

HERPETOFAUNA OF THE PRAIRIE CREEK SITE, DAVISS COUNTY, INDIANA

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ABSTRACT: The Prairie Creek Site, Daviess County, Indiana, yielded amphibian and reptile fossils from three stratigraphic zones: D, Late Pleistocene; C, Late Pleistocene-Holocene mix; and B, Holocene. None of the fossil amphibians and reptiles from any of the zones represent extinct forms, and all but one of the herpetological species have been recorded in or quite near the Prairie Creek area during modern times. Possible replacement of Blanding's turtle by the red-eared slider in Holocene times might suggest some reorganization of the herpetofauna at the end of the Pleistocene. The Late Pleistocene herpetofauna contrasts with the mammalian fauna which contains extinct species and several northern extralimital taxa. Pollen studies of the Pleistocene layers might be interpreted as reflecting a boreal climate, but many reptilian species could not exist in such a climate today, thus producing a striking dilemma in paleoclimatic interpretation.

INTRODUCTION

Late Pleistocene herpetofaunas from States bordering the Great Lakes are rare. Previous studies of fossils from lacustrine and marsh deposits in Indiana have described few taxa: *Rana* cf. *R. pipiens* (leopard frog), *Apalone* sp. (soft-shelled turtle), *Chelydra serpentina* (snapping turtle), and *Chrysemys picta* (painted turtle) from the Christensen mastodont locality, Hancock County (Graham, Holman, and Parmalee, 1983); *Rana* sp. (frog) and *Chelydra serpentina* from the Dollens mastodont locality, Madison County (Richards, Whitehead, and Cochran, 1988); a frog of the *Rana pipiens* complex from the Kolarik mastodont locality, Starke County (Richards and Ellis, in prep.); and *Chrysemys picta*, *Sternotherus* sp. (musk turtle), *Chelydra/Macrochelys* (snapping turtle), and *Pseudemys/Graptemys* (cooter/map turtle) from an earlier (1973) study of a mixed Late Pleistocene/Holocene stratum at the Prairie Creek locality, Daviess County (Tomak, 1975). Thus, the recovery of an extensive Late Pleistocene and Holocene herpetofauna (minimum of 25 species) that contains anurans (6 species), snakes (8 species), and an extremely abundant turtle fauna (9 species) from the Prairie Creek locality is of considerable importance.

In 1974 and 1975, Indiana University and the Glenn A. Black Laboratory of Archaeology excavated Late Pleistocene and Holocene faunal remains from the Prairie Creek site, Daviess County, Indiana. S.T. Jackson and D.R. Whitehead (unpublished ms.) found that the Prairie Creek pollen and plant macrofossils indicated a spruce-dominated boreal forest surrounding Late Pleistocene Lake Prairie Creek. Fraser and Gray (1992) described the Quaternary geology of the Prairie Creek basin. Richards (1993) presented a summary overview of the geology of the fossil site and a treatment of the small mammal remains.

During the latter part of the Late Pleistocene (approximately 16,000 to 13,000 B.P.), Lake Prairie Creek accumulated the remains of vertebrates that inhabited its waters, shores, and the surrounding region (Fraser and Gray, 1992). That accumulation was halted when lake waters breached downstream valley train deposits, flushing the bone-rich sediments of Lake Prairie Creek one to two miles downstream along the bed of Prairie Creek (Zone D of the present fossil site). The excavated portion of that deposit produced a radiocarbon date of $14,010 \pm 140$ B.P. (P.J. Munson, pers. comm.). During the Holocene (approximately 4,140 - 2,880 B.P.), remains of vertebrates living in and about Prairie Creek and the marshlands of the former upstream lake accumulated in the alluvial Holocene deposits (Zone B) of Prairie Creek. Archaeological materials in some of the Holocene strata ("living floors") suggest that some of the bone accumulation was the result of Native American activities. Zone C consists primarily of Holocene remains, with an abundant mixture of Late Pleistocene materials scoured from the creek bed deposits. Some Late Pleistocene remains have been reworked into the Zone B Holocene strata.

The Late Pleistocene (Zone D) includes remains of several boreal and northern extralimital mammals, such as the yellow-cheeked vole, southern red-backed vole, star-nosed mole, fisher, and red squirrel (Richards, 1993). Pollen profiles of the same zone show a high percentage of spruce, the presence of fir and larch, and a low value for hardwoods (S.T. Jackson and D.R. Whiteland, unpubl. ms.). The more temperate nature of the rich herpetofauna associated with a rather northern mammalian fauna presents a serious dilemma in the interpretation of Late Pleistocene climate.

CHECKLIST OF HERPETOFAUNAS FROM THE PRAIRIE CREEK SITE, DAVIESS COUNTY, INDIANA

The Late Pleistocene Fauna (Zone D)

<i>Ambystoma</i> sp.	Mole Salamander
<i>Bufo</i> sp.	Toad
<i>Rana catesbeiana</i>	Bullfrog
<i>Rana clamitans</i>	Green Frog
<i>Rana pipiens</i> complex	Leopard frog group
<i>Rana sylvatica</i>	Wood frog
<i>Chelydra serpentina</i>	Snapping turtle
<i>Sternotherus odoratus</i>	Common musk turtle
<i>Chrysemys picta</i>	Painted turtle
<i>Emydoidea blandingii</i>	Blanding's turtle
<i>Graptemys</i> sp.	Map turtle
<i>Pseudemys</i> sp.	Cooter
<i>Apalone spinifera</i>	Spiny softshell turtle
<i>Apalone</i> sp.	Softshell turtle
<i>Nerodia erythrogaster</i>	Copperbelly water snake
<i>Nerodia</i> sp.	Water snake
<i>Thamnophis</i> sp.	Garter or ribbon snake

The Pleistocene-Holocene Fauna Mixture (Zone C)

<i>Rana catesbeiana</i>	Bullfrog
<i>Rana pipiens</i> complex	Leopard frog group
<i>Sternotherus odoratus</i>	Common musk turtle
<i>Chelydra serpentina</i>	Snapping turtle
<i>Chrysemys picta</i>	Painted turtle
<i>Emydoidea blandingii</i>	Blanding's turtle
<i>Graptemys</i> sp.	Map turtle
<i>Pseudemys</i> sp.	Cooter
<i>Trachemys scripta</i>	Red-eared slider
<i>Terrapene carolina</i>	Eastern box turtle
<i>Apalone</i> sp.	Softshell turtle
<i>Coluber constrictor</i>	Racer
<i>Elaphe</i> sp.	Rat, corn, or fox snake
<i>Lampropeltis triangulum</i>	Milk snake
<i>Nerodia erythrogaster</i>	Copperbelly water snake
<i>Nerodia rhombifer</i>	Diamondback water snake
<i>Nerodia</i> sp.	Water snake
<i>Thamnophis</i> sp.	Garter or ribbon snake

The Holocene Fauna (Zone B)

<i>Siren intermedia</i>	Lesser siren
<i>Bufo americanus</i>	American toad
<i>Bufo woodhousii fowleri</i>	Fowler's toad
<i>Bufo</i> sp.	Toad
<i>Rana catesbeiana</i>	Bullfrog
<i>Rana pipiens</i> complex	Leopard frog group
<i>Sternotherus odoratus</i>	Common musk turtle
<i>Chelydra serpentina</i>	Snapping turtle
<i>Chrysemys picta</i>	Painted turtle
<i>Emydoidea blandingii</i>	Blanding's turtle
<i>Trachemys scripta</i>	Red-eared slider
<i>Terrapene carolina</i>	Eastern box turtle
<i>Apalone</i> sp.	Softshell turtle
<i>Coluber constrictor</i>	Racer
<i>Elaphe obsoleta</i>	Rat snake
<i>Elaphe</i> sp.	Rat, corn, or fox snake
<i>Lampropeltis getula</i>	Black kingsnake
<i>Nerodia rhombifer</i>	Diamondback water snake
<i>Nerodia</i> sp.	Water snake
<i>Thamnophis</i> sp.	Garter or ribbon snake
<i>Crotalus horridus</i>	Timber rattlesnake

Table 1. Minimum number of individuals of herpetological species from the Prairie Creek Site, Daviess County, Indiana. Because of the fragile nature of paired elements and the lack of a single, isolatable vertebra for each individual, it is very difficult to get MNI counts from snake remains (usually indicated as 1).

Taxon	Zone D	Zone C	Zone B
<i>Ambystoma</i> sp.	1	0	0
<i>Siren intermedia</i>	0	0	1
<i>Bufo americanus</i>	0	0	1
<i>Bufo woodhousii fowleri</i>	0	0	1
<i>Bufo</i> sp.	1	0	2
<i>Rana catesbeiana</i>	3	1	2
<i>Rana clamitans</i>	8	0	0
<i>Rana pipiens</i> complex	21	1	5
<i>Rana sylvatica</i>	2	0	0
<i>Sternotherus odoratus</i>	1	23	89
<i>Chelydra serpentina</i>	1	1	1
<i>Chrysemys picta</i>	11	2	6
<i>Emydoidea blandingii</i>	4	1	1
<i>Graptemys</i> sp.	1	1	0
<i>Pseudemys</i> sp.	1	1	0
<i>Trachemys scripta</i>	0	1	6
<i>Terrapene carolina</i>	0	1	3
<i>Apalone spinifera</i>	1	0	0
<i>Apalone</i> sp.	1	1	1
<i>Coluber constrictor</i>	0	1	1
<i>Elaphe obsoleta</i>	0	0	1
<i>Elaphe</i> sp.	0	1	1
<i>Lampropeltis getula</i>	0	0	1
<i>Lampropeltis triangulum</i>	0	1	0
<i>Nerodia erythrogaster</i>	1	1	0
<i>Nerodia rhombifer</i>	0	1	1
<i>Nerodia</i> sp.	1	1	1
<i>Thamnophis</i> sp.	1	1	1
<i>Crotalus horridus</i>	0	0	1

SYSTEMATIC PALEOZOOLOGY

These fossils will be permanently housed at the Glenn A. Black Laboratory of Archaeology, Indiana University, Bloomington. Scientific and vernacular names used follow Conant and Collins (1991). Modern amphibian and reptile distributions and habitat information follow Minton (1972) and Minton, *et al.* (1982). The abbreviations used include: L, R, left, right; MNI, minimum number of individuals; IUBT, Indiana University, Bloomington, temporary catalogue number; FLT, flotation sample; LF1, 2, living floor units (Native American); NLF, non-living floor. Table 1 lists the minimum numbers of individuals for taxa in each Zone.

Class AMPHIBIA: Amphibians

Order CAUDATA: Salamanders

Family SIRENIDAE: Sirens

Siren intermedia Barnes, 1826; Lesser siren

Material. Zone B-NLF: 3 vertebrae (IUBT-37).

Remarks. Goin and Auffenberg (1955) give characters that distinguish the vertebrae of *Siren* from those of the closely related *Pseudobranchius*. *Siren intermedia* vertebrae are much smaller than those of *S. lacertina*. The small *Siren* vertebrae from Zone B-NLF are indistinguishable from those of *Siren intermedia*, a species that has been recorded from the modern fauna of Daviess County, Indiana (Minton, 1972, map 20). This species prefers warm, quiet, shallow water with abundant aquatic plants and a soft bottom.

Family AMBYSTOMATIDAE: Mole salamanders

Ambystoma sp. indet.; Mole salamander

Material. Zone D: distal humerus (IUBT-36).

Remarks. This humerus is identified with confidence as that of *Ambystoma* but is too fragmentary to be identified to species. *Ambystoma maculatum*, *A. tigrinum*, *A. opacum*, and *A. texanum* have been recorded from Daviess County or are thought to occur there today (Minton, 1972, maps 6-9).

Order ANURA: Frogs and toads

Family BUFONIDAE: Toads

Bufo americanus Holbrook, 1836; American toad

Material. Zone B-LF1: R ilium (IUBT-38).

Remarks. Wilson (1975) discusses use of the ilium in identifying the various species of *Bufo*. The dorsal protuberance of the ilium of *Bufo americanus* is wider at its base than in the similar *B. woodhousii* (Holman, 1967), and in mature specimens of *B. americanus*, the peak of the dorsal protuberance is located anterior to the midpoint of its base (Tihen, 1962). The American toad prefers grasslands and sparse woods, avoiding deep woodlands and lowlands prone to repeated flooding.

Bufo woodhousii fowleri Hinckley, 1882; Fowler's toad

Material. Zone B-LF1: L ilium (IUBT-39).

Remarks. *Bufo woodhousii fowleri* is separable from the western subspecies *B. w. woodhousii* on the basis of having a much lower ilial prominence (Wilson, 1975). Fowler's toad has been recorded from Daviess County, Indiana (Minton, 1972, map 23). This subspecies prefers sandy areas and open woodlands.

Bufo sp. indet.; Toad

Material. Zone D: R ilium (IUBT-40). Zone B-FLT: parasphenoid and R scapula (IUBT-41). Zone B-LF2: 2 R tibiofibulae (IUBT-42).

Remarks. These elements could not be identified to species.

Family RANIDAE: True frogs
Rana catesbeiana Shaw, 1802; Bullfrog

Material. Zone D: 2 angulares, R scapula, and 3 R ilia (IUBT-43). Zone C: R ilium and distal femur (IUBT-44). Zone B-NLF: R exoccipital (IUBT-45). Zone B-LF2: L tibiofibula (IUBT-74). Zone B-LF1: puboischium, R ilium, distal femur, and L tibiofibula (IUBT-46).

Remarks. Holman (1984, 1987b) has given characters for the identification of *Rana* species based upon ilia. Although there are no specific records of this species from Daviess County, it almost certainly occurs there (Minton, 1972, map 29). The bullfrog occurs today in permanent aquatic situations but needs quiet, warm water to breed in.

Rana clamitans Latreille (in Sonnini
 and Latreille), 1801; Green frog

Materials. Zone D: 5 L, 8 R ilia (IUBT-47).

Remarks. Although there are no specific records of the green frog from Daviess County, it almost certainly occurs there today (Minton, 1972, map 28). In Indiana, green frogs inhabit cool, clear water, avoiding waters that are warm or muddy.

Rana pipiens complex; Leopard frogs

Material. Zone D: 16 L and 21 R ilia (IUBT-75). Zone C: R ilium (IUBT-76). Zone B-FLT: 3 L ilia (IUBT-48). Zone B-LF2: L ilium (IUBT-49). Zone B-LF1: L and R ilia (IUBT-50).

Remarks. Three species of the *Rana pipiens* complex (*R. pipiens*, *R. blairi*, and *R. utricularia*) assume rather parapatric distributions that segregate in southern and western Indiana (Conant and Collins, 1991). Only *R. utricularia* inhabits Daviess County today. These frogs live in wet meadows, marshes, bogs, and shallow ponds and generally shun cool water or rapid brooks (Minton, 1982).

Rana sylvatica Le Conte, 1825; Wood frog

Material. Zone D: 2 L ilia (IUBT-51).

Remarks. There are no specific records for wood frogs for Daviess County, but the species undoubtedly occurs there (Minton, 1972, map 33). This species is terrestrial during most of the year, hiding under leaves and in rotten logs.

Class REPTILIA: Reptiles
 Order TESTUDINES: Turtles
 Family KINOSTERNIDAE: Musk and mud turtles
Sternotherus odoratus (Latreille in Sonnini
 and Latreille, 1801); Common musk turtle

Material. Zone D: peripheral and hyoplastron (IUBT-1). Zone C: 12 nuchals, 3 neurals, 3 pygals, 153 costals, 129 peripherals, 19 epiplastra, 46 hyoplastra, 32 hypoplastra, 28 xiphiplastra, and 13 shell fragments (IUBT-2). Zone B-LF2: 9 nuchals, neural, 116 costals, 73 peripherals, 30 epiplastra, 51 hyoplastra, 35 hypoplastra, 38 xiphiplastra, and 6 shell fragments (IUBT-3). Zone B-LF1: 22 nuchals (Figure 1A), 6 neurals, 5 pygals, 466 costals, 435 peripherals, 54 epiplastra, 120 hyoplastra, 103 hypoplastra, 64 xiphiplastra, and 166 shell fragments (IUBT-4). Zone B-NLF: 2 neurals, 14 costals, 25 peripherals, 6 hyoplastra, hypoplastron, 2 xiphiplastra, and 7 shell fragments (IUBT-5).

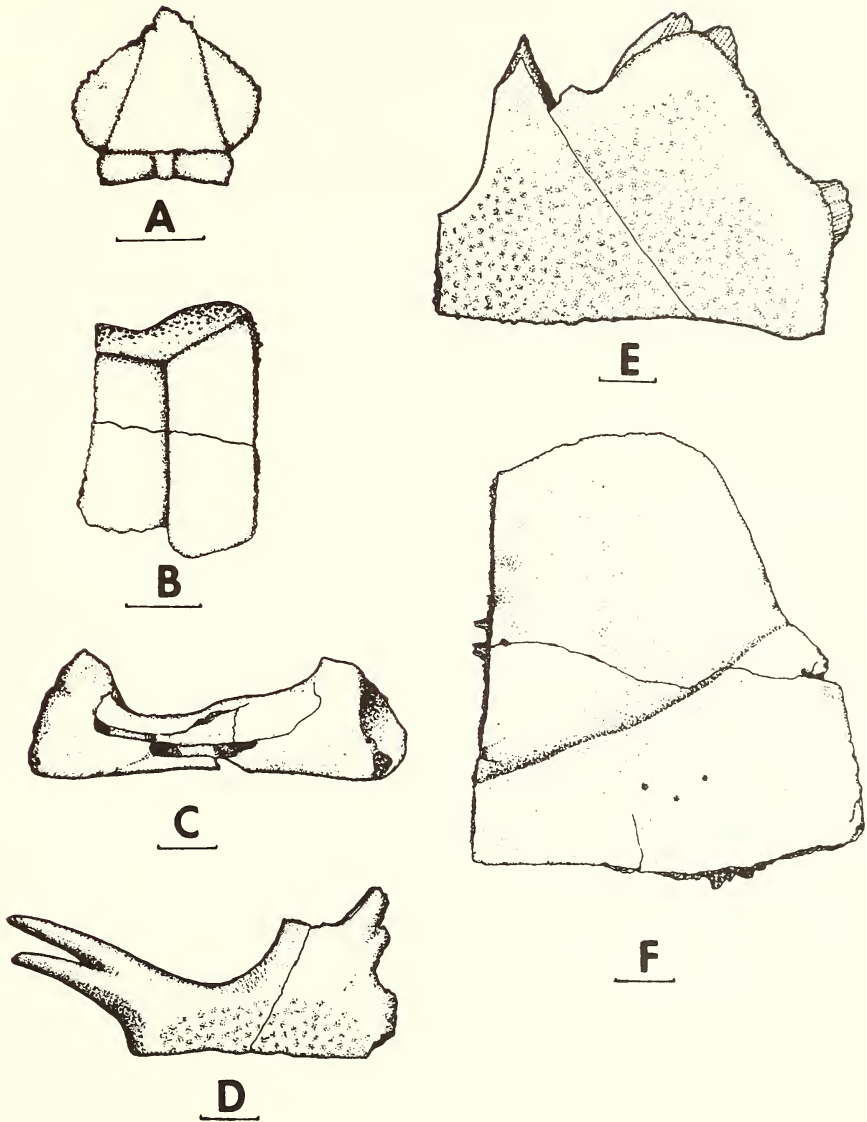


Figure 1. Turtle elements, Prairie Creek Site, Daviess County, Indiana. A. *Sternotherus odoratus* (common musk turtle), nuchal, Zone B (LF1): L-1238/44. B. *Graptemys* sp. (map turtle), peripheral, Zone D: L-1632/24. C. *Chelydra serpentina* (snapping turtle), right ulna, Zone D: L-496/7. D. *Apalone spinifera* (spiny softshell turtle), left hypoplastron, Zone D: L-794/8. E. *Apalone spinifera* (spiny softshell turtle), left hypoplastron, medial portion, Zone D: L-794/7. F. *Pseudemys concinna* (cooter), right xiphiplastron, Zone D: L-513/1. Each scale line equals 10 mm.

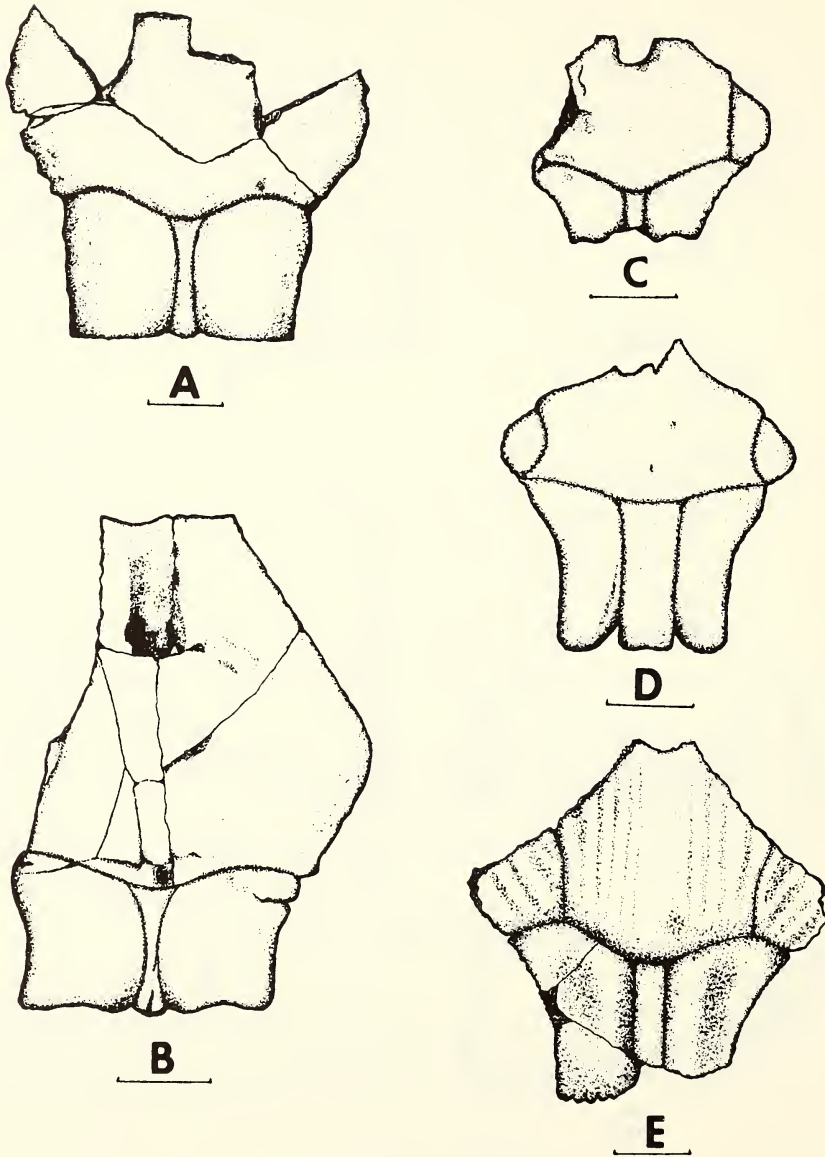


Figure 2. Turtle elements, Prairie Creek Site, Daviess County, Indiana. A. *Emydoidea blandingii* (Blanding's turtle), nuchal, Zone D: L-584/1. B. *E. blandingii*, nuchal, Zone D: L-1122/1. C. *Terrapene carolina* (eastern box turtle), nuchal, Zone B (LF1): L-453/315. D. *Chrysemys picta* (painted turtle), nuchal, Zone D: L-1188/1. E. *Trachemys scripta* (red-eared slider), nuchal, Zone B (LF2): L-229/38. Each scale line equals 10 mm.

Remarks. Characters for the identification of *Sternotherus odoratus* on the basis of individual shell bones are given in Preston (1979). This species has not been recorded from Daviess County during historic times but undoubtedly occurs there (Minton, 1972, map 35). In Indiana, the musk turtle prefers permanent water with a soft bottom.

Family CHELYDRIDAE: Snapping turtles
Chelydra serpentina (Linnaeus, 1758); Snapping turtle

Material. Zone D: 2 maxillae, dentary, hyoid element, 19 vertebrae, 13 scapulocoracoids, 3 humeri, 3 ulnae (Figure 1C), fibula, 6 ilia, ischium, 4 pubes, 2 femora, tibia, nuchal, 5 neurals, 19 costals, 50 peripherals, suprapygals, pygal, osteoscuta, 3 entoplastra, hyoplastron, 3 hypoplastra, and 8 shell fragments (IUBT-6). Zone C: 3 dentaries, vertebra, podial, pharynx, 3 scapulocoracoids, humerus, ilium, pubis, femur, 6 costals, 4 peripherals, neural, hyoplastron, 2 hypoplastra, and 3 shell fragments (IUBT-7). Zone B-LF2: vertebra, 4 scapulocoracoids, femur, neural, and 5 peripherals (IUBT-8). Zone B-LF1: 3 vertebrae, 2 scapulocoracoids, femur, 2 tibiae, neural, 2 costals, 7 peripherals, hyoplastron, and a shell fragment (IUBT-9).

Remarks. Preston (1979) has given characters that identify individual shell bones of the snapping turtle. This species occurs in Daviess County today in a wide variety of aquatic situations (Minton, 1972, map 34).

Family EMYDIDAE: Box and water turtles
Chrysemys picta (Schneider, 1783); Painted turtle

Material. Zone D: humerus, 11 nuchals (Figure 2D), 2 pygals, 68 costals, 112 peripherals, 5 epiplastra, 6 hyoplastra, 2 hypoplastra, and 6 xiphiplastra (IUBT-10). Zone C: 2 nuchals, 22 peripherals, 2 epiplastra, 3 hyoplastra, hyoplastron, and 5 xiphiplastra (IUBT-11). Zone B-LF2: 2 nuchals, 16 peripherals, 4 epiplastra, hyoplastron, 5 hypoplastra, and 6 xiphiplastra (IUBT-12). Zone B-LF1: 4 nuchals, pygal, 25 peripherals, 4 epiplastra, 3 hypoplastra, and 2 xiphiplastra, (IUBT-13).

Remarks. Preston (1979) has discussed the identification of the painted turtle on the basis of individual shell elements. Although there are no specific records of *C. picta* from Daviess County, the species undoubtedly occurs there today (Minton, 1972, map 43). The painted turtle prefers quiet, warm, shallow water with aquatic vegetation and a soft bottom.

Emydoidea blandingii (Holbrook, 1838); Blanding's turtle

Material. Zone D: 4 nuchals (Figure 2A-B), 3 neurals, pygal, costal, 36 peripherals, hyoplastron, hypoplastron, and 2 xiphiplastra (IUBT-14). Zone C: femur, peripheral, hyoplastron, hypoplastron, and 2 xiphiplastra (IUBT-15). Zone B-LF2: 2 peripherals and a hyoplastron (IUBT-16). Zone B-LF1: 2 peripherals, hyoplastron, and hypoplastron (IUBT-17).

Remarks. Preston (1979) discusses the identification of *E. blandingii* on the basis of individual shell elements, which in most cases are quite characteristic. This turtle occurs widely in the northern one-fourth of Indiana today (Minton, 1972, map 38), but it has been only questionably recorded from the southern part of the State from three scattered localities. It almost certainly does not occur in southwestern Indiana today. In Indiana, this turtle prefers shallow, warm, quiet water near grassy areas.

Graptemys sp. indet.; Map turtle

Material. Zone D: peripheral (Figure 1B) and xiphiplastron (IUBT-20). Zone C: pygal, 2 hyoplastra, and a hypoplastron (IUBT-21).

Remarks. These bones could not be identified to species. Two forms, *G. geographica* and *G. pseudogeographica*, occur in the area today (Minton, 1972, maps 41 and 42). Both occur primarily in rivers and streams.

Pseudemys sp. indet.; Cooter

Material. Zone D: 3 neurals, suprapygal, 8 costals, 6 peripherals, 2 epiplastra, entoplastron, hyoplastron, and 2 xiphiplastra (Figure 1F; IUBT-18). Zone C: 3 neurals, 7 costals, 2 peripherals, epiplastron, and a hypoplastron (IUBT-19).

Remarks. Preston (1979) discusses the identification of the genus *Pseudemys* by individual shell elements. Today, the only populations of *Pseudemys* in Indiana occur in the extreme southwestern portions of the State (Minton 1972, map 45). These turtles occur as hybrid populations of subspecies of *P. concinna* and *P. floridana*. These hybrids occur in large, shallow ponds that connect with the Wabash River only during flood periods. There are no modern records of these turtles from Daviess County. One right hyoplastron (Zone D: L-2299/1) was very large, its measurements indicating a carapace length of approximately 344 mm and a width of 230 mm. The longest carapace recorded for *Pseudemys c. hieroglyphica* was 375 mm long (Conant, 1975).

Trachemys scripta (Schoepff, 1792); Red-eared slider

Material. Zone C: 2 epiplastra, entoplastron, and hypoplastron (IUBT-28). Zone B-LF2: 2 nuchals (Figure 2E), 16 peripherals, 2 epiplastra, 2 hypoplastra, 2 xiphiplastra (IUBT-29). Zone B-LF1: 4 nuchals, 2 pygals, 26 peripherals, 3 epiplastra, hyoplastron, 2 hypoplastra, and a xiphiplastron (IUBT-30). Zone B-NLF: humerus, 2 peripherals, 2 epiplastra, entoplastron, and 2 hyoplastra (IUBT-31).

Remarks. Preston (1979) discusses the identification of *Trachemys scripta* on the basis of individual shell elements. This species undoubtedly occurs in Daviess County today (Minton, 1972, map 44). The red-eared slider occurs in a variety of quiet water situations.

Terrapene carolina (Linnaeus, 1758); Eastern box turtle

Material. Zone C: 9 peripherals and an entoplastron (IUBT-32). Zone B-LF2: nuchal, 3 neurals, 7 peripherals, and a hyoplastron (IUBT-33). Zone B-LF1: 2 nuchals (Figure 2C), 4 neurals, 25 peripherals, hyoplastron, 2 hypoplastra, and 2 xiphiplastra (IUBT-34). Zone B-NLF: peripheral (IUBT-35).

Remarks. Preston (1979) discusses the identification of *Terrapene carolina* on the basis of individual shell bones. This species occurs in the area today (Minton, 1972, map 39) and is a terrestrial woodland species.

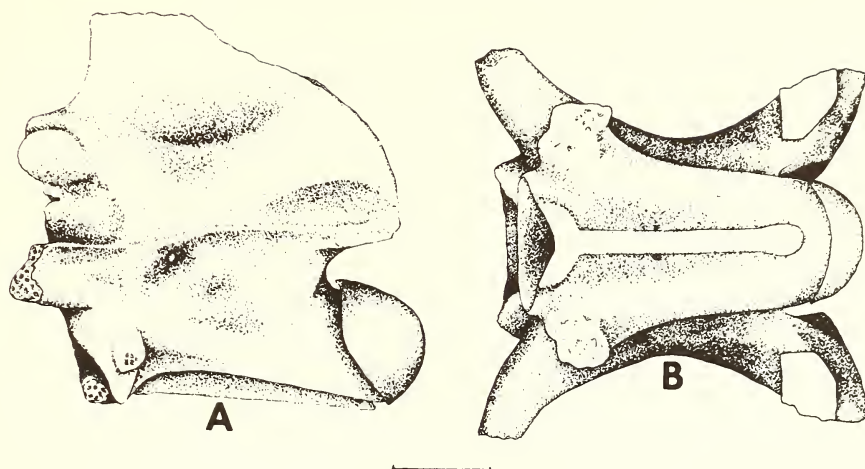


Figure 3. *Coluber constrictor* (racer), trunk vertebra, Zone C: L-217/1, Prairie Creek Site, Daviess County, Indiana. A. Left lateral aspect. B. Ventral aspect. Scale line for both illustrations equals 2 mm.

Family TRIONYCHIDAE: Softshell turtles

Apalone spinifera (Lesueur, 1827); Spiny softshell turtle

Material. Zone D: 2 hypoplastra (Figure 1D, E) (IUBT-22).

Remarks. Holman (1982) discusses the identification of species of *Apalone* on the basis of individual shell elements. This species undoubtedly occurs in the area today (Minton, 1972, map 46). The spiny softshell occupies a large variety of aquatic habitats, especially those with sandy or silty bottoms.

Apalone sp. indet.; Softshell turtle

Material. Zone D: 2 vertebrae, scapula, 2 neurals, 7 costals, hypoplastron, and 9 shell fragments (IUBT-23). Zone C: costal and 5 shell fragments (IUBT-24). Zone B-LF2: 2 hypoplastra and 11 shell fragments (IUBT-25). Zone B-LF1: nuchal, 4 costals, hypoplastron, and 13 shell fragments (IUBT-26). Zone B-NLF: ilium (IUBT-27).

Remarks. We are unable to identify these remains to species.

Order SQUAMATA: Lizards, amphihaenians, and snakes

Suborder SERPENTES: Snakes

Family COLUBRIDAE: Colubrids

Coluber constrictor Linnaeus, 1758; Racer

Material. Zone C: 2 vertebrae (Figure 3) (IUBT-52). Zone B-NLF: vertebra (IUBT-53). Zone B-LF1: 3 vertebrae (IUBT-54).

Remarks. Holman (1981) gives references that address the identification of *Coluber constrictor* on the basis of individual vertebrae. Racers occur in the modern fauna of Daviess County (Minton, 1972, map 67). This snake prefers forest edge habitats where the undergrowth is well-developed.

Elaphe obsoleta (Say in James, 1823); Rat snake

Material. Zone B-LF1: vertebra (Figure 4A-C; IUBT-55).

Remarks. Auffenberg (1963) discusses the identification of the species of *Elaphe* on the basis of individual vertebrae. The black rat snake, *E.o. obsoleta*, occurs in Daviess County, Indiana (Minton, 1972, map 68). This often arboreal snake prefers woodlands and forests.

Elaphe sp. indet.; Rat, corn, or fox snake

Material. Zone C: 2 vertebrae (IUBT-56). Zone B-FLT: 2 vertebrae (IUBT-57). Zone B-LF2: vertebra (IUBT-58). Zone B-LF1: 2 vertebrae (IUBT-59).

Remarks. These vertebrae are too fragmentary for specific identification.

Lampropeltis getula (Linnaeus, 1766); Black kingsnake

Material. Zone B-LF1: 3 vertebrae (IUBT-60).

Remarks. Holman (1981) refers to the literature that discusses the identification of *Lampropeltis* species by individual vertebrae. *Lampropeltis getula* undoubtedly occurs in Daviess County today (Minton, 1972, map 72). This snake is said to prefer sparse dry woods rather than river bottom forests.

Lampropeltis triangulum (Lacepede, 1788); Milk snake

Material. Zone C: vertebra (IUBT-61).

Remarks. Although there are no specific records of this snake from Daviess County, the milk snake is undoubtedly found there (Minton, 1972, map 73). The milk snake occurs in rather open situations near woodlands.

Nerodia erythrogaster (Forster, 1771); Copperbelly water snake

Material. Zone D: vertebra (IUBT-62). Zone C: vertebra (IUBT-63).

Remarks. Brattstrom (1967) has given characters that generally separate the vertebrae of *Nerodia* from those of *Thamnophis*. Auffenberg (1963) and Holman (1967) have given characters that separate individual vertebrae of *Nerodia* species from one another. *Nerodia erythrogaster* probably occurs in the area today (Minton, 1972, map 55) in a variety of quiet aquatic situations.

Nerodia rhombifer (Hallowell, 1852); Diamondback water snake

Material. Zone C: 3 vertebrae (IUBT-64). Zone B-LF1: 4 vertebrae (Figure 4D; IUBT-65).

Remarks. Although there are no specific records, this species can probably be found in Daviess County today (Minton, 1972, map 56). The diamondback water snake occurs in large, quiet, shallow bodies of water.

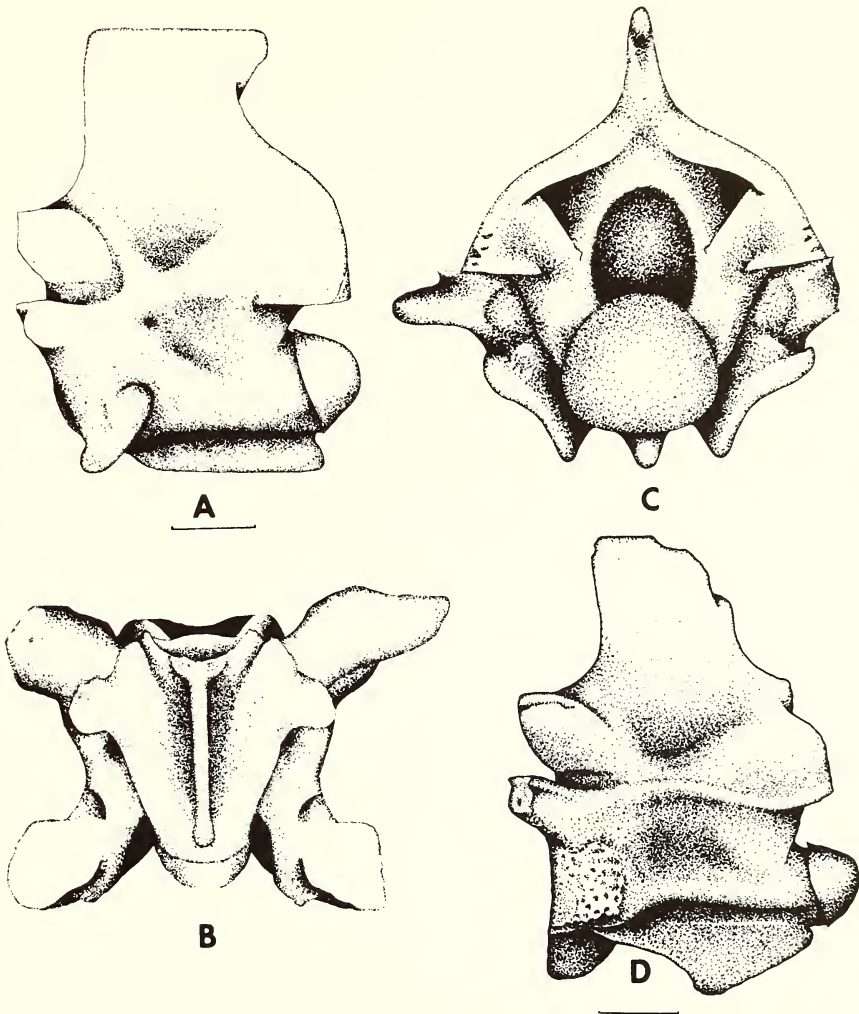


Figure 4. Snake vertebrae, Prairie Creek Site, Daviess County, Indiana. A-C. *Elaphe obsoleta* (rat snake), trunk vertebra, Zone B (LF1): L-453/1. A. Lateral aspect. B. Ventral aspect. C. Posterior aspect. D. *Nerodia rhombifer* (diamondback water snake), trunk vertebra, left lateral aspect, Zone B (LF1): L-859/4. Scale line at A equals 2 mm and applies to A, B, and C. Scale line at D equals 2 mm.

Nerodia sp. indet.; Water snake

Material. Zone D: 13 vertebrae (IUBT-66). Zone C: vertebra (IUBT-67). Zone B-NLF: 2 vertebrae (IUBT-68). Zone B-LF1: right mandible, and 2 vertebrae (IUBT-69).

Remarks. These elements are too fragmentary to identify to species.

Thamnophis sp. indet.; Garter or ribbon snake

Material. Zone D: basisphenoid and 40 vertebrae (IUBT-70). Zone C: 2 vertebrae (IUBT-71). Zone B-NLF: vertebra (IUBT-72).

Remarks. Three species of *Thamnophis* (*T. proximus*, *T. sauritus*, and *T. sirtalis*) probably occur in Daviess County today (Minton, 1972, maps 62, 65, 66), but these elements could not be attributed to a particular species.

Family VIPERIDAE: Vipers

Crotalus horridus Linnaeus, 1758; Timber rattlesnake

Material. Zone B-LF1: 2 vertebrae (IUBT-73).

Remarks. Characters for distinguishing isolated vertebrae of *C. horridus* were given in Holman (1967). The timber rattlesnake has not been recorded from Daviess County, Indiana in historic times and may not occur there today (Minton, 1972, map 81).

DISCUSSION

The Late Pleistocene (Zone D) herpetofauna at the Prairie Creek locality was composed almost entirely of aquatic and semiaquatic species. The turtle fauna was represented by a high percentage of *Chrysemys picta* (45% of turtles in Zone D) and a relatively high percentage of *Emydoidea blandingii* (11%). Using an MNI count based upon peripherals (rather than the nuchal), *Chelydra serpentina* also demonstrated a high percentage in Zone D (33%, 4 L peripheral #2). All three turtles can occur in quiet, warm, shallow water with a soft bottom. These species are also the most northerly distributed of the aquatic turtles (Conant and Collins, 1991). Only aquatic (*Nerodia*) and semiaquatic (*Thamnophis*) snakes occurred in Zone D. While *Thamnophis* is the most northern-occurring of any snake, *Nerodia erythrogaster* is a rather southern to temperate species, colonizing no further north than southern Michigan. The most northern-occurring of the large water-snakes, *Nerodia sipedon*, undoubtedly present in Daviess County today, was not identified from the Prairie Creek fauna. Ranid frogs (*Rana catesbeiana*, *R. clamitans*, and especially the *R. pipiens* complex) were abundant, the predominance of the latter suggesting the importance of wet meadows, marshes, and/or bogs during Zone D deposition. *Rana sylvatica* is the most northern-occurring of the anurans and is found in Indiana today.

The Holocene (Zone B) herpetofauna was composed of a mixture of aquatic and terrestrial species. Turtle remains were extremely abundant but consisted largely of *Sternotherus odoratus* (1,857 identified pieces representing 89 MNI, 81-90% of turtle MNI in various Zone B units). This temperately distributed turtle attests to the importance of permanent waters with a soft bottom (perhaps quiet, muddy sections of Prairie Creek) during Holocene sedimentation. *Trachemys scripta* first appeared at Prairie Creek in Holocene strata, where it inhabited quiet water with aquatic vegetation; it is a turtle of relatively southern, somewhat temperate climates. *Terrapene carolina* also first appeared in Zone B, attesting to nearby woodlands. Although the aquatic/semiaquatic snakes (*Nerodia* and *Thamnophis*) were present, Holocene Zone B contained a diversity of terrestrial snakes (*Coluber constrictor*, *Elaphe obsoleta*, *Lampropeltis getula*, *L. triangulum*, and *Crotalus horridus*), indicating temperate environments ranging from forests to grasslands bordering woodlands. Ranid frogs were still present, but terrestrial toads (*Bufo americanus* and *B. woodhousii*) appeared in greater numbers, supporting other indications for open woodlands and grasslands during deposition of Holocene sediments. Hylid frogs were

unexplainably absent from the Prairie Creek fauna. *Siren intermedia*, a relatively southern species of warm, quiet, shallow water with a soft bottom and abundant aquatic plants, was present only in Holocene strata.

Zone C contained two species (*Pseudemys* sp. and *Graptemys* sp.) that were unique to Zones D and C. *Nerodia rhombifer* is a rather southern snake species, colonizing northward only to west-central Illinois. In mixed strata, all of these species are of limited use in interpreting environmental change.

The Prairie Creek site is herpetologically important in that it bridges the gap between Late Wisconsinan and Holocene times and supports the evidence (Fay, 1986, 1988; Holman, 1986, 1987a, b) that herpetofaunas of Late Wisconsinan age often have Holocene and modern analogs, unlike mammalian faunas of Late Wisconsinan age which usually lack modern analogs.

Extinct (ground sloth, armadillo, giant beaver, dire wolf, horse, peccary, and mastodont) and extralimital mammals (star-nosed mole, fisher, red squirrel, red-backed vole, and yellow-cheeked vole) from the Late Wisconsinan Zone D clearly represent a community that has no analog today. However, all of the herpetological taxa, as far as can be determined, represent living species and, with the possible exception of *Emydoidea blandingii*, may be found living at or near the fossil locality today (Minton, 1972; Minton, *et al.*, 1982).

The co-occurrence in a fauna of boreal mammalian species with more temperate or southern taxa is thought by some to have been structured by more "equable" Late Pleistocene climates (i.e., climates with reduced seasonal temperature extremes and more evenly distributed moisture (Graham, 1976, 1979, 1985; Graham and Mead, 1987)). These "equable climates" allowed individual taxa to adjust distributions according to their own "individualistic" tolerances along changing environmental gradients, uniquely reorganizing biotic communities (Graham, 1984; King and Graham, 1981). The occurrence of northern amphibian and reptile fossils with more temperate zoned taxa would not be discernible in many cases (Fay, 1986, 1988; Holman, 1986, 1987b), because amphibian and reptile species in the eastern United States have such strictly northern distributional limits that their significance in middle latitudes would not be recognized.

It is noteworthy that *Emydoidea blandingii* was most abundant in the Late Pleistocene zone (and only represented in the Holocene), while *Trachemys scripta* was confined to Holocene strata. The ranges of these two species overlap in northern Indiana and central Illinois today. A replacement of "cooler" Late Pleistocene *Emydoidea blandingii* by more temperate Holocene *Trachemys scripta* is suggested. This may indicate that herpetofaunas did not remain entirely "inert" in the Late Pleistocene but did undergo some reorganization based upon the "individualistic" tolerances of each species, as has been suggested for mammalian communities.

Pollen analysis from the Late Pleistocene levels of the Prairie Creek locality show a high percentage of spruce, the presence of fir and larch, and a low percentage of hardwoods. Such vegetation is more typical of boreal areas today. However, the herpetofauna contains typical Carolinian and even a few typical Austroriparian species. It is extremely doubtful that many of the herpetological forms from the Late Pleistocene Zone D fauna could survive in a boreal climate at present, for there would not be suitable temperatures for their eggs to hatch (Holman, 1986; Stuart, 1979). The following forms from Zone D would probably have been unable to successfully propagate themselves in a true boreal climate: *Sternotherus odoratus*, *Graptemys* sp., *Pseudemys* sp., *Apalone* sp., *Apalone spinifera*, and *Nerodia erythrogaster*. Therefore, rather than suggesting a boreal climate based on northern extralimital mammals (and perhaps *Emydoidea blandingii* among the reptiles), Graham's "equable climate" model may provide a more accurate description for the Late Pleistocene faunal zone at the Prairie Creek locality.

The Prairie Creek herpetofauna suggests that amphibians and reptiles do adjust distributions according to their "individualistic" tolerances as do mammals, though some past range adjustments may not be apparent given the northern distributions of some modern species. In addition, most amphibian and reptile species were not greatly affected by the reductions in environmental extremes ("equable climate") that so greatly affected mammalian distributions during the Late Pleistocene.

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