

## URBAN HERPETOLOGY II: AMPHIBIANS AND REPTILES OF THE INDIANAPOLIS AIRPORT CONSERVATION LANDS

**B. Jagger Foster, Dale W. Sparks, and Joseph E. Duchamp<sup>1</sup>:** Department of Life Sciences; Indiana State University; Terre Haute, Indiana 47809 USA

**ABSTRACT.** Prior to the construction of a new highway interchange on lands managed by the Indianapolis International Airport, we surveyed the amphibians and reptiles. This study was done in Hendricks and Marion counties, Indiana between April 2001 and October 2003. We recorded 11 amphibian species and 9 reptilian species during the survey. The amphibians, in approximate order of decreasing abundance, were: *Acris crepitans*, *Pseudacris crucifer*, *Bufo americanus*, *Pseudacris triseriata*, *Rana catesbeiana*, *Rana clamitans*, *Bufo fowleri*, *Hyla chrysoscelis*, *Hyla versicolor*, *Ambystoma texanum*, and *Eurycea cirrigera*. Reptilian species were: *Thamnophis sirtalis*, *Nerodia sipedon*, *Apalone spinifera*, *Elaphe obsoleta*, *Chrysemys picta*, *Chelydra serpentina*, *Trachemys scripta*, *Terrapene carolina*, and *Coluber constrictor*. The heavily developed area north of Interstate Highway 70 (I-70) and the rural, agricultural area south of I-70 shared virtually identical frog species, but the numbers of individuals were greatly reduced north of I-70. Reptiles and salamanders were less abundant and less diverse north of I-70. A group of retaining ponds in a warehouse district north of I-70 was inhabited by *Acris crepitans*, *Bufo americanus*, *Rana catesbeiana*, and *R. clamitans*. A wetland complex that was developed to help offset effects of wetlands lost due to the airport expansion was the most diverse area we encountered. It contained 14 of the 20 species found during the project.

**Keywords:** Amphibians, reptiles, conservation, Indiana, Indianapolis International Airport, urbanization

Indianapolis International Airport (IIA) is in a rapidly-developing area on the southwestern edge of Indianapolis, Marion County, Indiana (Fig. 1). Natural habitats in this area occur primarily as fragmented patches of various sizes and with varying degrees of isolation (Sparks et al. 1998). Fragmentation has been found to have a negative impact on amphibian and reptilian populations (Germaine & Wakeling 2001; Pough et al. 1998; Kolozsvary & Swihart 1999). Our study area is a series of properties that lie south and west of IIA in Marion and Hendricks counties. Indianapolis Airport Authority purchased this land as part of a federal noise reduction plan and to preserve habitat for the Indiana bat (*Myotis sodalis*), a federally-endangered species. The conservation lands consist of many small, fragmented woodlots that are surrounded by a matrix of agriculture, residential housing, and commercial properties (Sparks et al. 1998). Because of the presence of a rapidly developing urban area, active ecological res-

toration, and on-going mitigation efforts, this area provides an unusual opportunity to study the impacts of urbanization on a variety of taxa including both amphibians and reptiles. Also, the results of this study can be used to influence future conservation decisions as part of the area is designated as permanent habitat for bats.

Our primary objective was to assess the herpetofauna occurring on IIA properties. In doing so, we compared the more urban area north of I-70 and the more rural area south of I-70 to examine the effects of development on amphibians and reptiles. We also compared two man-made aquatic habitats (described below): retaining ponds located amongst warehouses north of I-70, and mitigation wetlands south of I-70. Both areas were constructed in the 1990s. These retaining ponds are reminiscent of tail-water pits that are permitting wetland species to invade the High Plains of Kansas (Sparks et al. 1999). As such, retaining ponds may allow some amphibians to continue to persist in urban habitats. Thus we compared the retaining ponds to the mitigation wetlands to determine if they serve as a refuge for amphibians and reptiles in urban areas.

<sup>1</sup> *Current Address:* Department of Forestry and Natural Resources; Purdue University; West Lafayette, Indiana 47907 USA

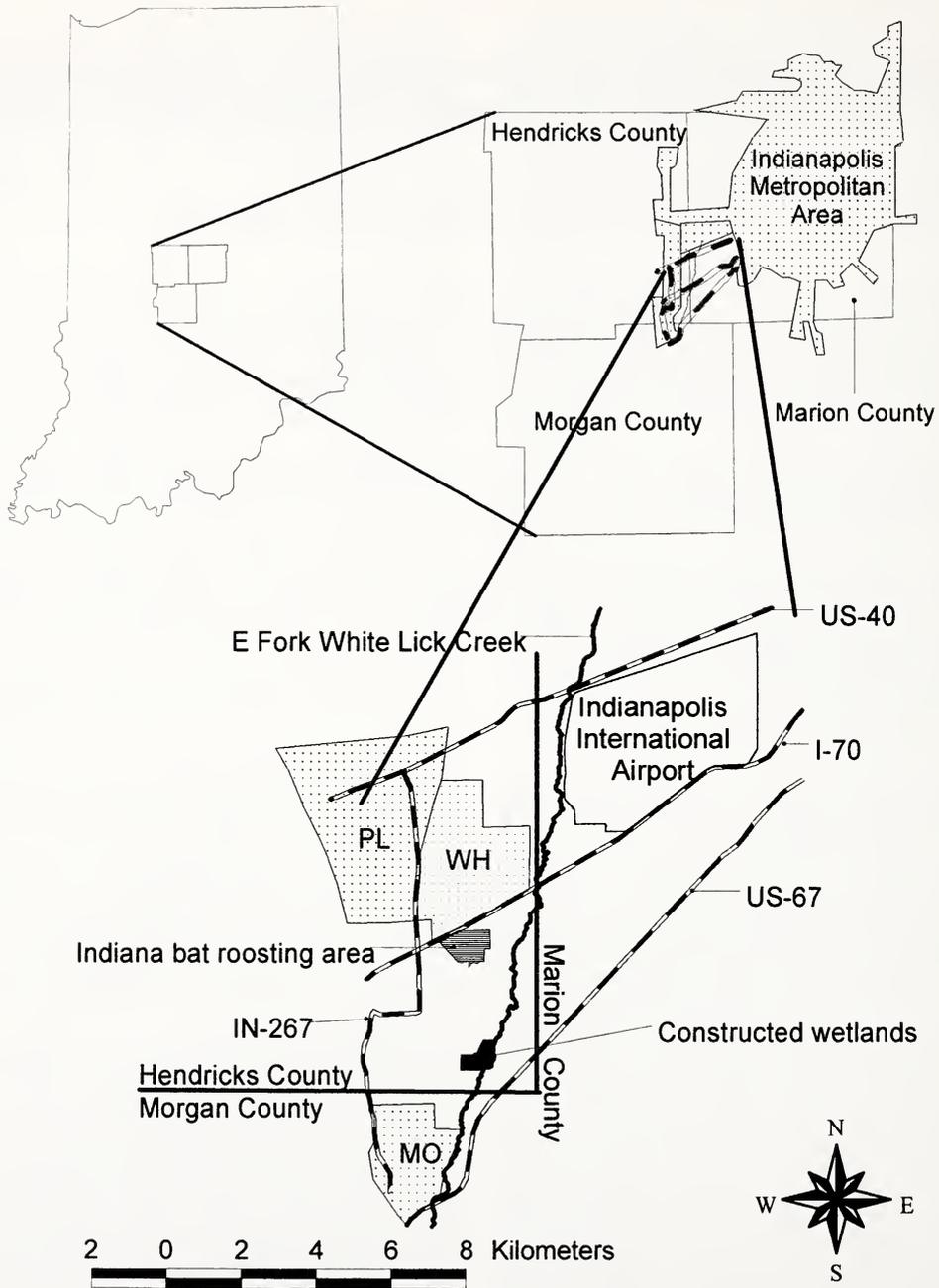


Figure 1.—Map of the Indianapolis International Airport Conservation Lands showing the spatial arrangement of local landmarks. The upper left figure represents the location of Hendricks, Marion, and Morgan counties in Indiana. The upper right figure shows how the study area (hashed lines) relates to the greater Indianapolis metropolitan area (stippled polygon). The bottom figure details the proximity of local landmarks including developed areas (stippled polygons abbreviated as: PL = Plainfield, WH = warehouse district of Plainfield, and MO = Mooresville), transportation corridors (US-40 = U.S. Highway 40, US-67 = U.S. Highway 67, I-70 = Interstate Highway 70, IN-267 = Indiana Highway 267), and other features.

## METHODS

**Study area.**—Our study area (Fig. 1) encompassed approximately 30 km<sup>2</sup> and extended from U.S. Highway 40 to U.S. Highway 67 along the East Fork of White Lick Creek, and west from Bridgeport Road to Indiana Highway 267 (IN-267). Interstate Highway 70 (I-70) bisects the study site from east to west. Smaller county and service roads dissect the interior of the study area. In addition to a medium-sized perennial stream (East Fork of White Lick Creek), the area contains numerous bodies of permanent water including newly-constructed retaining ponds, farm ponds, and a wetland area designed to mitigate the wetlands loss from the airport expansion.

We studied 17 retaining ponds ranging in size from 0.2–1.8 ha ( $\bar{x}$  = 1.0) in the warehouse district north of I-70. All are associated with post-1990 construction, and three were constructed in 2001. Vegetation surrounding these ponds was regularly mowed, with little woody vegetation present. These ponds were constructed to reduce problems associated with runoff, with most of them fed by runoff from rooftops and parking lots.

The mitigation wetlands, conversely, were specifically designed to provide habitat for wildlife. The wetland complex (54.5 ha total) lay along the west bank of East Fork of White Lick Creek just north of the Hendricks/Morgan County line, and contained a variety of habitats. Three ponds (1.4 ha each) were designed to flood temporarily. Vegetation in these ponds mainly consisted of cottonwoods (*Populus deltoides*), willows (*Salix* sp.), cattails (*Typha latifolia*), and smartweeds (*Polygonum*). Three smaller ponds (1.0 ha) contained approximately 15 cm of standing water, and the margins of these ponds were ringed with a thick growth of cattails. Deeper water (up to 3 m deep) was provided by a farm pond (0.6 ha) that was already present when IIA purchased the property. Vegetation surrounding these ponds consisted primarily of pasture grasses and planted wildflowers. Wooded habitat was also provided by the riparian forest that bordered the stream, and by trees planted in the summer of 2002.

**Survey techniques.**—Most of our research was conducted from 2001–2003 for as long as amphibians and reptiles were active. To locate adult amphibians and reptiles we searched un-

der cover objects such as logs, sheet metal, riprap, and construction debris throughout the area. We set minnow traps in aquatic habitats to catch amphibians and snakes (a total of 120 trap-days, February–June 2001–2002). We also drove a standard route on 12 occasions through the study area on nights during or following heavy rains to look for animals on the road and listen for calling frogs. Because we were unable to obtain permission to directly sample these ponds, driving this route was the primary technique used to determine if the retaining ponds served as amphibian habitat. In addition to these techniques, we noted any amphibians or reptiles encountered during other research projects. During the three-year period of the study we spent approximately 2400 hours actively searching for specimens. Representative specimens were collected whenever possible and deposited in the Indiana State University Vertebrate Collection.

## RESULTS AND DISCUSSION

We documented a total of 11 amphibian species and 9 reptile species throughout the study area (Table 1). From Hendricks County, we captured 9 of the 15 species reported by Minton (2001), 10 additional species reported by Foster et al. (2003), and herein document a twentieth species. In Marion County, we captured 7 species of amphibians and 4 species of reptiles, all previously reported by Minton. Below is an annotated list (taxonomy and order of species accounts follows Minton (2001), except we recognize the southern leopard frog as *Rana sphenocephala* instead of *Rana utricularia*) of species we captured or observed during the study. Numbers in parenthesis are Indiana State University Vertebrate Collection (ISUVC) numbers of voucher specimens.

CLASS AMPHIBIA  
ORDER CAUDATA

**Family Ambystomatidae.**—The small-mouth salamander (*Ambystoma texanum*, ISUVC #4089) is the only mole salamander we captured. Although we trapped intensively for aquatic breeding salamanders, we successfully captured this species at only two sites. One of these was at the northern most point of the mitigation wetlands, and the second was in a small intermittent stream in the woodlots used by the bats (Fig. 1).

Table 1.—Total number of amphibian and reptiles recorded near the Indianapolis International Airport from 2001–2003. Records are reported from both the highly developed (urban) area north of Interstate Highway 70, and the more rural area south of Interstate Highway 70. The number of frog calls was estimated by a single observer (BJF).

Species	Estimated calls			Visual sightings		
	Urban	Rural	Total	Urban	Rural	Total
<b>Frogs</b>						
American toad	1	151	152	2	1	3
Fowler's toad	44	0	44	0	1	1
Cricket frog	356	1380	1736	3	150	153
Cope's treefrog	1	20	21	0	2	2
Gray treefrog	0	8	8	0	0	0
Spring peeper	2	1983	1985	0	3	3
Western chorus frog	14	106	120	1	0	1
Bull frog	27	76	103	6	32	38
Green frog	28	75	103	10	9	19
<b>Salamanders</b>						
Smallmouth				0	7	7
Two-lined				0	1	1
<b>Turtles</b>						
Snapping				2	5	7
Painted				0	8	8
Box				0	3	3
Red-eared				0	2	2
Spiny softshell				2	14	16
<b>Snakes</b>						
Racer				0	2	2
Black rat				3	7	10
Garter				4	23	27
Banded water				0	18	18
<b>Total</b>	<b>473</b>	<b>3799</b>	<b>4272</b>	<b>33</b>	<b>288</b>	<b>321</b>

**Family Plethodontidae.**—The only plethodontid seen within the study area was a single two-lined salamander (*Eurycea cirrigera*, ISUVC #4104). However, several other two-lined salamanders were captured and released in Pioneer Park in Mooresville (Morgan County) just south of our study area. We suspect that this salamander occurs only in small and relatively isolated populations within the study area.

#### ORDER ANURA

**Family Bufonidae.**—We found two species of Bufonidae. The American toad (*Bufo americanus*, ISUVC #3594, 4029, 4030) was common both north and south of I-70. Fowler's toad (*B. fowleri*, ISUVC #4031) was restricted to areas immediately adjacent to development. Specifically, this included a small area behind a shopping mall just north of the warehouse

district, and a pond in a subdivision adjacent to Highway 267.

**Family Hylidae.**—We found five species of Hylidae. The cricket frog (*Acris crepitans*, ISUVC #4020) was the most common amphibian throughout the study area. We observed cricket frogs in a variety of habitats: flooded agricultural fields, retaining ponds, mitigation wetlands, and farm ponds. The second most common species at IIA was the spring peeper (*Pseudacris crucifer*, ISUVC #4021). It was encountered in every type of aquatic habitat. Both species were common at the mitigation wetlands.

We heard vocalizations from both members of the gray treefrog complex. We collected a voucher specimen of Cope's gray treefrog (*Hyla chrysoscelis*, ISUVC #4019, identity verified by call). *Hyla chrysoscelis* was found throughout the study area. Gray treefrogs

(*Hyla versicolor*) were heard calling south of I-70, and both species were often heard chorusing within the same body of water. We were unable to obtain a specimen of *H. versicolor*, but our call records are the first report of *H. versicolor* from Hendricks County.

The western chorus frog (*Pseudacris triseriata*, ISUVC #4022) was encountered at only four localities: two flooded areas north of I-70, the mitigation wetlands, and the bat roosting area, where it was most common. We were surprised that the western chorus frog was not encountered more frequently.

**Family Ranidae.**—Both the bullfrog (*Rana catesbiana*, ISUVC #4023) and green frog (*Rana clamitans*; ISUVC #4024, 4027, 4028) were common throughout the study area. Bull and green frogs were often heard calling from the mitigation wetlands. Bullfrogs were abundant in the retaining ponds in the warehouse district, whereas green frogs occupied a pond immediately south of the warehouse district.

#### CLASS REPTILIA ORDER TESTUDINES

**Family Chelydridae.**—The common snapping turtle (*Chelydra serpentina*, ISUVC #3838, 4103) was found throughout the study area in farm ponds and pools of the East Fork of White Lick Creek.

**Family Emydidae.**—We found three species of Emydidae. Midland painted turtles (*Chrysemys picta*; ISUVC #4034, 4035) were found in small ponds throughout the study area and observed sporadically in White Lick Creek. The eastern box turtle (*Terrapene carolina*, ISUVC #4107), and the red-eared slider (*Trachemys scripta*, ISUVC #4033) were encountered only occasionally. Two box turtles were observed in the bat roosting area, and one was found dead on a county road. The slider was recorded only twice—a dead juvenile taken at the mitigation wetlands, and a large adult observed basking in a pond.

**Family Trionychidae.**—The eastern spiny softshell turtle (*Apalone spinifera*, ISUVC #4108) was the only trionychid we found. Most observations were of turtles basking on the banks of the East Fork of White Lick Creek.

#### ORDER SERPENTES

**Family Natricidae.**—We found two species of Natricidae. The eastern garter snake

(*Thamnophis sirtalis*, ISUVC #3596, 4039, 4040, 4041) was found both north and south of I-70. Our data suggest this is the most common snake in the developed areas. The banded water snake (*Nerodia sipedon*, ISUVC #4038) was more common in less-developed areas, but still less common than the eastern garter snake.

**Family Colubridae.**—We found two species of Colubridae. We found two southern black racers (*Coluber constrictor*, ISUVC #3837, 4044) dead along county roads. Although adequate habitat was present, the black racer was rare at IIA. The black rat snake (*Elaphe obsoleta*; ISUVC #4105, 4106, 4072) was more common in the southern portion of the study area, and also occurred in the developed area north of I-70.

#### SPECIES OF POSSIBLE OCCURRENCE

Little is known of the historical distributions of amphibians and reptiles on the IIA site, particularly those in Hendricks County. Five amphibian species that we expected at IIA, but did not encounter during the study, were: eastern tiger salamander (*Ambystoma tigrinum*), redback salamander (*Plethodon cinereus*), zigzag salamander (*Plethodon dorsalis*), slimy salamander (*Plethodon glutinosus*), and the southern leopard frog (*Rana sphenocephala*). Additional amphibians that could occur at the IIA properties by virtue of their range and habitat preference, but were not observed during our survey, include: mudpuppy (*Necturus maculosus*), Jefferson's salamander (*Ambystoma jeffersonianum*), spotted salamander (*Ambystoma maculatum*), marbled salamander (*Ambystoma opacum*), eastern newt (*Notophthalmus viridescens*), northern leopard frog (*Rana pipiens*), and wood frog (*Rana sylvatica*).

We hypothesize that three of these amphibians have been eliminated by development. The redback salamander is especially sensitive to habitat fragmentation (Kolozyvary & Swihart 1999), and thus has likely been eliminated. The slimy salamander and southern leopard frog have both been documented in the vicinity of our study area (Minton 2001), but they are now either absent or greatly reduced in numbers. Interestingly, Brodman (2003) noted slimy salamanders are now frequently absent from areas where the species once occurred.

Five common reptiles expected at IIA, but not encountered, were stinkpot turtle (*Sternotherus odoratus*), northern ringneck snake (*Diadophis punctatus*), midland brown snake (*Storeria dekayi*), eastern hognose snake (*Heterodon platirhinos*), and five-lined skink (*Eumeces fasciatus*). We may have overlooked the stinkpot turtle because turtle traps were not used to sample ponds. It is common throughout most of Indiana and may be present at IIA. The midland brown snake also may be present at IIA as it is found in both urban and suburban areas (Minton 2001). Other researchers (D. Brown & R. Marrs pers. commun.) noted that the ringneck snake was present on the study area prior to development. Both the eastern hognose snake and the five-lined skink have been found previously in the vicinity of our study site (Minton 2001), but we found none despite exhaustive searches. Thus we suspect three reptiles (ringneck snake, eastern hognose snake, and five-lined skink) have been eliminated by development.

Additional reptiles that could occur at the IIA properties by virtue of their range and habitat preference but were not observed during our survey include: broadhead skink (*Eumeces laticeps*), Kirtland's snake (*Clonophis kirtlandii*), milk snake (*Lampropeltis triangulum*), rough green snake (*Ophiodrys aestivus*), and eastern ribbon snake (*Thamnophis sauritus*). The mitigation wetlands, fragmented woodlots, and old fields are suitable habitat for most of these species. Kirtland's snake, still present in the Indianapolis area, has become rare in recent years and is now listed as a state-endangered species. Thus, it is unlikely to occur on our study site. Some of the other species listed above may still be present in small numbers; but we suspect that most, if not all, have been extirpated by development.

#### RETAINING PONDS

The retaining ponds were used by four anurans: cricket frog, bullfrog, green frog, and American toad. All four species were also present at the mitigation wetlands and in many other parts of the project area. Other species (such as chorus frogs, spring peepers, and the gray tree frog complex) might use retaining ponds if small portions of wooded habitat and un-mown grasslands are set aside when future retaining ponds are built. In addition, most of the current retaining ponds are separated from

other aquatic habitats by roads. At present, these ponds provide habitat for only the most abundant and vagile species of anurans.

#### MITIGATION WETLANDS

A greater variety of local amphibians and reptiles was found in the mitigation wetlands than in the other habitats. The area provided ample breeding habitat and diversity in surrounding habitat (adjacent woodlots, creeks, farm ponds, and shallow temporary fishless depressions). All amphibian species, except Fowler's toads and two-lined salamanders, were found in the mitigation wetlands. Given that the area surrounding the wetlands is now being reforested as part of the bat management efforts, this area should continue to improve as habitat for amphibians and reptiles.

#### IMPACTS OF DEVELOPMENT

Overall, our data suggest natural habitats adjacent to agricultural lands are more valuable than those adjacent to urban development for maintaining population and species diversity among amphibians and reptiles. This trend toward fewer species in developed habitats is seen in frogs, salamanders, and reptiles.

Our results indicate frog populations are reduced in the developed area north of I-70. These results, however, also indicate that most anuran species continue to persist. All but one anuran species occurred both north and south of I-70. *Hyla versicolor* was only found south of I-70. Bullfrogs and green frogs were not the most numerous in terms of individual animals, but both species were present in even the most heavily-developed areas.

We captured salamanders only in the less-developed area south of I-70 because we were unable to locate suitable (without fish) ponds north of I-70, and every potential pond we trapped yielded fish. We did search for salamanders under debris in suitable woodland habitat and found none. Thus, it is likely that salamanders are absent in the portion of our study area north of I-70.

Reptiles, conversely, were both less abundant and had less biodiversity north of I-70. Only four of nine reptile species occurred north of the interstate. Although some turtles may have been overlooked in both areas, reptiles seem more sensitive than amphibians to urban development. Brodman (2003) suggest-

ed that in Indiana reptiles are more threatened than amphibians, a statement with which we agree. Despite the fact that both our study and Brodman's were more efficient at detecting amphibians, the absence of what are thought to be common reptiles (such as the banded water snake and North American racer) in developed areas is disturbing.

Faunal surveys are of particular value when the area surveyed has the potential of being permanently preserved (Vincent et al. 1998). Despite continual habitat modification at our study site, appreciable numbers of amphibians and reptiles occur at IIA. It is our hope this assessment of reptile and amphibian populations surrounding IIA will contribute to preservation of the remaining undeveloped land, and aid in planning restoration of areas obtained as part of the noise reduction plan and other future mitigation efforts. Particular attention should be paid to providing fish-free ponds within woodlots for frogs and salamanders, and to preserving the remaining woodlots in the area.

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