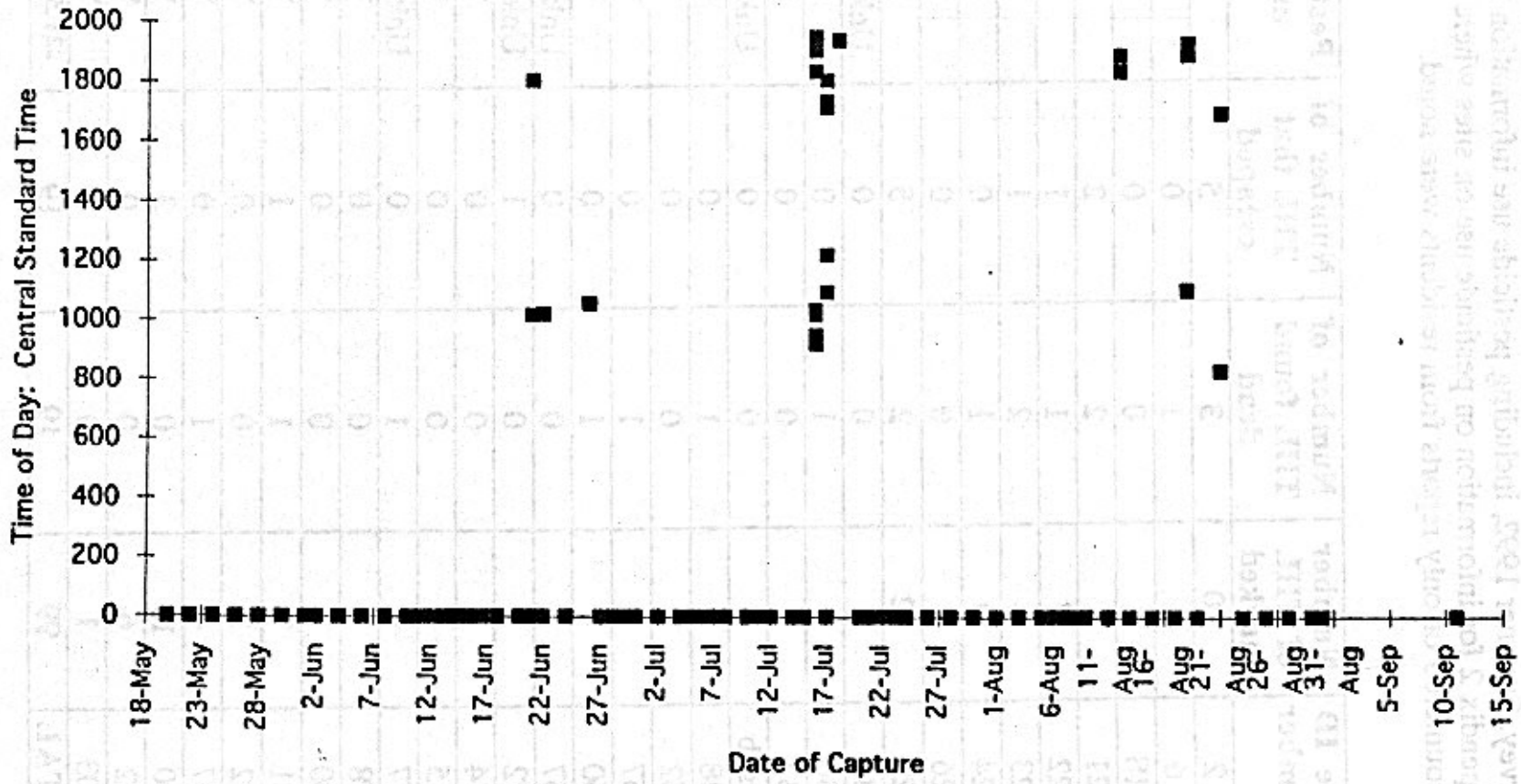
Data on Horned Lizards Encountered: Summer 1992

Date	Site ID	Lizard	R	Sex*	size	(mm)	Weight	Tair	Tsoil	Weather	Time	Behavior/Notes
	Number	ID			SVL	Total	(g)	(C)	(C°)	Conditions	(CST)	
6-Jul-92	90	90-C2		F	109	152	29	34.4	35	low sun, still gusty	20:22	bare ground
6-Jul-92	90	90-D2		F	96	146	37	33.9	32.8	set sun, gusty	20:43	scurried off road into short grass
1-Aug-92	90	90-A3		M	100	141	47	27.8	30	mstly cldy, lt wind	9:05	on top of very thk grass by horse pen
1-Aug-92	90	90-A1	Y	M	87	134	26	28.3	30.6	mstly cldy, lt wind	9:22	frozen in bare patch
1-Aug-92	90	90-B3		M	112	164	63	28.3	32.2	mstly cldy, lt wind	9:40	frozen, on edge of 2' tall veg.
1-Aug-92	90	90-C3		H	28	41	1	29.4	38.9	mstly cldy, lt wind	10:27	running
1-Aug-92	90	90-D4		H	30	44	1	30.6	38.9	mstly cldy, lt wind	10:54	running, under weeds
1-Aug-92	90	90-A4		M	112	163	52	37.2	38.9	ptly cldy, no wind	18:05	frozen under sparse 1 ft tall ragweed
1-Aug-92	90	90-B4		F	111	154	51	35.6	36.7	ptly cldy, no wind	19:03	frozen in shade of roadside weeds/shedding
1-Aug-92	90	90-C4		M	115	175	64	35.0	35.6	ptly cldy, no wind	19:37	frozen under 1 ft tall ragweed
1-Aug-92	90	esc		H	-	htchlng	-	28.9	34.4	ptly cldy, occ brz	9:56	lost in thk veg
1-Aug-92	90	esc		H	-	htchlng	-	28.9	34.4	ptly cldy, occ brz	9:56	lost in thk veg
1-Aug-92	90	esc		H	-	htchlng	-	29.4	38.9	ptly cldy, occ brz	10:47	lost in thk veg
17-Jul-92	NA	00-D4		F	66	89	16.5	27.8	-	ptly cldy, cool	-	feeding near an ant bed/not a survey site

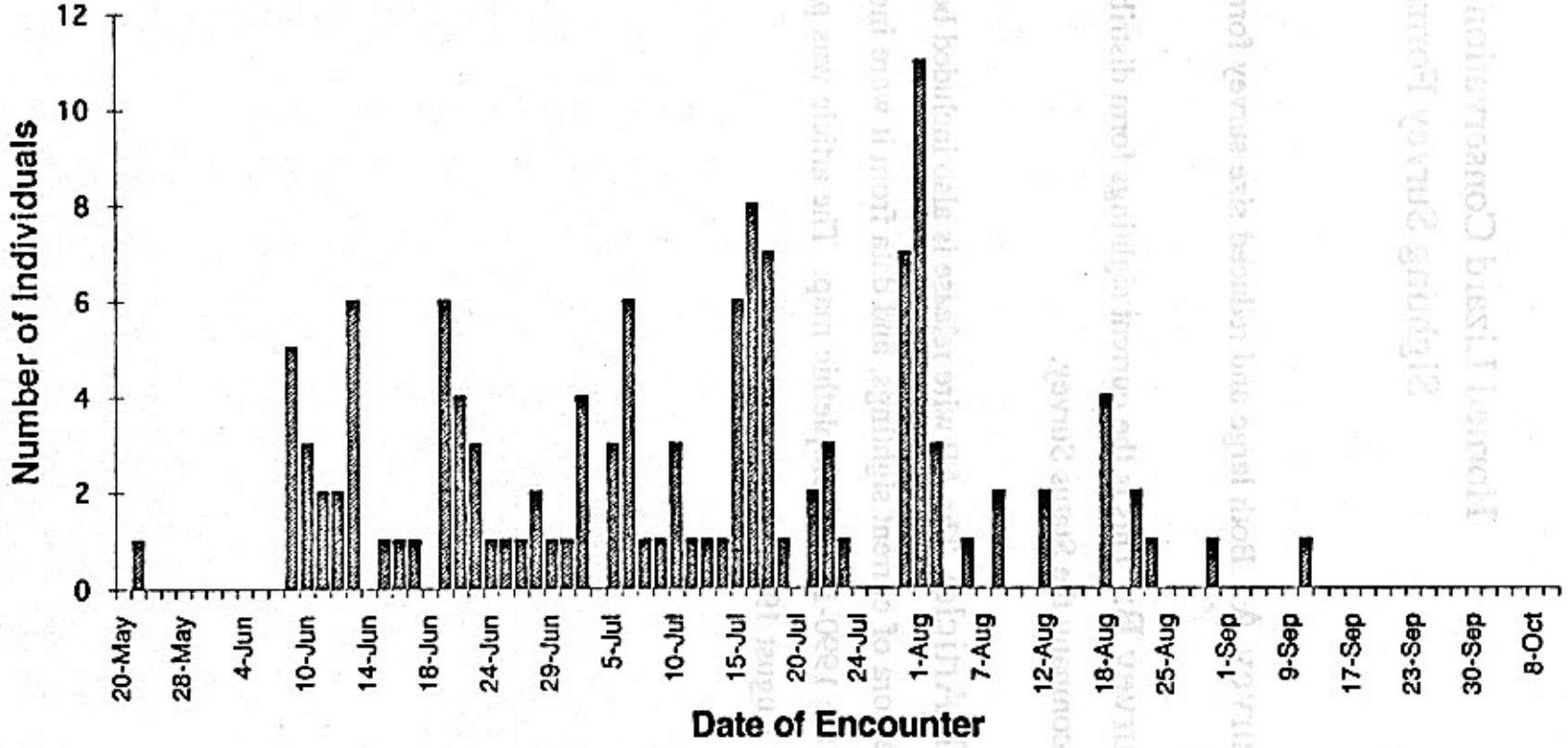
Table 2: Data for *P. cornutum* (THL) encountered on study sites during Status Survey, Summer 1992, including pesticide use information for those sites. See Appendix 2 for information on pesticide use on sites where no THL were encountered or only reports from residents were noted.

Site ID Number	Number of THL marked	Number of THL found dead	Number of THL that escaped	Pesticides used?	Pesticides used on Pogos?
2	10	3	5	Y	N
6	1	1	0	Y	N
18	1	0	0	N	N
21	1	2	2	Y	Y
22	7	1	1	Y	Y
23	4	2	1	Y	N
24	0	1	0	Y	Y
26	1	0	0	N	N
29	12	2	5	Y	Y
32	2	0	0	Unknown	Unknown
36	1	1	0	N	N
37	1	0	0	Y	Y
39sub	3	0	0	Unknown	Unknown
48	0	1	0	Y	Y
52	1	0	0	Y	Y
57	0	1	0	Y	N
60	4	1	0	Y	Y
67	1	0	0	Unknown	Unknown
72	3	0	1	Unknown	Unknown
74	2	0	0	Y	N
75	2	0	0	Y	N
77	0	1	0	Unknown	Unknown
78	1	0	0	Y	Y
80	1	0	0	Y	N
81	7	1	1	Y	N
82	2	0	0	Y	Y
87	4	1	0	Y	N
90	19	0	3	Y	N
92	6	0	0	Y	Unknown
103	1	0	0	Y	Y
TOTAL	99	19	19	22Y,5UN,3N	11Y,6UN,13N

Graph 1: Lizard Activity During Status Survey: Summer 1992



Graph 2: Number of Phrynosoma cornutum Encountered During Summer 1992 Status Survey



Appendix 5:

Horned Lizard Conservation Society
Sighting Survey Forms

Survey A: Both large and reduced size survey forms are provided.

Survey B: This is the current sightings form distributed by HLCS to accompany the Status Survey.

AP Article: The AP wire release is also included because it generated a plethora of current sightings, and data from it were included in the construction of the 1990-1992 choroplethic map. The article was printed in The Pampa News, 19 August 1992.

Texas Horned Lizard Sighting Survey

Explanation

This survey comes to you from a group of everyday Texans who are trying to help a little Texas critter sometimes known as the horny toad or horned frog. The horny toad is doing well in some parts of Texas but is in trouble in other parts of our state. You can help us discover what is happening to them by filling out this survey. We may be able to help the horny toad make a comeback!

Sightings

Have you seen a horny toad in the last 10 years? ☐ Yes ☐ No When? _____

Where was it? (City/Area, County) _____

Type of land/description of environment: ☐ backyard ☐ desert ☐ sparse grassland

☐ improved pasture ☐ grassland w/scattered trees ☐ scrubland ☐ woodland ☐ higher elevations

☐ other (describe) _____

Approximate body size: _____

Did you used to see horny toads often? ☐ Yes ☐ No

If yes, what decade(s)? (50's, 60's, etc.) _____

Where? (City/Area, County) _____

_____

Type of land/description of environment: ☐ backyard ☐ desert ☐ sparse grassland

☐ improved pasture ☐ grassland w/scattered trees ☐ scrubland ☐ woodland ☐ higher elevations

☐ other (describe) _____

Other Comments: _____

_____

_____

Name and address: _____

If your information is particularly pertinent, may we call you for more details? Phone _____

Would you be interested in becoming a member of the Horned Lizard Conservation Society? ☐ Yes ☐ No

Membership categories: ☐ Subscribing $10 (newsletter only) ☐ Student $10 ☐ Regular $25 ☐ Contributing $50

Thank you for your cooperation!

This information will be kept confidential and is not available to collectors or animal dealers.

Please fold this paper on the dotted lines on the reverse side and put your name and address as the return address.

Horned Lizard Conservation Society

Survey Committee • P.O. Box 122 • Austin, Texas 78767

3/91

Texas Horned Lizard Sighting Survey

You can help us discover what is happening to the horny toads in Texas by filling out this survey. We may be able to help them make a comeback!

Have you seen a horny toad in the last 10 years?

❑ Yes ❑ No When? _____

Where was it? (City/Area, County) _____

_____

Type of land/description of environment:

❑ backyard ❑ desert ❑ sparse grassland
❑ improved pasture ❑ grassland w/scattered trees
❑ scrubland ❑ woodland ❑ higher elevations
❑ other (describe) _____

Approximate body size: _____

Did you used to see horny toads often? ❑ Yes ❑ No

If yes, what decades? (50's, 60's, etc.) _____

Where? (City/Area, County) _____

_____

Type of land/description of environment:

❑ backyard ❑ desert ❑ sparse grassland
❑ improved pasture ❑ grassland w/scattered trees
❑ scrubland ❑ woodland ❑ higher elevations
❑ other (describe) _____

Other Comments: _____

_____

_____

Name and address: _____

_____

Phone (optional): _____

Would you be interested in becoming a member of the Horned Lizard Conservation Society? ❑ Yes ❑ No

Membership categories:

❑ Student $10 ❑ Subscribing $10 (newsletter only)
❑ Regular $25 ❑ Contributing $50

Thank you for your cooperation! Please mail this survey to:

Horned Lizard Conservation Society
Survey Committee
P.O. Box 122, Austin, Texas 78767

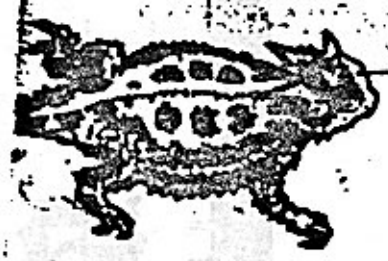
N1-3/91

For your convenience we are providing this camera-ready artwork in a 2-column format (25 pica width).

You may simply cut it out and paste onto your page layout.

Thank you.

Have You Seen a Horny Toad Lately?



The Horned Lizard Conservation Society would like you to fill out and mail in this form to help determine the current status of the Texas horned lizard (horny toad). Please remember that horned lizards are protected in the state of Texas and should not be disturbed in any way.

Information on Sightings

Date:____ Time:_____

County:_____

Exact Location (street address, nearest intersection etc.):

_____

_____

_____

Surroundings (field, woodland, street, etc):

_____

Weather Conditions:

_____

Number of lizards: _____

Size:_____

Behavior of lizards (sunning, feeding, running, etc.):

_____

_____

_____

Comments:

_____

_____

_____

Horned Lizard Conservation Society
Dept 150-1 ♦ P.O. Box 122 ♦ Austin, Texas 78767

Horned toad numbers diminish

WACO (AP) — Forget global warming. Don't worry about the ozone layer. There's something far more important for Texans to worry about.

The horned toads, ferocious-looking miniature dinosaurs that for ages have stalked red ants across the Central Texas landscape are vanishing.

Officials say horned toads are hard to find these days. They've been killed off by fire ants, pesticides and loss of habitat.

They're actually misnamed, scientists say, because they're not really toads, they're lizards.

"Horny toads like dirty, dusty, sandy, dry areas with lots of red ants to eat," said Bill Davis, publicity and marketing director for the Horned Lizard Conservation Society. "We don't have that anymore, so there's not many of them left."

In far West Texas and New Mexico, where there still is plenty of dust, dirt and food, horned toads continue to be plentiful.

The Horned Lizard Conservation Society, an Austin-based group, is asking people to report Central Texas sightings of the lizards.

The group hopes to eventually reintroduce the lizards in the landscapes they once roamed, where possible. However, their resurgence is unlikely wherever fire ants abound.

"A horned lizard can eat 200 red ants a day," Davis said. "They can eat fire ants, too, but fire ants swarm them and kill them."

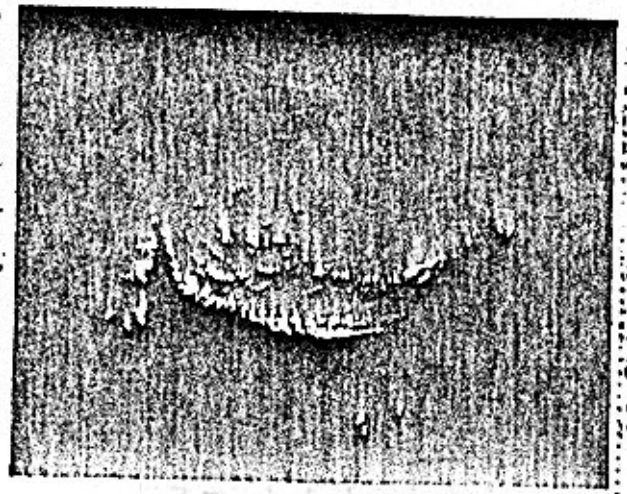
Texas horned lizards most enjoy eating harvester ants, the big red ants that make large circular clearings around the opening of their nests.

Should something try eating them, the lizards can squirt blood from ducts at the corners of their eyes as a defense.

Fred Gehlbach, a biology professor at Baylor University, said the last horned toads in the immediate vicinity of Waco were seen in the late 1970s and early 1980s, with few sightings since.

He said they disappeared locally about the same time the state of Texas sprayed East and Central Texas with Mirex, a pesticide to kill fire ants.

Harvester ants have also become scarce, "so it's possible horned toads died out either because their food supply did or because of spraying," Gehlbach said. "We're just not sure."



(Staff photo by Daniel Wagner)

A horned toad visits *The Pampa News* recently.

Three species of horned lizards make Texas their home, the mountain short-horned, round-tail and Texas horned lizards. The Texas Parks and Wildlife Department lists the mountain short-horned and Texas horned lizards as threatened.

This means no one may take them from their habitat or sell them without a special permit.

The society says the Texas horned lizard is the most well-known of these species of the horned lizard.

To report sightings, write the Horned Lizard Conservation Society at P.O. Box 122, Dept. 161-S, Austin 78767.

Political hardball, Page 3 | Women football preview, Page 9 | Alaskan volcano erupts, Page 5

The Pampa News

25c AUGUST 19, 1992 WEDNESDAY