Proceedings of the Iowa Academy of Science

Volume 92 | Number Article 4

1985

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Proc. Iowa Acad. Sci. 92(5):159-163, 1985

The Amphibians and Reptiles of Iowa's Loess Hills

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The amphibians and reptiles of Iowa's Loess Hills were surveyed from 1969 through 1983. Results of this study were compared with collections made prior to 1969, mostly those of R. M. Bailey from 1939 through 1946. The area was found to support 21 snake, four lizard, six turle, ten anuran, and two salamander species. Five species have declined in abundance and seven may have increased. Most of the declining forms were prairie dwellers while most of those appearing to increase were woodland species. Three species were added to the known fauna of the Loess Hills.
INDEX DESCRIPTORS: Amphibians and reptiles, Loess Hills, endangered species.

The amphibians and reptiles of the Loess Hills include three extremes of adaptation. The earliest as well as the most recent post-glacial inhabitants were mesic, forest adapted species. Forms that invaded during the altithermal period 3,000-7,730 years ago (Baker and Van Zant, 1976) were xeric grassland adapted. A third, marsh-land species group, occupied the Missouri River flood plains and the rivers themselves, and may have penetrated the loess through a few river and stream valleys. Today's herpetofauna is composed primarily of members of the first two groups, a few representatives of the third and many generally adapted species found throughout Iowa.

This study was conducted to determine which amphibians and reptiles persist in the Loess Hills today and, more importantly, to determine if significant changes in relative abundance of species, or the above mentioned species groups, have occurred in the last 40 years. It compares the results of our survey with the extensive collections made in the area by Dr. Reeve Bailey from 1939 through 1946 and with a few random collections made by others and deposited in research museums. Bailey and Bailey, (1941) defined the ranges of frogs and toads in the Loess Hills. Bailey, (1943) found a lizard (*Eumeces obsoletus*), new to the herpetofauna of Iowa, in the extreme southern portion of the Loess Hills.

METHODS

Recent intensive studies of the biology of the loess began in 1979 with the first of five annual natural history forays to the area, sponsored by the Iowa State Preserves Advisory Board. In addition to the forays, the authors and several Drake University graduate students made separate surveying trips to the area from 1969 through 1983. In 1980 and 1981, the spadefoot toads (*Scaphiopus*) of the Loess Hills were surveyed (Mabry and Christiansen, 1982). All records were plotted on maps, and data obtained prior to 1969 were compared with those obtained thereafter to suggest distributional changes that might be underway. It is unfortunately not possible to estimate the total number of days in the field of all past studies for comparison with the present work.

The ratio of old records to new for most species in the western line of counties, was approximately 3:2, and we have selected this relationship as an indication of no change (or only slight decline) in species abundance. Species with the greatest variation from this ratio were selected as examples of forms that might be increasing or decreasing. Indications of significance of these differences from a 3:2 ratio were provided by calculation of binomial probabilities, using a computer. Chi square values were calculated as well, but are not presented because of questionable validity when mean expected values were less than five. These evaluations were based on the assumption that past and recent collectors had similar interests and used similar collecting techniques. We believe that they did, since both had primary interest in anurans and both utilized road collecting as a major collecting technique.

Roads were driven at slow speeds and representative specimens observed on the road were collected. Periodic stops were made to listen for frog calls. When verification was needed for the species calling, the workers left the vehicle with flashlights to search for the calling frog in nearby marshes or roadside ditches. Habitats were also sampled by turning logs, rocks, and boards on numerous walking surveys. Some roadside ditches, streams, and pools were seined, and turtles were sampled by baited traps during recent surveys. Specimens collected by Bailey were deposited in the Iowa State University collection or in the University of Michigan Museum of Zoology. Recent collections have been placed in the Drake University Research Collection.

RESULTS AND DISCUSSION

The amphibians and reptiles found in the Loess Hills are listed in Table 1. There are 31 reptilian species listed including 21 snakes, four lizards and six turtles. Of the 12 amphibians, ten are frogs or toads and two are salamanders. Three of the turtles listed, smooth and spiny softshells (*Trionyx spiniferous* and *T. muticus*) and false map turtles, (*Graptemys pseudogeographica*) were found only in the Missouri River and its large tributaries. It is likely that smooth softshells and false map turtles do not follow even the largest rivers as far as the bluffs (see Williams and Christiansen, 1981). Such forms are referred to as flood plain species in Table 1.

The Loess Hills support a large number of prairie species. Table 2 shows that more forms are prairie adapted than are associated with any other habitat. It is evident, however, that a large number of woodland species is also present as well as many forms that seem more or less equally adapted to both habitats.

A comparison of records obtained prior to 1969 with those obtained that year and later, was used to suggest which species may have increased in abundance and which may have declined. Great Plains toads (*Bufo cognatus*), gray treefrogs (*Hyla versicolor*), and blue racers (*Coluber constrictor*) seem nearly as abundant today as they apparently were during the time of the Bailey and Bailey (1941) study. Figure 1. shows the localities for *C. constrictor* as a representative of a

Figs. 1-6. Each of the following figures shows the distribution of a species of amphibian or reptile with a decreasing or unchanged abundance in the Loess Hills. Open circles indicate localities discovered prior to 1969; closed circles indicate those discovered thereafter.
Fig. 1. *Coluber constrictor,* blue racers.
Fig. 2. *Lampropeltis calligaster,* prairie kingsnakes
Fig. 3. *Pituophis melanoleucus sayi,* bullsnakes.
Fig. 4. *Thamnophis radix haydeni,* western plains garter snakes.
Fig. 5. *Elaphe v. vulpina,* fox snakes.
Fig. 6. *Acris crepitans blanchardi,* Blanchard's cricket frog.

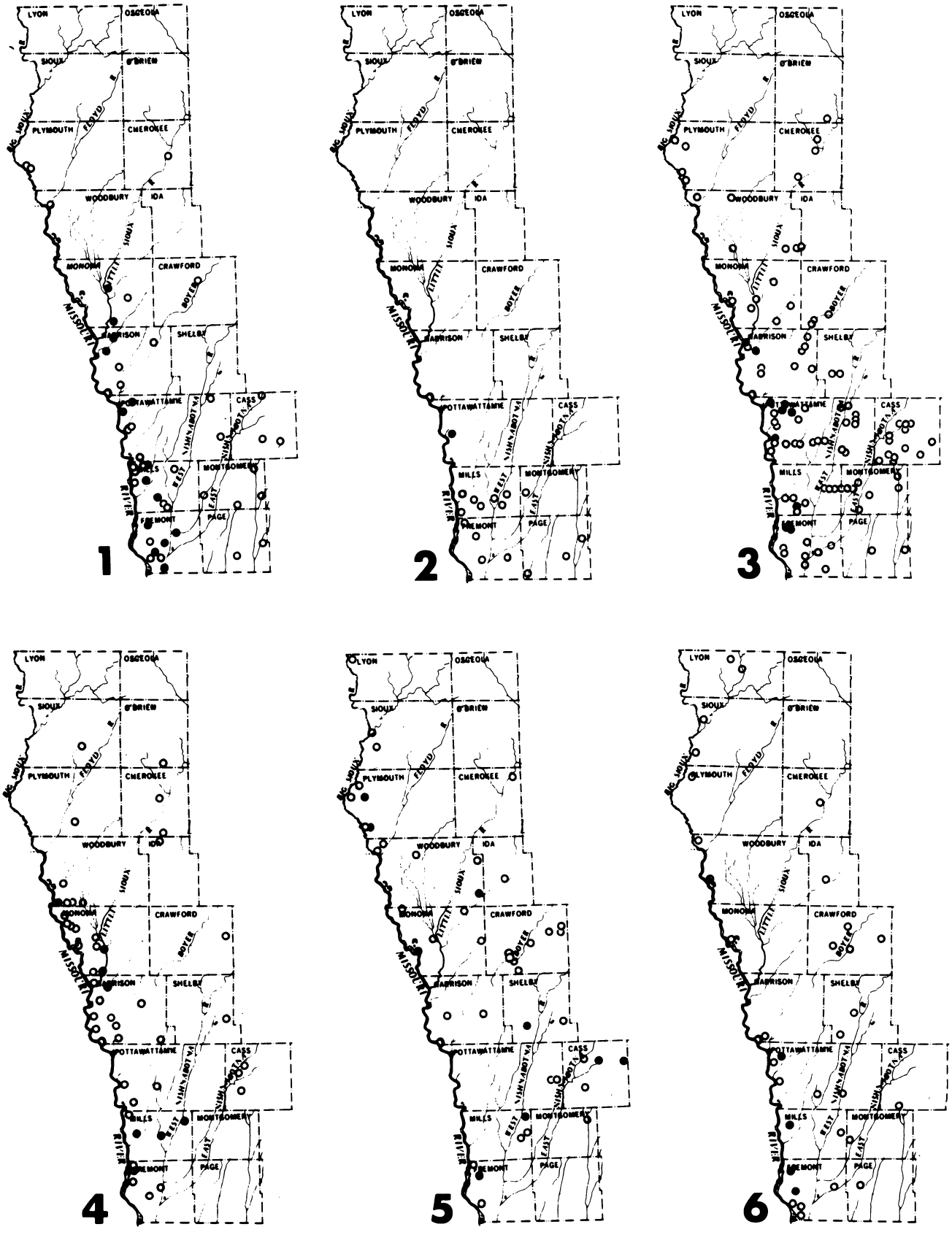
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Table 1. Checklist of the Amphibians and Reptiles of Iowa's Loess Hills. Letters in ( ) indicate habitat affinities based on observed habitat preferences in Iowa and general geographic distribution.
(F) = Floodplain (W) = Woodland (G) = Generalist (P) = Prairie

Amphibia		
Anura		
Bufo a. americanus Holbrook	(W)	American toad
Bufo w. woodhousei Girard	(P)	Woodhouse's toad
Bufo cognatus Say	(P)	Great Plains toad
Scaphiopus bombifrons Cope	(P)	Plains spadefoot
Rana catesbeiana Shaw	(G)	Bullfrog
Rana pipiens Schreber	(G)	Northern leopard frog
Rana blairi Mecham, et. al.	(P)	Plains leopard frog
Acris crepitans blanchardi (Harper)	(G)	Blanchard's cricket frog
Pseudacris t. triseriata (Wied)	(G)	Western chorus frog
Hyla versicolor Le Conte or *H. chrysoscelis* Cope	(W)	Gray treefrog
Caudata		
Ambystoma texanum (Matthes)	(W)	Small-mouthed salamander
Ambystoma t. tigrinum (Green)	(G)	Eastern tiger salamander
Reptilia		
Testudines		
Chelydra s. serpentina Linnaeus	(G)	Common snapping turtle
Chrysemys picta belli (Gray)	(G)	Western painted turtle
Graptemys pseudogeographica Gray	(F)	False map turtle
Terrapene o. ornata (Agassiz)	(P)	Ornate box turtle
Trionyx spiniferous hartwegi (Conant & Goin)	(F)	Western spiny softshell
Trionyx muticus Le Sueur	(F)	Smooth softshell
Squamata, Lacertilia		
Cnemidophorus sexlineatus viridis (Lowe)	(P)	Prairie racerunner
Eumeces obsoletus (Baird & Girard)	(P)	Sonoran skink
Eumeces s. septentrionalis (Baird)	(P)	Northern prairie skink
Eumeces fasciatus (Linnaeus)*	(W)	Five-lined skink*
Squamata, Serpentes		
Regina grahami Baird & Girard	(G)	Graham's water snake
Nerodia s. sipedon (Linnaeus)	(G)	Northern water snake
Thamnophis sirtalis parietalis (Say)	(P)	Red-sided garter snake
Thamnophis radix haydeni (Kennicott)	(P)	Western plains garter snake
Tropidoclonion l. lineatum (Hallowell)	(P)	Northern lined snake
Storeria dekayi texana Trapido	(W)	Texas brown snake
Storeria o. occipitomaculata (Storer)	(W)	Northern red-bellied snake
*Heterodon n. nasicus** Baird & Girard	(P)	Plains hognose snake*
Heterodon platyrhinos Latreille	(W)	Eastern Hognose snake
Carphophis amoenus vermis (Kennicott)	(W)	Western worm snake
Diadophis punctatus arnyi (Kennicott)	(W)	Prairie ringneck snake
Coluber constrictor flaviventris (Say)	(P)	Eastern yellow-bellied racer
Pituophis melanoleucus sayi (Schlegel)	(P)	Bullsnake
Elaphe v. vulpina (Baird & Girard)	(G)	Western fox snake
Elaphe o. obsoleta (Say)	(W)	Black rat snake
Lampropeltis c. calligaster (Harlan)	(G-P)	Prairie kingsnake
Lampropeltis triangulum syspila (Cope)	(W)	Red milk snake
Lampropeltis getulus holbrooki (Stejneger)	(W)	Speckled kingsnake
Crotalus v. viridis (Rafinesque)	(P)	Prairie rattlesnake
Sistrurus c. catenatus (Rafinesque)*	(G)	Eastern massasauga*

*Probably extripated from the loess bluffs; The original *Eumeces* record is questionable (See Taylor, 1935 error in plotting). *Heterodon nasicus* from a single specimen taken near Blue Lake, Monona Co. in 1913.

species judged to have little recent change in the western line of counties. Little sampling has been conducted in the next line of counties eastward since 1969.

Three species were found in the Loess Hills for the first time in the course of this study. Smallmouth salamanders (*Ambystoma texanum*) were collected in an abandoned rock quarry and at Forney's Lake in Fremont County, and in a roadside marsh in Mills County (Jeffrey D. Camper, pers. comm.). A single northern prairie skink (*Eumeces septentrionalis*) was collected in northern Sioux County and several

Figs. 7-12. Each of the following figures shows the distribution of a species of amphibian or reptile with a possibly increasing range in the Loess Hills. Open circles indicate localities discovered prior to 1969; closed circles indicate those discovered thereafter.
Fig. 7. *Rana catesbeiana,* bullfrog.
Fig. 8. *Storeria dekayi texana,* Texas brown snake.
Fig. 9. *Heterodon platyrhinos,* eastern hognose snake.
Fig. 10. *Diadophis punctatus arnyi,* prairie ringneck snake.
Fig. 11. *Elaphe o. obsoleta,* black rat snakes.
Fig. 12. *Lampropeltis triangulum sispila,* red milk snakes.

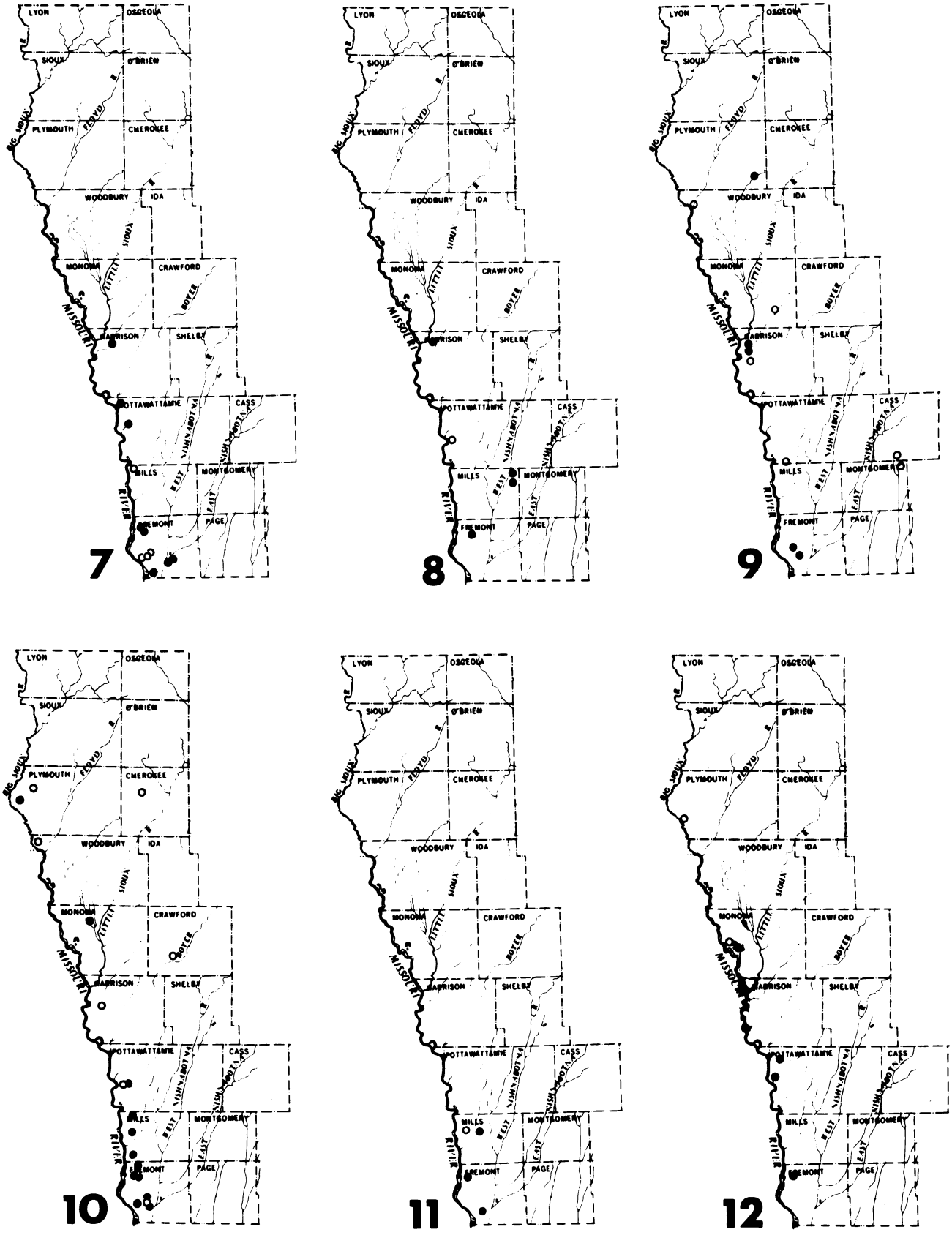
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Table 2. Number of species typically occupying each Loess Hills habitat type.

	Frogs	Salamanders	Turtles	Lizards	Snakes	Total
Floodplain	0	0	3	0	0	3
Woodland	2	1	0	1	8	12
No preference	4	0	2	0	5	11
Prairie	4	1	1	3	8	17
	10	2	6	4	21	43

lined snakes (*Tropidoclonion lineatum*) were observed (one collected) in Willow Slough in Mills County just beyond the eastern limit of the Loess Hills. These records are not believed to represent new introductions or new invasions but are of relatively uncommon or secretive forms, easily missed in earlier studies.

Five species appear to have declined relative to the other forms found in the Loess Hills (Table 3). Three of these were considered prairie forms, although *Lampropeltis calligaster*, the prairie kingsnake, is widely distributed east of the prairie states. Once abundant, (Figure 2) the only prairie kingsnake found in the course of this study was dropped at the feet of the collectors by a hawk flying overhead, and may have come from a substantial distance away. Bullsnakes (*Pituophis melanoleucus*) were extremely abundant during Bailey's work, with 61 specimens represented in collections from the western tier of Iowa counties prior to 1969 (Figure 3). In our opinion, the decline in abundance of this species is even more severe than indicated by the collection of the small number of recent specimens. Where the snake was abundant 50 years ago, mangled, decayed specimens were often passed when specimens from the general area were already well represented in the collection (Bailey, pers. comm.). Nearly all the bullsnakes collected in the present study were road-kill specimens. Plains garter snakes (*Thamnophis radix*) (Figure 4) and fox snakes (*Elaphe vulpina*) (Figure 5) declined as well, probably reflecting loss of critical habitat. Cricket frogs (*Acris crepitans*) (Figure 6) may have declined in response to pesticides or loss of marsh habitat. Severe recent declines of this species have also been observed in Wisconsin (Vogt, 1981). No woodland or aquatic flood plain species appeared to be severely diminished in the Loess Hills.

Seven snakes and two frogs may be increasing in abundance. The plains spadefoot, *Scaphiopus bombifrons*, was first found in Iowa in 1967 by Huggins (1971). It is now one of the most abundant animals there, and occurs in all the western counties except Lyon and Sioux (Mabry and Christiansen, 1983). It is the only plains species to show a recent increase in abundance (Table 3). Bullfrogs (*Rana catesbeiana*) have also increased in abundance (Figure 7) probably largely because of introduction to man-made ponds by farmers desiring a source of frog's legs. See Bailey (1944). Increases are postulated for Dekay's snakes (*Storeria dekayi*) (Figure 8), eastern hognose snakes (*Heterodon platyrhinos*) (Figure 9), ringneck snakes (*Diadophis punctatus*) (Figure 10), black rat snakes (*Elaphe obsoleta*) (Figure 11) and milk snakes (*Lampropeltis triangulum*) (Figure 12). All of the latter five species are woodland forms.

It is evident that the species showing declines are prairie forms or generalists with strong prairie affinities. Those showing hints of increases are primarily woodland forms with spadefoot toads and bullfrogs the only exceptions. We propose that this reflects an expansion of the woodland habitat in the loess and perhaps an increase in agricultural use of the prairie. Growth of the woodland has been reported by Howe *et. al.* (1984) and the impact of agriculture on prairie habitat is a long-standing Iowa problem.

It must be recognized that a major source of error exists in a comparison of old records to new when the effort expended in the two collecting periods can not be evaluated. Since most species observed did not differ substantially from a 3:2 ratio, they were judged not to have changed in abundance during the past 40 years. It is quite possible that they (including our reference standard, blue racers) have declined. It would be surprising if they had not, considering the loss of marsh lands and other optimum habitats that has occurred.

Table 3. Ratio of old records to new in the western tier of Iowa counties. Old records were obtained prior to 1969; new records thereafter. G = general habitats; P = prairie habitats; and W = Woodland habitats. Ratios are ratio of old records to new. P – Values were calculated from binomial probabilities. They are shown for comparative purposes only.

	Habitat	Number	Ratio	P – Value
	Declining Species			
Lampropeltis calligaster	G-P	12	(11:1)	.02
Pituophis melanoleucus	P	71	(61:10)	.01
Elaphe vulpina	G	28	(22:6)	.03
Thamnophis radix	P	39	(32:7)	.01
Acris crepitans	G	23	(18:5)	.05
Typical Species with "Unchanged" Abundance				
Coluber constrictor	P	36	(22:14)	.52
	Increasing Species			
Lampropeltis triangulum	W	9	(4:5)	.27
Elaphe obsoleta	W	3	(1:2)	.35
Diadophis punctatus	W	17	(5:12)	.01
Heterodon platyrhinos	W	6	(2:4)	.18
Storeria dekayi	W	5	(1:4)	.08
Rana catesbeiana	G	11	(3:8)	.03
Scaphiopus bombifrons	P	54	(2:52)	.01

ACKNOWLEDGEMENTS

We thank Dr. Reeve M. Bailey for the use of notes associated with specimens he collected and deposited at Iowa State University and the University of Michigan Museum of Zoology. We also thank Dr. Russell Burken, Mr. Joseph Spurgeon, and Dr. Ted Crawford for help in the field. Funding for a portion of this study was provided by the Iowa Conservation Commission.

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