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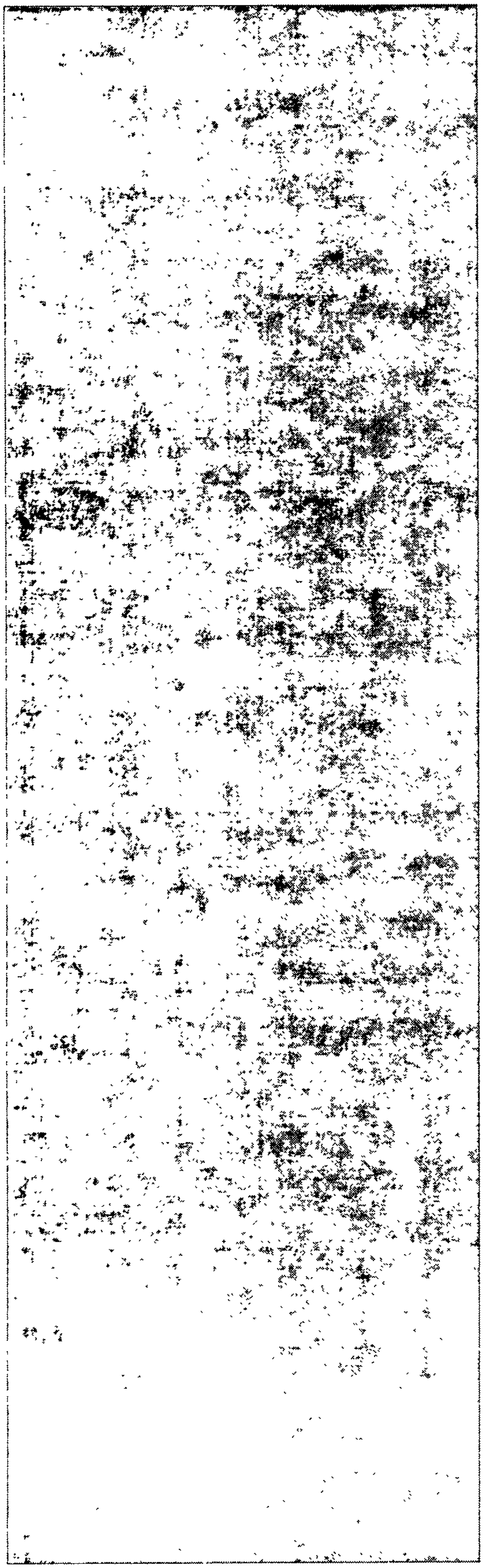

Studies of Annual and Seasonal Variations in Four Species of Reptiles and Amphibians at Los Alamos National Laboratory

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STUDIES OF ANNUAL AND SEASONAL VARIATIONS IN FOUR SPECIES OF REPTILES AND AMPHIBIANS AT LOS ALAMOS NATIONAL LABORATORY

by

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ABSTRACT

Baseline studies of reptiles and amphibians of the Pajarito wetlands at Los Alamos National Laboratory have been conducted by the Ecology group since 1990. With the data gathered from 1990–1997 (excluding 1992), we examined the annual and seasonal population changes of four species of reptiles and amphibians over the past seven years. The four species studied are the Woodhouse toad (*Bufo woodhousii*), the western chorus frog (*Pseudacris triseriata*), the many-lined skink (*Eumeces multivirgatus*), and the plateau striped whiptail lizard (*Cnemidophorus velox*). Statistical analyses indicate a significant change on a seasonal basis for the western chorus frog and the many-lined skink. Results indicate a significant difference in the annual population of the Woodhouse toad.

INTRODUCTION

Research has demonstrated the importance of reptiles and amphibians in natural ecosystems. Reptiles and amphibians are indicators of general environmental health while aquatic amphibians and snakes are good indicators of the health of aquatic systems. These animals are especially sensitive to pollution and loss of aquatic habitat (Hall 1980). Amphibians and reptiles are also important in food chains, and they make up large proportions of vertebrates in certain ecosystems (Bury and Raphael 1983). Because of recent concern for non-game wildlife, biologists and land managers find themselves faced with the need to conduct studies and to assess management needs for a group of animals they know little about (Jones 1986). Long-term studies can provide insight into relationships between variation in environmental factors and variation in population dynamics (Dunham and Overall 1994).

Population characteristics of reptiles and amphibians fluctuate from year to year as well as month to month. In lizards for example, growth rates have been shown to differ among years, the variation often being attributed to differences in rainfall or food availability between years (Ballinger and Congdon 1980; Dunham 1978). The variation among years may be a proximate response to variation in rainfall and temperature (Smith et al. 1995). Influences by humans, such as disturbance and urban development of areas, may be detrimental to these species. With these factors in mind, we wished to examine whether significant changes of populations at the Los Alamos National Laboratory (LANL) Pajarito wetlands have occurred seasonally or annually.

Pitfall trapping has been employed widely for surveys of amphibian and reptile diversity and abundance in different habitat types. Also, pitfall trapping is useful for investigating seasonal activity patterns. Traps can be operated continuously so that variations in seasonal activity can be detected (Bury and Corn 1987).

This report documents the results of monitoring reptiles and amphibians using pitfall trapping at LANL by the Ecology Group (ESH-20) since 1990. The goal was to determine seasonal and annual trends among reptiles and amphibians of the Pajarito wetlands. Seasonal and annual differences were analyzed for populations of the four most common species caught. The results will show whether significant changes within these four species have occurred over the past seven years.

Monitoring generally requires sampling over several years so that population and community health can be accurately estimated. This is especially needed in sampling amphibians and reptiles because populations fluctuate greatly from year to year. Multiyear data collection allows biologists to determine which population trends can be attributed to naturally fluctuating environmental conditions and which ones should be attributed to other causes (Jones 1986). Studies such as this will allow ESH-20 to provide pertinent information for LANL management decisions as they pertain to reptiles and amphibians.

Capture data collected from 1990–1997 were analyzed for two species of reptiles, plateau striped whiptail lizard (*Cnemidophorus velox*) and many-lined skink (*Eumeces multivirgatus*), and two species of amphibians, Woodhouse toad (*Bufo woodhousii*) and western chorus frog (*Pseudacris triseriata*), to determine whether there were significant seasonal or annual fluctuations in populations of these species.

MATERIALS AND METHODS

Study Area

The study area is located within LANL's Technical Area 36, known as the Pajarito wetlands. The wetlands are located 804 m (2655 ft) west of White Rock on Pajarito Road (Figure 1). The study site is 127 m (419 ft) wide by 356 m (1175 ft) long.

Vegetation occurring in this area include a riparian and a dry upland association (Degenhart et al. 1996). The major vegetation in the upland area is Apache plume (*Fallugia paradoxa*), rabbitbrush (*Chrysothamnus nauseosus*), big sage (*Artemisia tridentata*), and blue grama (*Bouteloua gracilis*). Vegetation in the wetland area include rush (*Juncus* spp.), willows (*Salix* spp.), and broad-leaved cattail (*Typha latifolia*). Pitfall traps were situated in both upland and riparian vegetation types.

Pitfall Traps

Pitfall trapping was the method used for capturing reptiles and amphibians at LANL. The study site is divided into two areas—denoted as north and south—by an ephemeral stream. Seven small ponds are located adjacent to the north side of the stream.

Drift fences (aluminum flashing) with pitfall traps (large buckets) are commonly used to inventory and monitor populations of amphibians and reptiles (Heyer et al. 1994). Aluminum flashing is placed in the ground and used to intercept and direct animals into pitfall traps. Lids are elevated above the traps to provide overhead protection by attaching uniformly shaped wooden blocks underneath the corners. The entire trap system, including the aluminum flashing and buckets, are referred to as a pitfall trap array.

Nine pitfall trap arrays were placed in the wetland area in 1990, and trapping was continued on a seasonal basis until 1997. All data collected for 1992 was invalidated because of predation within the pitfall traps. In 1993, an additional seven

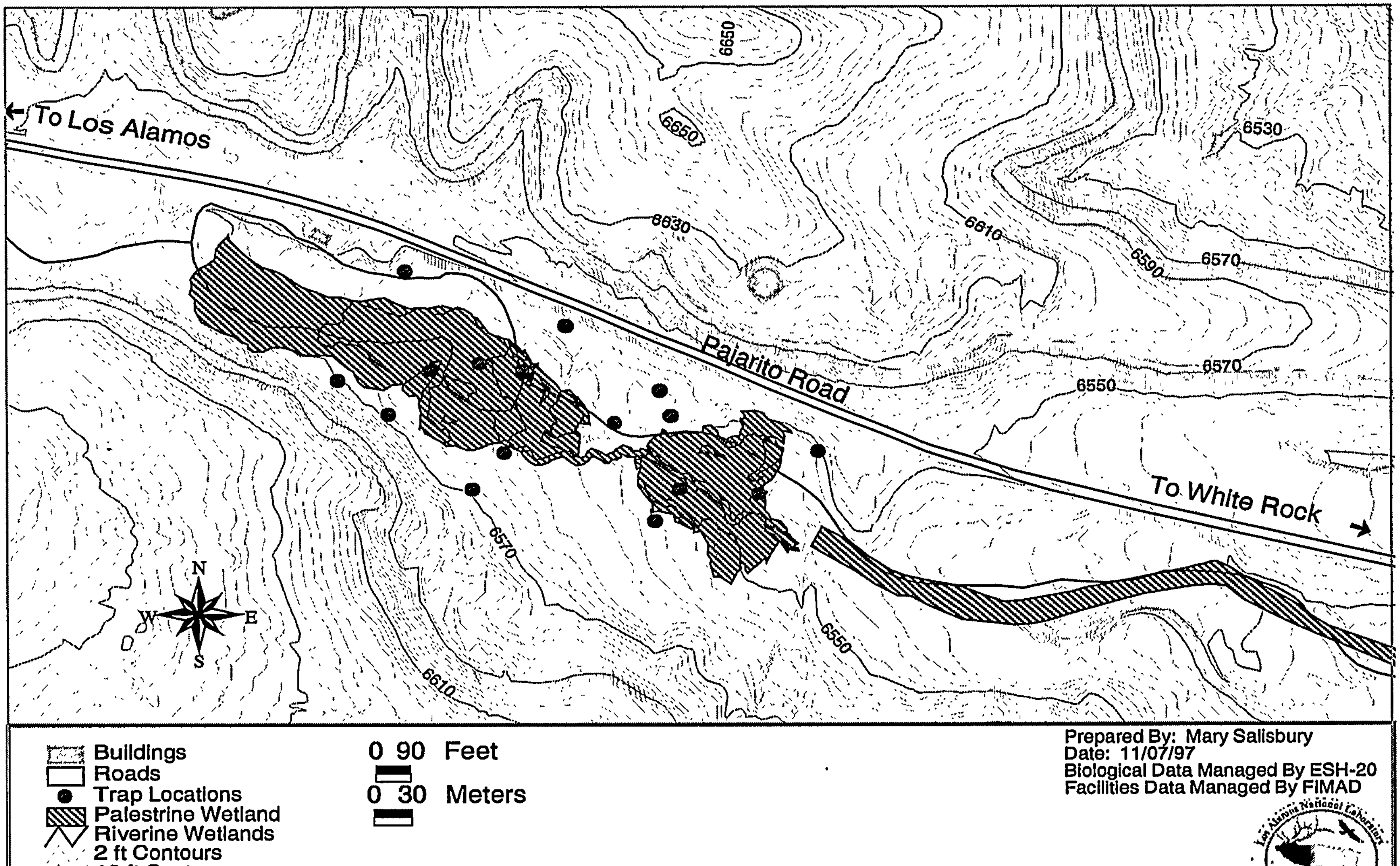

Figure 1: Pitfall Trap Array Locations within Pajarito Wetlands

pitfall trap arrays were added to the study site at the wetland area. The total number of pitfall traps (1-gallon buckets) in the 16 arrays was 72. In 1997, all pitfall traps were replaced with 5-gallon buckets. The total number of traps was reduced from 72 to 40. Although the number of traps changed, the traps are in the same location and encompass the previously occupied space.

Traps were opened for the season in late April and remained open through late September. They were checked daily Monday through Friday and closed on the weekends. Trapping days for all years are similar. Field technicians responsible for checking the traps changed on a yearly basis. Because data collected from 1992 are incomplete, we excluded them from our analysis.

Animal Processing

Once animals were captured, they were brought back to the laboratory to be measured. The mass of the animal was measured in grams with a Mettler electronic scale. Then the distance from the tip of the rostrum to the vent (snout-vent length) was measured in millimeters with Mitytoyo electronic calipers. Total tail length was measured from the vent to the tip of the tail. If the tail had been damaged or showed regeneration, then the regenerated portion of the tail was measured from the anterior portion of where the tail was broken off to the most posterior portion of the tail. The data were recorded with date, trap number, and comments.

Analysis

Data for 1990 and 1991 were adjusted for comparison to the other years' data. The total number of captures (1990 and 1991 were calculated separately) were divided by nine to get an average number of captures per trap. The resulting numbers were multiplied by 16 to estimate the number of animals that would have been captured if 16 traps were first present when trapping began. The adjusted results may not be whole numbers; results were recorded to the nearest tenth.

Annual and seasonal fluctuations in the number of captures were analyzed for each species using a Kruskal-Wallis non-parametric test. Numbers of captures of reptiles and amphibians were tested for annual and monthly differences during 1990–1997 (excluding 1992).

RESULTS

Table 1 lists all of the reptiles and amphibians captured at the Pajarito wetlands since 1990 (excluding 1992). The four reptiles and amphibians of interest caught on an annual basis at the Pajarito wetlands since 1990 (excluding 1992) have been recorded and are included in Table 2. The four reptiles and amphibians of interest caught on a seasonal basis (excluding 1992) are included in Table 3. Table 4 shows the results of the Kruskal-Wallis test conducted for the species of interest by year and month.

Woodhouse Toad

Figure 2 shows graphs indicating seasonal and annual fluctuations of the Woodhouse toad. The seasonal graph shows the total number of captures of each month over all of the years. The annual graph shows the total per year. The seasonal variation shows a low number of toads captured (2) for July, while the highest captured is 16.8 for August. The graph displaying annual variation indicates a low number of captures (1-2 toads caught) for 1994-1996, and a high number of captures (27) for 1997.

As indicated in Table 4 the P-value for annual variation is 0.05, where the P-value for seasonal variation is 0.64.

TABLE 1. Reptiles and Amphibians Caught at Pajarito Wetlands.*

Species	1997	1996	1995	1994	1993	1991**	1990**
Tiger salamander	1	7	1	1	5	53.3	8.9
New Mexico spadefoot toad	2	7	0	1	0	1560.8	1.8
Woodhouse toad	27	1	2	2	9	7.1	1.8
Canyon tree frog	0	0	0	0	1	1.8	0
Western chorus frog	55	15	4	12	21	48	49.7
Short-horned lizard	5	0	0	1	1	0	3.6
Prairie lizard*	5	12	3	6	13	3.6	17.8
Plateau striped whiptail	83	101	42	73	23	55.1	85.3
Many-lined skink	33	37	22	35	49	40.8	81.8
Great plains skink	0	1	0	1	1	3.6	42.7
Night snake	0	1	0	0	0	0	0
Smooth green snake	0	0	0	0	1	0	0
Western terrestrial garter snake	5	3	1	9	10	5.3	7.1
Prairie rattlesnake	1	0	0	0	0	0	0

*All numbers of animals captured include data ranging from April through October 1990–1997 (excluding 1992).
**1990 and 1991 have been adjusted for animals caught in 16 traps vs. 9 traps

TABLE 2. Reptiles and Amphibians Caught Annually at Pajarito Wetlands.*

Species	1997	1996	1995	1994	1993	1991**	1990**
Woodhouse toad	27	1	2	2	9	7.1	1.8
Western chorus frog	55	15	4	12	21	46.2	49.8
Plateau striped whiptail	83	101	42	73	23	53.3	78.2
Many-lined skink	33	37	22	35	49	39.2	81.8

*All animals captured range from May through September
**1990 and 1991 have been adjusted for animals caught in 16 traps vs. 9 traps

TABLE 3. Reptiles and Amphibians Caught Seasonally at Pajarito Wetlands 1990–1997 (excluding 1992).*

Species	May	June	July	August	September
Woodhouse toad	9.1	9	2	16.8	13
Western chorus frog	28.3	8.6	28.2	59.5	78.4
Plateau striped whiptail	62.6	138.8	101.1	68.7	82.3
Many-lined skink	17.9	37.7	59.4	138	38

*1990 and 1991 have been adjusted for animals caught in 16 traps vs. 9 traps

TABLE 4. Results of Kruskal-Wallis Non-Parametric Test for Annual and Seasonal Variation.

Species	P-value for Annual	P-value for Seasonal
Woodhouse toad	0.05*	0.64
Western chorus frog	0.10	0.04*
Plateau striped whiptail	0.16	0.27
Many-lined skink	0.74	<0.01*

*Significant at P = 0.05

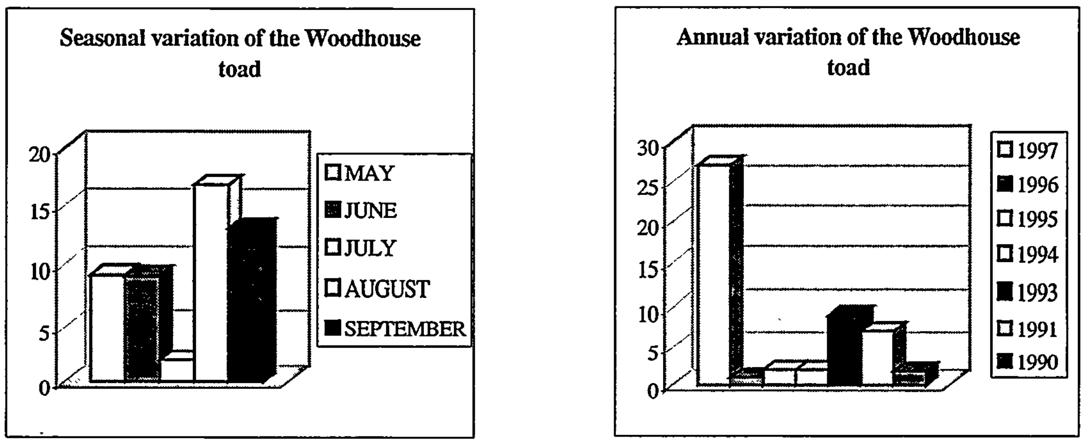

Figure 2. Seasonal and annual variations of the Woodhouse toad.

Western Chorus Frog

In Figure 3 the graph representing seasonal variation of the western chorus frog shows a low number of captures being 8.6 for June and the high number of captures of 78.4 for September. The graph indicating annual variation shows a low number of captures of 4 in 1995, while in 1997 a high number of frogs (55) were caught. Shown in Table 4 are the P-values for annual and seasonal variation. Annual variation had a P-value of 0.10. Seasonal variation had a P-value of 0.04.

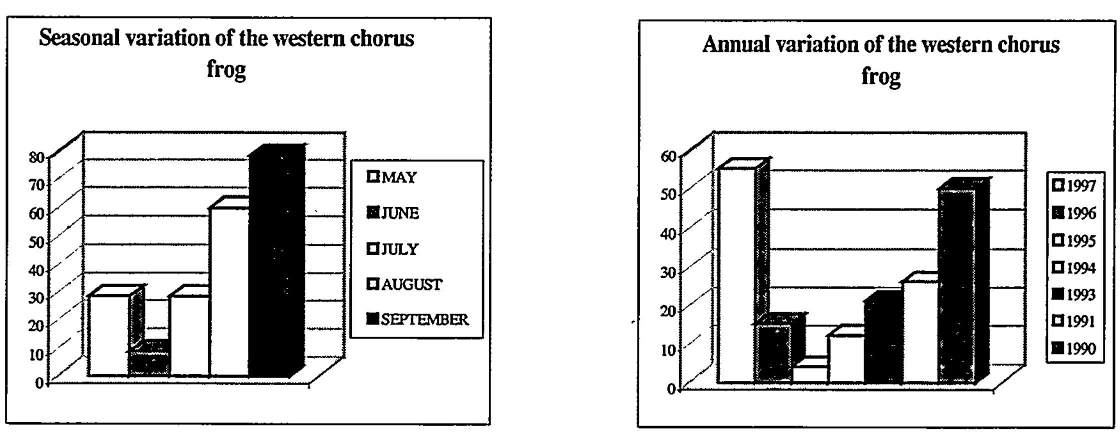

Figure 3. Seasonal and annual variations of the western chorus frog.

Plateau Striped Whiptail

Figure 4 shows graphs indicating annual and seasonal variations of the plateau striped whiptail. The smallest number of captures was 62.6 individuals in May, while the highest number of captures was 138.8 in June. The annual graph shows 1993 as the lowest number of captures (20) and 1996 as the highest number of captures (98). Shown in Table 4 are the P-values for seasonal and annual variation. The P-value for annual variation is 0.16, the P-value for seasonal variation is 0.27.

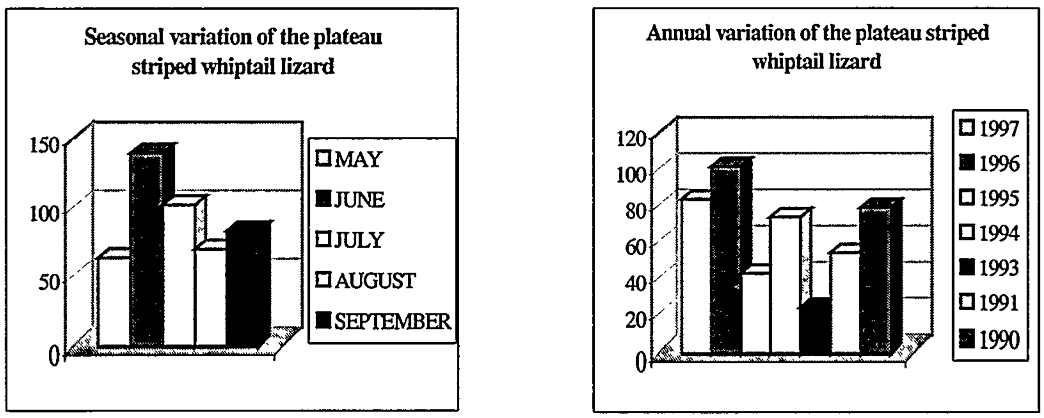

Figure 4. Seasonal and annual variations of the plateau striped whiptail lizard.

Many-Lined Skink

Figure 5 shows graphs indicating annual and seasonal variations in captures of the many-lined skink. The smallest number of skinks captured on a seasonal basis is 17.9 for May. The greatest number of skinks captured is 138 for August. The lowest number of skinks that were caught on an annual basis was 22 in 1995. The greatest number captured being 81.8 was in 1990. As shown in Table 4, the P-value for seasonal variation is <0.01. For annual variation the P-value is 0.74.

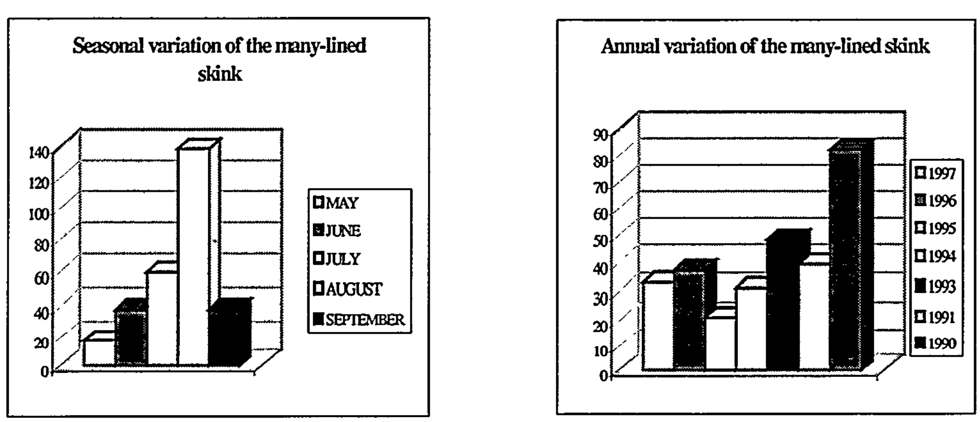

Figure 5. Seasonal and annual variations of the many-lined skink.

DISCUSSION

Annual variation of the Woodhouse toad is significant with elevated numbers in 1997 compared to 1990–1996. More juveniles were caught in 1997 than any other year. The majority of all juveniles caught in 1997 were in the months of August and September. Reasons for this may be attributed to increased precipitation in the late summer months. Gehlbach (1965) suggested that populations in northwestern New Mexico have a biannual breeding regime, corresponding to spring and summer peaks in precipitation. Currently there are no data to support his suggestion (Degenhardt et al. 1996).

The populations of western chorus frogs showed a significant difference in August and September as compared to other months. This may be attributed to the fact that chorus frogs are much more active during the day in late fall. Also, the monsoon season in New Mexico occurs in mid-summer, which may cause the frogs to gather in ponds and breed, thus producing large quantities of young frogs in the fall months.

The many-lined skink has shown a significant difference in terms of seasonal variation. Large quantities of juvenile skinks were caught in all of August for all years sampled. This is probably because of the emergence of hatchlings and increased activity for foraging purposes, prior to aestivation during the winter months.

Reptiles and amphibians have been trapped at the Pajarito wetlands using pitfall traps since 1990. Animals were trapped in 1992, but this data could not be used. The project was initiated to monitor these species as they are affected greatly by environmental changes. Through the years we have modified our sampling design and implemented new techniques to help us better understand the population dynamics of these animals. Monitoring generally requires sampling over several years so that species and community health can be more accurately evaluated. This is especially needed in sampling amphibians and reptiles because populations fluctuate greatly from year to year with environmental changes, with respect to precipitation. Data collected over several years allows biologists to determine if population trends are resulting from naturally fluctuating environmental conditions or to other causes (Jones 1986).

Literature Cited

Ballinger, R. E., Congdon, J. D. 1980. Food resource limitation of body growth rates in *Sceloporus scalaris* (Sauria:Iguanidae). Copeia 1980(4):921–923.

Bury, R. B., Corn, P.S. 1987. Evaluation of pitfall trapping in northwestern forests: trap arrays with drift fences. Journal of Wildlife Management. 51:112–119.

Bury, R. B., Raphael, M.G. 1983. Inventory methods for amphibians and reptiles, *in* Bell, J. F., Atterbury, T. eds. Renewable resource inventories for monitoring changes and trends: Proceedings of an international conference; 1983 August 15-19; Corvalis, OR. SAF 83-14. Corvalis, OR: Society of American Foresters: 416–419.

Degenhart, W. G., Painter, C. W., Price, A. H. 1996. The amphibians and reptiles of New Mexico. University of New Mexico Press.

Dunham, A. E. 1978. Food availability as a proximate factor influencing individual growth rates in the iguanid lizard

Sceloporus merriami. Ecology 59:770–778.

Dunham, A. E., Overall, K. L. 1994. Population responses to environmental change: Life history variation, individual-based models, and the population dynamics of short-lived organisms. American Zoologist 34:382–396.

Gehlbach, F. R. 1965. Herpetology of the Zuni Mountains region, northwestern New Mexico. Proc. U. S. Natl. Mus. 116(3505):243–332

Hall, R. J. 1980. Effects of environmental contaminants on reptiles: A review. U. S. Department of Interior, Fish and Wildlife Service special scientific report 228. Washington, D.C.

Heyer, W. R.,. Donnelly, M. A, McDiarmid, R. W., Hayek, L. A. C. and Foster, M. S. eds. 1994. Measuring and monitoring biological diversity. Standard methods for amphibians. Smithsonian Inst. Press, Washington D. C.

Jones, B. K. 1986. Reptiles and amphibians. Pp. 267–290, *in* Cooperrider, A. Y., R. J. Boyd, and H. R. Stuart, eds. Inventory and monitoring of wildlife habitat. U. S. Dept. Inter., Bur. Land Manage. Service Center. Denver, CO. xviii, 858 pp.

Smith, G. R., Ballinger, R. E., Rose B. R. 1995. Reproduction in *Sceloporus virgatus* from the Chiricahua Mountains of southeastern Arizona with emphasis on annual variation. Herpetologica. 51(3):342–349.