A Herpetofaunal Inventory of Arkansas Post National Memorial, Arkansas County, Arkansas

Malcolm L. McCallum
Red River Watershed Institute
Museum of Life Sciences
Department of Biological Sciences
Louisiana State University in Shreveport
One University Place
Shreveport, LA 71115

Stanley E. Trauth and Robert G. Neal
Department of Biological Sciences
Arkansas State University
State University, AR 72467-0599

Vernon Hoffman
University of Arkansas
Community College
P.O. Box 3350
Batesville, AR 72501

Abstract

The Arkansas Post National Memorial (ARPO) is a unique historical landmark with an interesting herpetofaunal community. We conducted an amphibian and reptile inventory of this national park from 2000-2002. We found eight amphibian and 21 reptilian species inhabiting the park. These included eight species not previously identified at ARPO. Overall species richness was highest at Alligator Slough, although the northern portion of ARPO was relatively rich. Aquatic trophic guilds included 7 (36.8%) piscivores, 7 (36.8%) omnivores, 4 (21.1%) insectivores, and one (5.3%) carnivore. The terrestrial trophic guilds included 13 (76.5%) insectivores, 2 (11.8%) carnivores, and 1 (5.9%) each of omnivores and generalized carnivores. We provide a species list, analysis of the distributions, diversity relationships and the trophic guilds present at ARPO, including management recommendations for the conservation of the herpetofauna community at ARPO.

Introduction

Even relatively small National Park Service lands may provide potential refuges for amphibian and reptilian species. The U.S. Congress passed the National Parks Omnibus Management Act in 1998 in response to concerns about the status of biodiversity in the nation's national park system (National Research Counsel 1992). This act called for baseline inventory data for parks throughout the nation. Arkansas Post National Memorial (ARPO) in southeastern Arkansas (Arkansas County) was one of these areas lacking data.

Arkansas Post was designated as a national memorial in 1960. It spans approximately 302 ha (747 acres) of which 451 acres is federal land. The habitat is dominated by bottomland hardwood forest, backwater slough, and big river habitat. The surrounding land use is typical of the Mississippi Delta, being composed of rice and soybean production. Crop dusting is performed adjacent to the park throughout the growing season. Recreational use at ARPO was estimated at 49,087 visitors in 1999. Nearly all the natural habitat in the Mississippi Delta has been modified or fragmented by agriculture. Habitat fragmentation and alteration have been implicated as primary factors influencing amphibian declines (Pechmann and Wilbur, 1994; Blaustein et al., 1994) and biodiversity declines in general (Heywood, 1992). Many amphibian and reptilian populations are best described as metapopulations (Levins, 1969; Hanski and Gilpin, 1997) whose stability is dependent upon a balance between population extirpation and recolonization (Johnson et al., 2002). Although the habitats at ARPO are not virgin lands, their setting in the Delta makes ARPO an important conservation area; thus, habitat management to limit disturbance may allow ARPO to act as ecological source for refueling adjacent populations (Weins, 1996). Despite its importance as a biodiversity holding ground, little is known about ARPO's wildlife and plant communities.

During 21-23 of April 2000 we undertook a short-term herpetofaunal survey at ARPO with the cooperation of park personnel. Despite its small size, an array of amphibians and reptiles was found at the park. Several species of turtles, lizards, and frogs were plentiful. The preliminary inventory resulted in four new county records for amphibians and reptiles at the park (red milk snake [*Lampropeltis triangulum syspila*], Graham's crayfish snake [*Regina grahamii*], northern fence lizard [*Sceloporus undulatus hyacinthinus*], and the marbled salamander [*Ambystoma opacum*]).

Additional inventory work at ARPO provided a more thorough, survey in 2001-2002. This study attempted to identify at least 90% of the amphibian and reptilian species utilizing ARPO. The primary objective of that investigation was to provide an up-to-date assessment of species richness at the park. Secondary objectives involved the estimation of relative abundance, delineation of local ranges for each species, collection and deposition of voucher specimens, and the implementation of survey methods that would insure a 90% repeatability of the project.

Materials and Methods

We followed up our preliminary inventory with a primary inventory from fall 2001 through summer 2002. Data from both surveys were combined for this report. Our primary terrestrial inventory methods included road cruising (Karns, 1986) and general search and seizure activities (Vogt and Hine, 1982). Aquatic methods included dip netting, seining (Karns, 1986), and the use of minnow (Karns, 1986) and turtle traps (Legler, 1960). We employed a seven-member team during most visits. Most common and scientific names are based on Moriarty (2000).

We visited the park on 8-9 August 2001, 19-20 October 2001, 15 March 2002, 12-14 April 2002, and, 7-8 May 2002. A sampling grid of primary and secondary points for ARPO (Fig. 1) was designed for our use by the long-term ecological monitoring (LTREM) staff stationed at the NPS Heartland Inventory and Monitoring headquarters in Republic, Missouri. At each primary point on the sampling grid, four secondary points were identified in each of the primary compass directions from the primary point. Coverboard use was adapted from Grant et al. (1992). We alternately placed two wood and two tin coverboards at each secondary point to account for potential differences in their quality as amphibian and reptilian attractants. Each coverboard plot was visited at least once during the study. Twelve of the 37 primary points were designated as coverboard plots, and time-area constrained searches (TACS) were used at 13 primary points. Eleven of the primary points were eliminated from the study because they fell outside the park boundary or in water bodies. Point 28 was near shore, so we placed cover boards along the shoreline at this sight. Both points 7 and 15 had a secondary point removed for the same reason as described above. If a primary grid point appeared in a heavily wooded area, then coverboards were not applied, and we instead designated that point for TACS. The TACS technique was a modification of the "time constrained search and seizure method" and the "quadrant search and seizure;" utilized by Campbell and Christman (1982).

Four secondary points, designated as described above, were identified. An 8 m^2 plot was delineated at each secondary point and searched systematically for 10 minutes. All logs, rocks, and other debris were returned to their original position after turning. Each primary point was recorded using a Trimble GeoExporer 3 Global Positioning

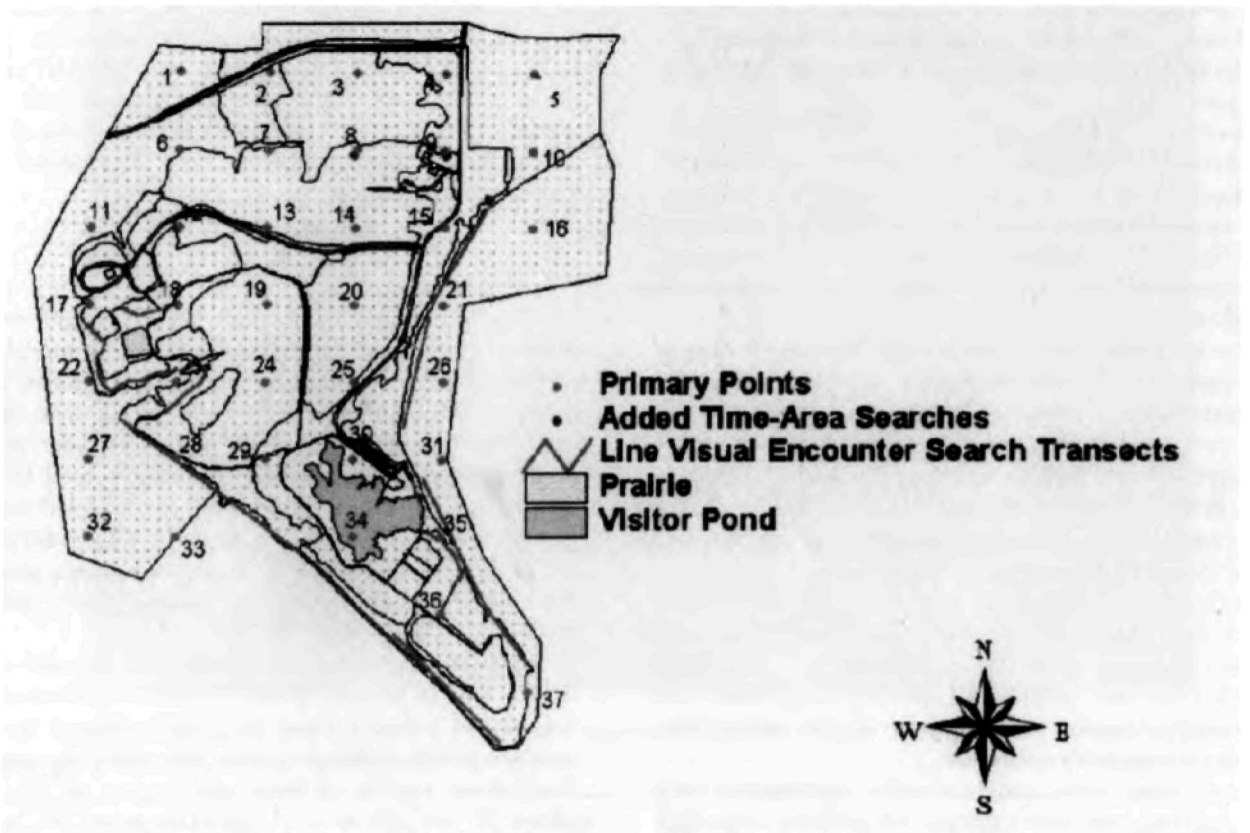

Fig. 1. Map of Arkansas Post National Memorial showing primary points and other search areas.

Table 1. Amphibians of Arkansas Post National Memorial.
Key: (+++++) = Commonly encountered, (+) = Rare, (?) = unverified observation

Amphibia	Family		Relative Abundance
Anura	Bufonidae	American Toad (*Bufo americanus*)	+++
		Fowler's Toad (*Bufo fowleri*)	+++++
		Northern Cricket Frog (*Acris crepitans*)	+++++
		Spring Peeper (*Pseudacris crucifer*)	+++
		Cope's Gray Treefrog (*Hyla chrysoscelis*)	+
		Green Treefrog (*Hyla cinerea*)	++++
	Microhylidae	Eastern Narrowmouth Toad (*Gastrophryne carolinensis*)	+++
	Ranidae	Bullfrog (*Rana catesbeiana*)	+++
		Bronze Frog (*Rana clamitans clamitans*)	++++
		Southern Leopard Frog (*Rana sphenocephala*)	+++++
Caudata	Ambystomatidae	Marbled Salamander (*Ambystoma opacum*)	+
	Plethodontidae	Western Slimy Salamander (*Plethodon albagula*)	?

System (GPS) portable hand-held unit at the highest accuracy possible given the conditions at the time. No less than 150 data point readings were collected with the GPS for each primary point, and these were saved as a single file for each grid point.

Generalized search and seizure methodology was utilized throughout the entire park in addition to the other two methods. All trails and east-west/north-south transects between coverboard plots were hiked. Both day and night road cruising were implemented on all park roads and on roads adjacent to the park. Animals were recorded as encountered.

Turtle trapping was implemented in the vicinity of primary point 1 on 12-14 April 2002. The water depth in other locations was too shallow to adequately sample by this method. We placed two turtle traps near basking logs where turtles were observed. Dip netting was implemented in roadside ditches, Alligator Slough (AS), and in the Visitor Center Lake (VCL), and in a small backwater pond northeast of the VCL.

Spotlighting was used at AS and on the VCL to observe frogs and alligators. The eye-shine from these animals is easily seen using a spotlight or high-intensity flashlight. These lights are also helpful in capturing amphibians and reptiles at night because the light prevents the animal from seeing the investigator's approach.

In most cases, only a single voucher specimen of each species observed was taken during the primary inventory. These specimens were preserved (Pisani, 1973) and deposited in the National Park Service Heartland Division Special Collection within the Arkansas State University Museum of Zoology herpetology collection. Specimens with their numbers were entered into an electronic Microsoft Access database for reference. A map of ARPO with all primary points and designated special areas (with labels) is shown in Fig. 1. We utilized ArcView 3.0 as the geographic information system (GIS) to analyze species richness throughout the park.

Results

The preliminary inventory yielded eight amphibian species (one salamander and seven anurans) and 21 reptilian species (one crocodilian, six turtles, five lizards, and nine snakes). The extensive inventory found eight additional species including three anurans, one salamander, two turtles, and two snakes. Six species were represented by a single observation/specimen. These were the marbled salamander (*Ambystoma opacum*), red milk snake (*Lampropeltis triangulum syspila*), green anole (*Anolis carolinensis*), rough green snake (*Opheodrys aestivus*), and the western slimy salamander (*Plethodon albagula*; Tables 1 and 2).

Overall herpetofaunal species richness was highest at AS (vicinity of primary points 22 and 23) followed by VCL (vicinity of primary point 34). The northern two rows of primary points at the park were also relatively species rich. Amphibian species richness was highest at AS (primary points 22 and 23), at VCL (primary point 34), and in the vicinity of primary points 1, 6, and 7. The American alligator was observed nesting at Alligator Slough (Fig. 2).

Fig. 2. The American alligator nest (at base of tree) and eggs at Alligator Slough (7 Aug 2001), Arkansas Post National Memorial. Eggs were covered after photograph was taken.

Trophic guilds at ARPO and in the surrounding counties (Arkansas and Desha counties) are provided in Fig. 3. Aquatic trophic guilds in the surrounding counties included 12 (36.4%) piscivores, 11 (33.3%) omnivores, 9 (27.3%) insectivores, and one (3%) carnivore. Terrestrial trophic guilds in the surrounding counties included 21

Table 2. Reptiles of Arkansas Post National Memorial.
Key: (+++++) = Commonly encountered, (+) = Rare, (?) = unverified observation

Reptilia	Family		Relative Abundance
Squamata	Phrynosomatidae	Northern Fence Lizard (*Sceloporus undulatus hyacinthinus*)	+++
	Scincidae	Five-lined Skink (*Eumeces fasciatus*)	++++
		Broadhead Skink (*Eumeces laticeps*)	+++
		Ground Skink (*Scincella lateralis*)	+++++
	Colubridae	Eastern Racer (*Coluber constrictor*)	+++
		Speckled Kingsnake (*Lampropeltis getula*)	+++
		Red Milk Snake (*Lampropeltis triangulum*)	+
		Green Water Snake (*Nerodia cyclopion*)	+++++
		Yellowbelly Water Snake (*Nerodia erythrogaster flavigaster*)	++++
		Broad-banded Water Snake (*Nerodia fasciata confluens*)	++++
		Diamondback Water Snake (*Nerodia rhombifer*)	++++
		Rough Green Snake (*Opheodrys aestivus*)	+
		Graham's Crayfish Snake (*Regina grahamii*)	+++
		Western Ribbon Snake (*Thamnophis proximus*)	++
	Viperidae	Western Cottonmouth (*Agkistrodon piscivorus*)	++++
Testudines	Chelydridae	Common Snapping Turtle (*Chelydra serpentina*)	++++
	Emydidae	Common Map Turtle (*Graptemys geographica*)	++
		Eastern River Cooter (*Pseudemys concinna*)	+++++
		Three-toed Box Turtle (*Terrapene carolina triunguis*)	++++
		Red-eared Slider (*Trachemys scripta*)	+++++
	Kinosternidae	Common Musk Turtle (*Sternotherus odoratus*)	++
		Razorback Musk Turtle (*Sternotherus carinatus*)	++++
Crocodilia	Alligatoridae	American Alligator (*Alligator mississippiensis*)	++

Table 3. Species richness at Alligator Slough.

Species	Inhabitant	Observed In Vicinity
American Alligator	X	
Black Racer	X	
Broad-banded Water Snake	X	
Broadhead Skink	X	
Bronze Frog	X	
Bullfrog	X	
Common Musk Turtle	X	
Common Snapping Turtle	X	
Diamondback Water Snake		X
Eastern Narrowmouth Toad		X
Five-lined Skink	X	
Graham's Crawfish Snake	X	
Green Treefrog		X
Green Water Snake	X	
Ground Skink	X	
Marbled Salamander		X
Northern Cricket Frog	X	
Northern Fence Lizard	X	
Razorback Musk Turtle	X	
Red Milk Snake		X
River Cooter		X
Southern Leopard Frog	X	
Speckled Kingsnake	X	
Three-toed Box Turtle	X	
Western Cottonmouth	X	
Western Ribbon Snake		X
Western Slimy Salamander	X	
Yellowbelly Water Snake	X	

(67.7%) insectivores, six (19.4%) carnivores, three (9.7%) generalized carnivores, and one (3.2%) omnivore. The aquatic trophic guilds at ARPO included seven (36.8%) piscivores, seven (36.8%) omnivores, four (21.1%) insectivores, and one (5.3%) carnivore. The terrestrial trophic guilds at ARPO included 13 (76.5%) insectivores, two (11.8%) carnivores, and 1 (5.9%) each of omnivores and generalized carnivores.

Discussion

The most important habitat resource for herpetofauna in the park is the area surrounding and including AS. No other part of ARPO is nearly as rich. Species abundance in this area was also much higher than anywhere else in the park. Twenty-one species (Table 3) were found in this area, representing 57% of the total richness. Another seven species were observed close enough to AS to derive benefits from its habitats. This suggests that 76% of the amphibians and reptiles at ARPO may utilize the habitats of AS. Although they could not be identified, several species of basking turtles were observed swimming in AS. All seven turtle species observed at the park probably utilize this area to some extent. Six species of amphibians were observed at AS representing 50% of the amphibian species richness on ARPO. Twenty-two species of reptiles were observed at AS representing 88% of the reptilian species richness at the park.

At least one American alligator and its nest were observed within the area of AS. The single nest was first sighted on 7 August 2001 (Fig. 4). We counted 22 hatchlings in the vicinity of the nest 10 months later on 7 May 2002. The hatchlings remained in close association with their nest for the next several months. A second pod of hatchlings (no nest was found in this area) was observed in the VCL around the same time, but the following spring none of these individuals was present. It appeared that all hatchlings from this second pod probably died during the winter. This suggests AS may be an important source habitat for

Table 4. Species richness at Visitor Center Lake.

Species	Inhabitant
American Alligator	X
Bronze Frog	X
Common Map Turtle	X
Diamondback Water Snake	X
Eastern Narrowmouth Toad	X
Green Treefrog	X
Northern Cricket Frog	X
River Cooter	X
Southern Leopard Frog	X

American alligators. We observed populations of ghost shrimp in AS so dense that our dipnet contained nearly a liter of the invertebrates following one scoop on 7 August 2002. The abundance of ghost shrimp and other invertebrates in the waters of this location undoubtedly provides a rich, high-caloric diet to prepare the hatchlings for the winter months. This single factor may have been sufficient to relate the survivorship differences observed between the two pods during our study.

The high species richness at AS may also be due to lower levels of visitors in this area as compared to other parts of the park. Alligator Slough has only one small dirt footpath. Other areas have paved paths with mowed borders. This probably leads to heavier traffic and higher potential for human interaction with the wildlife. The natural attractiveness of AS makes it an important natural resource at ARPO.

The VCL provides an important resource for the herpetofaunal community of ARPO. Eleven species were observed here representing 30% of the total species richness at ARPO (Table 4). Diamondback water snakes were particularly abundant here. As mentioned previously, hatchling alligators were present here on 7August 2001, but were not observed in April 2002. Eastern narrowmouth toads (*Gastrophryne carolinensis*), northern cricket frogs (*Acris*

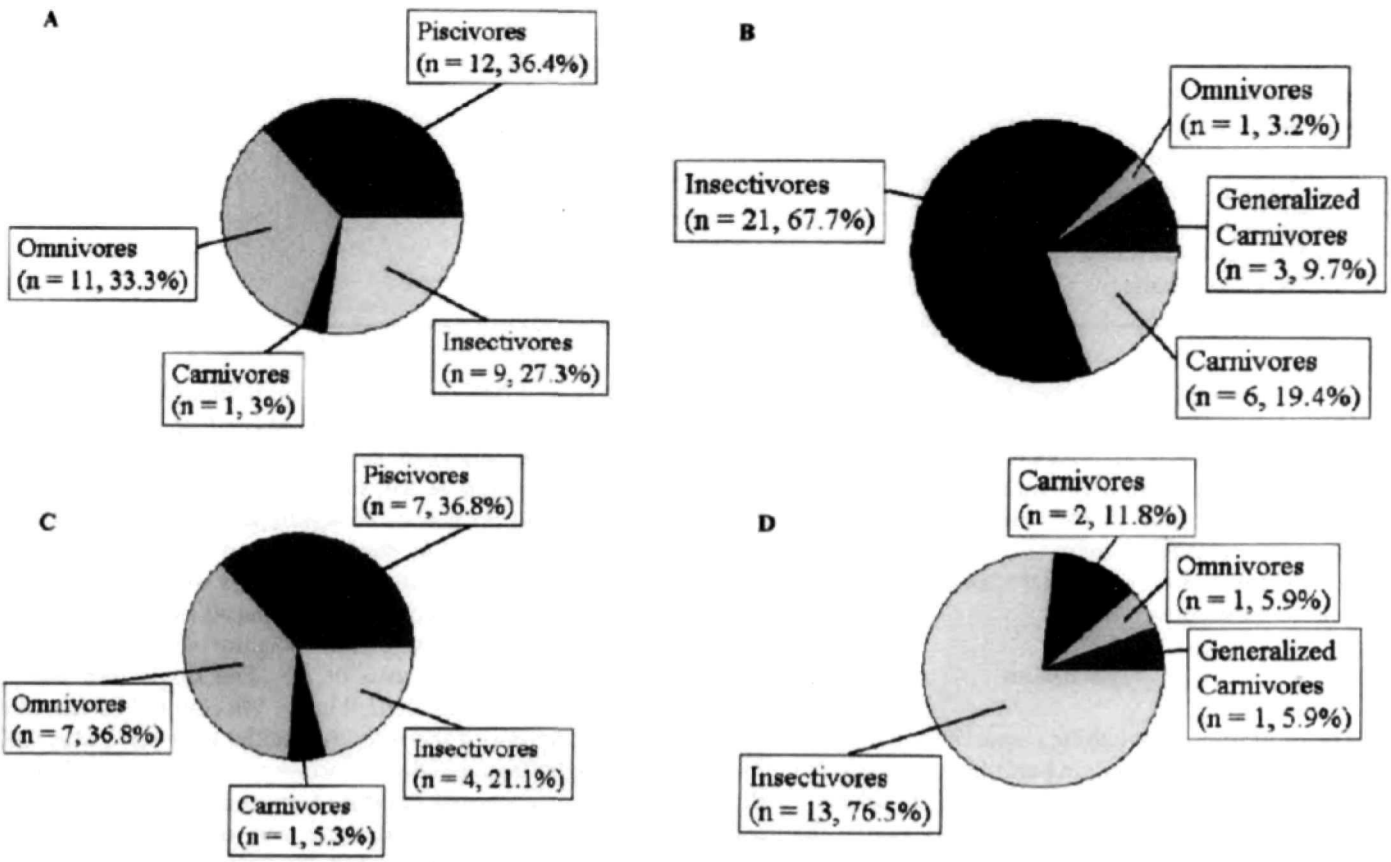

Fig. 3. Aquatic and terrestrial herpetofaunal trophic guilds in Arkansas and Desha counties. A) Aquatic Arkansas-Desha, B) Terrestrial Arkansas-Desha, C) Aquatic ARPO, D) Terrestrial ARPO.

crepitans), green treefrogs (*Hyla cinerea*), bronze frogs (*Rana clamitans*), bullfrogs (*Rana catesbeiana*), and southern leopard frogs (*Rana sphenocephala*) were observed calling at this location. Except for the eastern narrowmouth toad, all amphibians and reptiles present at the pond were essentially aquatic species. The pond is entirely surrounded by mowed lawn grass. In most areas the grass is mowed to the water's edge. Human activity at this small lake is heavy. These factors may be suppressive to amphibian and reptilian populations that might otherwise inhabit the terrestrial habitats adjacent to VCL.

The forested areas at ARPO are highly fragmented. The largest tracts of forested land appear in the areas of highest species richness. Fewer than 10 northern cricket frogs were observed in mowed areas away from the forest edge. Arkansas Post has large tracts of mowed habitat for human use distributed in the central region of the park. This creates an atoll-shaped forest habitat within this region. This type of habitat distribution is typically expected to possess lower than average species diversity (MacArthur and Wilson, 1967).

The low richness and abundance of ambystomatid salamanders are important to address. A single marbled salamander was recovered during the preliminary inventory from habitats adjacent to AS. No adults or larvae were observed during the entire primary inventory. In fact, no fishless ephemeral ponds are present at ARPO. Such ponds are essential for maintenance of ambystomatid populations.

In all trophic guilds present at ARPO we observed fewer species present than occur in the surrounding counties. This is partly due to the limited habitat diversity present at ARPO compared to the surrounding area. The aquatic trophic guilds of ARPO were relatively similar to the guild breadths present in the surrounding counties. In both, piscivores were the most common groups, being comprised primarily of snake species. Aquatic omnivores were the second most represented guild and were represented primarily by turtles. Additional aquatic sampling might increase the representation of omnivores through additional turtle species being revealed. The terrestrial trophic guilds at ARPO were more represented by insectivores than the surrounding counties. This probably arose from our inability to collect more carnivores from the park. Carnivorous species represented 19.4% of the herpetofauna in the surrounding counties. Snakes are the primary group of carnivores comprising this guild. Among these, the timber rattlesnake and pygmy rattlesnake are unlikely to occur at ARPO except as transients. Park officials have observed the northern copperhead at ARPO, further monitoring is likely to recover this species.

Species diversity is the variety of species present combined with their relative abundances. Species diversity is believed to decrease when ecological integrity is compromised (Feinsinger, 2001). The use of species richness alone, without adequate consideration of relative abundance, can lead to inappropriate decisions regarding natural resource management (Feinsinger, 2001). It is, therefore, important that continued long-term monitoring occur at ARPO in order to insure the accuracy and precision of the resultant data set supporting future decision-making. Our brief, one-year study is primarily a species inventory and, except in a few cases, provides limited abundance information.

Management Recommendations

We believe the following management recommendations are necessary to conserve the herpetofaunal diversity at ARPO: 1) Construct up to five small, temporary wildlife ponds in forested areas to promote ambystomatid populations. 2) Supplement currently depauperate marble salamander populations with egg clutches from nearby populations (IUCN guidelines state that reintroductions into areas where species are functionally extirpated is acceptable). A small effort has high probability of restoring the park's populations. 3) Alligator Slough should be considered a special biological resource of the park and should be monitored routinely. Avoid human use improvements in this area. 4) Timber management should include a forest floor management plan so that sufficient logs, woody debris, and other refugia are available as amphibian and reptilian habitats. This should further include significant expansion of the forested areas of the park at the expense of the mowed lawn areas. 5) Establish a long-term, population monitoring plan for the park. 6) Alter human access and management by encouraging people to remain on the sidewalks, especially around VCL. An example of this may include posting warning signs for venomous snakes and alligators. These signs may discourage most people from entering the habitat proper. This would not prevent people from enjoying the visual beauty of such areas and would definitely contribute to its preservation over the long term.

ACKNOWLEDGMENTS.—We thank Kevin Eads, Ben Wheeler, Ben Ball, Robyn Konvalinka, and Charles McDowell for assistance during the inventory, the Arkansas Game and Fish for scientific collection permits, and the National Park Service for technical assistance and funding (Grant #Q6370010459).

Literature Cited

Blaustein, A. R., D. B. Wake, and **W. P. Sousa.** 1994. Amphibian declines: judging stability, persistence, and susceptibility of populations to local and global extinctions. Conserv. Biol. 8:60-71.

Campbell, H. W., and **S. P. Christman.** 1982. Field techniques for herpetofaunal community analysis. Pp. 193-200, *In:* Scott, N.J., Jr. (ed.), Herpetological communities. Wildlife Research Report 13, U.S. Fish and Wildlife Service, U.S. Depart. Inter.

Feinsinger, P. 2001. Designing field studies for biodiversity conservation. Island Press. Washington, D.C. 212 pp.

Grant, B. W., A. D. Tucker, J. E. Lovich, A. M. Mills, P. M. Dixon, and **J. W. Gibbons.** 1992. The use of coverboards in estimating patterns of reptile and amphibian biodiversity. Pp. 379-403, *In:* D. R. McCullough and R.H. Barnett (eds.). Wildlife 2001. Elsvier Sci. Publ. London, England. 608 pp.

Hanski, I. A., and **M. E. Gilpin.** 1997. Metapopulation biology: ecology, genetics, and evolution. Academic Press. San Diego, California. 358 pp.

Heywood, V. H. 1992. Global biodiversity assessment. Cambridge Univ. Press. New York, New York. 1140 pp.

Johnson, C. M., L. B. Johnson, C. Richards, and **V. Beasley.** 2002. Predicting the occurrence of amphibians: An assessment of multiple-scale models. Pp. 157-170, *In*: Scott, M. J., P. J. Heglund, and M. L. Morrison (eds.). Predicting species occurrences: issues of accuracy and scale. Island Press. Washington, D.C. 1090 pp.

Karns, D. R. 1986. Field herpetology: methods for the study of amphibians and reptiles in Minnesota. Univ. Minnesota James Ford Bell Mus. Nat. Hist. Occas. Pap. 18:1-88.

Legler, J. M. 1960. A simple and inexpensive device for trapping aquatic turtles. Utah Acad. Proc. 37:63-66.

Levins, R. 1969. Some demographic and genetic consequences of environmental heterogeneity for biological control. Bull. Entomol. Soc. Amer. 15:237-240.

MacArthur, R. H., and **E. O. Wilson.** 1967. The theory of island biogeography. Princeton Univ. Press. Princeton, New Jersey. 352 pp.

Moriarty, J. J. 2000. Scientific and standard common English names of amphibians and reptiles of North America north of Mexico with comments regarding confidence in our understanding. Herpetol. Circ. 29:1-89.

National Research Counsil. 1992. Science and the National Parks. National Academy Press. Princeton, New Jersey. 76 pp.

Pechmann, J. H. K., and **H. M. Wilbur.** 1994. Putting declining amphibian populations in perspective: Natural fluctuations and human impacts. Herpetologica 50:65-84.

Pisani, G. R. 1973. A guide to preservation techniques for amphibians and reptiles. Herpetol. Circ. No. 1, Soc. Study Amphib. Rept. St. Louis, Missouri. 46 pp.

Vogt, R. C., and **R. L. Hine.** 1982. Evaluation of techniques for assessment of amphibian and reptile populations in Wisconsin. Pp. 201-217, *In:* Scott, N.J., Jr. (ed.), Herpetological communities. Wildl. Research Report 13, U.S. Fish and Wildl. Serv., U.S. Depart. Int.

Weins, J. A. 1996. Wildlife in patchy environments: Metapopulations, mosaics, and management. Pp. 53-84, *In*: D.R. McCullough (ed.). Metapopulations and wildlife conservation. Island Press. Washington, D.C. 506 pp.