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Philadelphia, Pennsylvania

Inventory of Amphibians, Reptiles, and Mammals at Allegheny Portage Railroad National Historic Site and Johnstown Flood National Memorial

Technical Report NPS/NER/NRTR--2006/036

ON THE COVER

Top Left - Spotted Salamander (*Ambystoma maculatum*), Top Center - Eastern American Toad (*Bufo americanus*), Top Right - Northern Short-tailed Shrew (*Blarina brevicauda*), Bottom Left - Eastern Milk Snake (*Lampropeltis triangulum*), and Bottom Right – Virginia Opossum (*Didelphis virginiana*). Photographs by B. Ross.

Inventory of Amphibians, Reptiles, and Mammals at Allegheny Portage Railroad National Historic Site and Johnstown Flood National Memorial

Technical Report NPS/NER/NRTR--2006/036

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U.S. Department of the Interior
National Park Service
Northeast Region
Philadelphia, Pennsylvania

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Summary

National parks are becoming more insular because of increased habitat fragmentation resulting from urbanization or other land uses in the surrounding landscape (Ambrose and Bratton 1990; Yahner 2000a). Parks are valuable for the long-term maintenance of faunal diversity (e.g., amphibian, reptile, mammal, and bird diversity) and the functional integrity of ecosystems. The National Park Service has determined the need for an in-depth inventory of amphibian, reptile, and mammal populations to complement previous research on birds and butterflies at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania (Yahner and Keller 2000b; Yahner et al. 2001a). The objectives of our project were to (1) review existing literature and documentation of the National Park Service and other sources, and develop a database for historic and potential occurrence of amphibians, reptiles, and mammals at ALPO and JOFL, (2) conduct an inventory of presence, relative abundance, and distribution of amphibians, reptiles, and mammals at ALPO and JOFL, and (3) provide general recommendations for monitoring amphibians, reptiles, and mammals at ALPO and JOFL.

We surveyed amphibian and reptile populations from March through October 2004 and 2005 using visual-encounter (VES), artificial cover-object (ACO), pitfall-trapping, anuran-calling (ACS), general-search surveys (GSS), and opportunistic observations. We detected 12 salamander, six anuran, two turtle, and eight snake species at ALPO and 10 salamander, six anuran, and eight snake species at JOFL. We did not encounter lizards at either park during 2004 or 2005. Jefferson salamander (*Ambystoma jeffersonianum*), valley and ridge salamander (*Plethodon hoffmani*), northern red salamander (*Pseudotriton ruber*), common snapping turtle (*Chelydra serpentina*), and eastern box turtle (*Terrapene carolina*) were detected only at ALPO, whereas Wehrle's salamander (*Plethodon wehrlei*) was only found at JOFL. Redback (*Plethodon cinereus*) and northern slimy salamanders (*Plethodon glutinosus*) were the most abundant terrestrial salamanders at ALPO, whereas northern slimy and Wehrle's salamanders were the most abundant terrestrial salamanders at JOFL. Mountain dusky (*Desmognathus ochrophaeus*) and northern two-lined salamanders (*Eurycea bislineata*) were the most abundant aquatic salamanders at each park. Northern spring peeper (*Pseudacris crucifer*) and wood frog (*Rana sylvatica*) were the most abundant anurans and eastern garter (*Thamnophis sirtalis*) and northern redbelly snakes (*Storeria occipitomaculata*) were the most abundant snakes at each park. Monitoring efforts based on GSS, ACO, VES, and ACS at our survey locations will provide information on richness, relative abundance, and distribution of herpetofauna species and can be compared among years and to results from this project because of standard survey protocols. Monitoring herpetofauna using these survey protocols will provide information on long-term trends in herpetofauna populations.

Additionally, we inventoried mammal populations between March-October 2004 and 2005, using live-trapping surveys (LTS), vehicular-road surveys (VRS) and opportunistic observations. We observed 23 mammal species at ALPO and 16 mammal species at JOFL. Virginia opossum (*Didelphis virginiana*), smoky shrew (*Sorex fumeus*), big brown bat (*Eptesicus fuscus*), fox squirrel (*Sciurus niger*), woodland jumping mouse (*Napaeozapus insignis*), porcupine (*Erethizon dorsatum*), gray fox (*Urocyon cinereoargenteus*), long-tailed weasel (*Mustela frenata*), and feral

cat (*Felis catus*) were detected only at ALPO, whereas southern bog lemming (*Synaptomys cooperi*) and red fox (*Vulpes vulpes*) were found only at JOFL. Eastern chipmunk (*Tamias striatus*) and white-footed mouse (*Peromyscus leucopus*) were the most abundant mammal species at each park. A monitoring program for mammals at ALPO and JOFL should be based on LTS for small-sized mammals (eastern chipmunk and smaller) and VRS for medium to large-sized mammals (larger than eastern chipmunk). If resources are available, we recommend that a formal inventory of bat species be conducted at the parks.

In conjunction with bird and butterfly inventories and vegetation mapping at ALPO and JOFL, information acquired during the inventory of herpetofauna and mammals serves as a foundation for an extensive long-term database of flora and fauna. Data obtained during our project contribute to an understanding of presence, relative abundance, and distribution of species within each park. Based on knowledge and information derived from amphibian, reptile, and mammal inventories, resource management specialists will be able to make informed decisions on how best to manage natural resources within national parks.

Acknowledgments

The National Park Service provided funding for the amphibian, reptile, and mammal inventory project. We appreciate cooperation of National Park Service personnel, especially Mr. John Karish, Chief Scientist, Northeast Region, and Ms. Kathy Penrod, Resource Management Specialist, Allegheny Portage Railroad National Historic Site and Johnstown Flood National Memorial. We extend our thanks to Ms. Emily Hill for her clerical assistance.

Introduction

The National Park Service (NPS) has determined that park managers need comprehensive information about biological resources in parks to maintain biodiversity and natural ecosystems (National Park Service 2000). Thus, the NPS recognized the need for an in-depth inventory of amphibians, reptiles, and mammals at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL) to accompany the previously conducted inventories of birds and butterflies at the parks (Yahner and Keller 2000b; Yahner et al. 2001a). Studies have been conducted that identified and tested protocols for inventorying and monitoring amphibian, reptile, and mammal populations in national parks (Yahner et al. 1997, 1999). These protocol studies along with inventories of amphibians and reptiles (Yahner et al. 2001b, 2002) and mammals (Yahner et al. 2004) served as models for the proposed amphibian, reptile, and mammal work at ALPO and JOFL. A major goal of the proposed study was to develop and initiate an inventory program for amphibians, reptiles, and mammals at ALPO and JOFL. Information on presence, relative abundance, and distribution of amphibians, reptiles, and mammals on these public lands is important to NPS personnel (hereafter referred to as resource management specialists) who are mandated to manage natural resources. As large tracts of public lands, such as national parks, become more insular from increased habitat fragmentation because of urbanization or other land uses, these tracts will be increasingly valuable for the long-term maintenance of faunal diversity and the functional integrity of landscapes and natural ecosystems in the eastern United States (Ambrose and Bratton 1990; Yahner 2000a).

The objectives of the research project were to:

1. review existing literature and documentation of the National Park Service and other sources and develop a database for historic and potential occurrence of amphibians, reptiles, and mammals at ALPO and JOFL;

2. conduct an inventory of presence, relative abundance, and distribution of amphibians, reptiles, and mammals at ALPO and JOFL; and

3. provide general recommendations for monitoring amphibians, reptiles, and mammals at ALPO and JOFL.

Study Areas

Allegheny Portage Railroad National Historic Site

Allegheny Portage Railroad National Historic Site (ALPO) is located in Cambria and Blair counties, Pennsylvania, and comprises 508 ha (1,256 ac) (National Park Service 2001a; Figure 1). The park is located within the Allegheny Mountain Section of the Appalachian Plateau Province, which corresponds to the Transitional Life Zone (Rhoads 1903; Genoways and Brenner 1985).

The Main unit of ALPO comprises 426 ha (1,052 ac) and is approximately 10 km (6.2 mi) west of the city of Altoona (Yahner et al 2001a). The Main unit of the park follows a historic railroad trace northwest to southeast (Figure 2). Elevation within the park ranges from 346 m (1,135 ft) within the Foot of Ten portion of the Main unit to 734 m (2,408 ft) at Cresson Summit near the Visitor Center (Yahner et al 2001a). There are one small pond (<0.2 ha [0.5 ac]) and numerous small or intermittent streams.

The Staple Bend Tunnel unit of ALPO is separate from the Main unit of the park. The Staple Bend Tunnel unit comprises 82 ha (204 ac) and is located approximately 6.5 km (4.0 mi) east of the city of Johnstown (National Park Service 2001a; Figure 3). Like the Main unit of the park, this section follows the historic railroad trace.

Deciduous and mixed forest dominate the park (76%, 384 ha [949 ac]), and the forest is composed of plateau, pioneer, and northern hardwoods (Yahner et al 2001a). Sixteen percent of the park (81 ha [200 ac]) is early successional habitat. Grassland (grass and forbs 5%, 25 ha [62 ac]) and coniferous forest (<1%, <5 ha [12 ac]) comprise a small portion of the park.

Johnstown Flood National Memorial

Johnstown Flood National Memorial (JOFL) is located in Cambria county, central Pennsylvania, approximately 16 km (10 mi) northeast of the city of Johnstown and consists of 70 ha (173 ac) (National Park Service 2001b; Figures 1 and 4). The park is located within the Allegheny Mountain Section of the Appalachian Plateau Province, which corresponds to the Transitional Life Zone (Rhoads 1903; Genoways and Brenner 1985).

The topography of JOFL is relatively flat, and elevation varies from 479 m (1,572 ft) at the Little Conemaugh River to 552 m (1,811 ft) northeast of the Visitor Center (Yahner et al 2001a). The main drainage in the park is the South Fork of the Little Conemaugh River, and emergent wetlands and river acreage compose approximately 6% (4 ha [10 ac]) of the park.

Early successional habitat (39%, 27 ha [67 ac]), located primarily adjacent to the river, is the dominant habitat type at JOFL (Yahner et al 2001a). Thirty-six percent (25 ha [52 ac]) of the habitat at JOFL is deciduous forest (plateau and pioneer hardwood). Grasslands (grass and forbs) constitute 21% of the park (15 ha [37 ac]) and surround the Visitor Center.

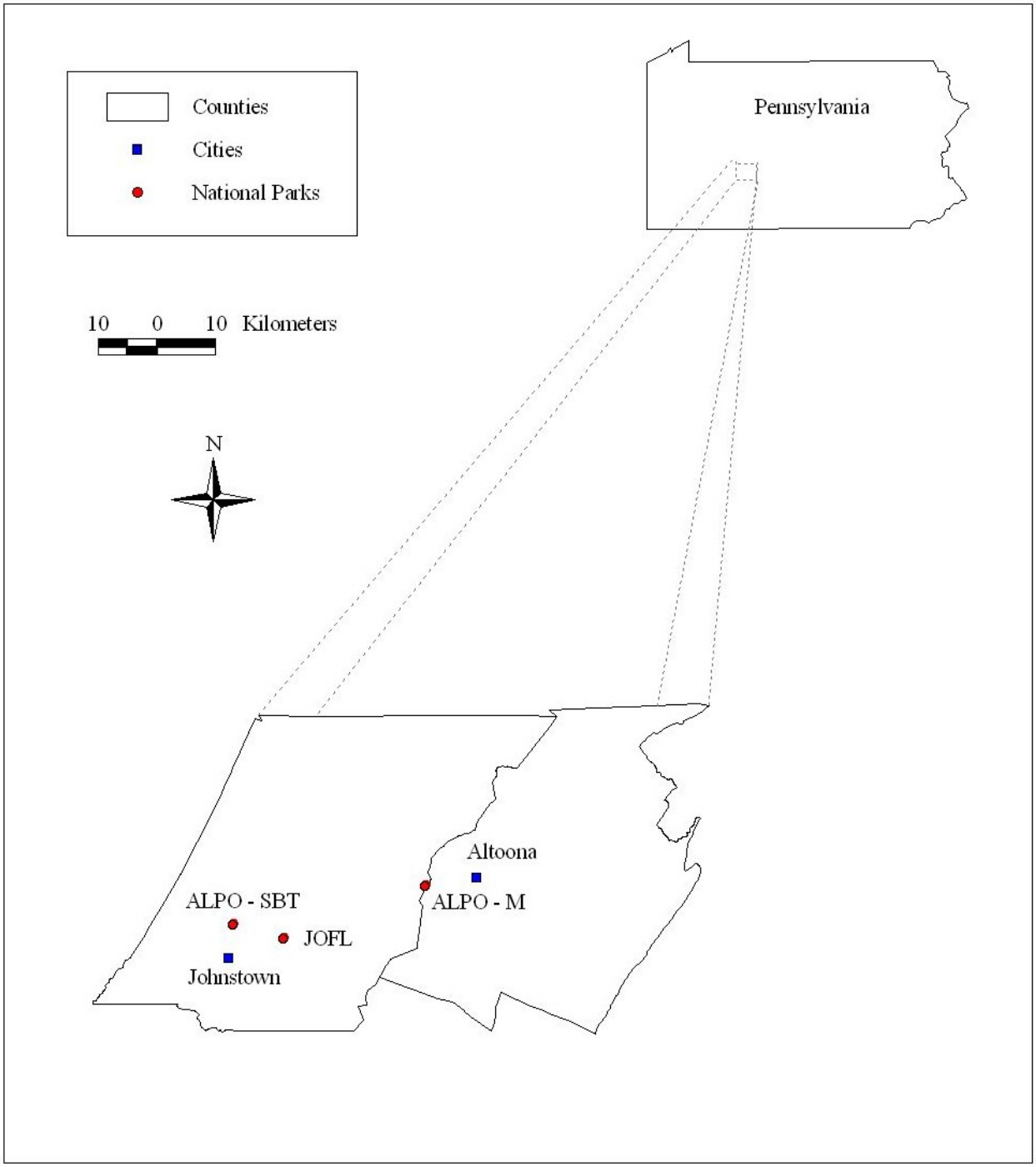

Figure 1. Location of the Main (M) and Staple Bend Tunnel (SBT) units of Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL) in Cambria (left) and Blair (right) counties, Pennsylvania.

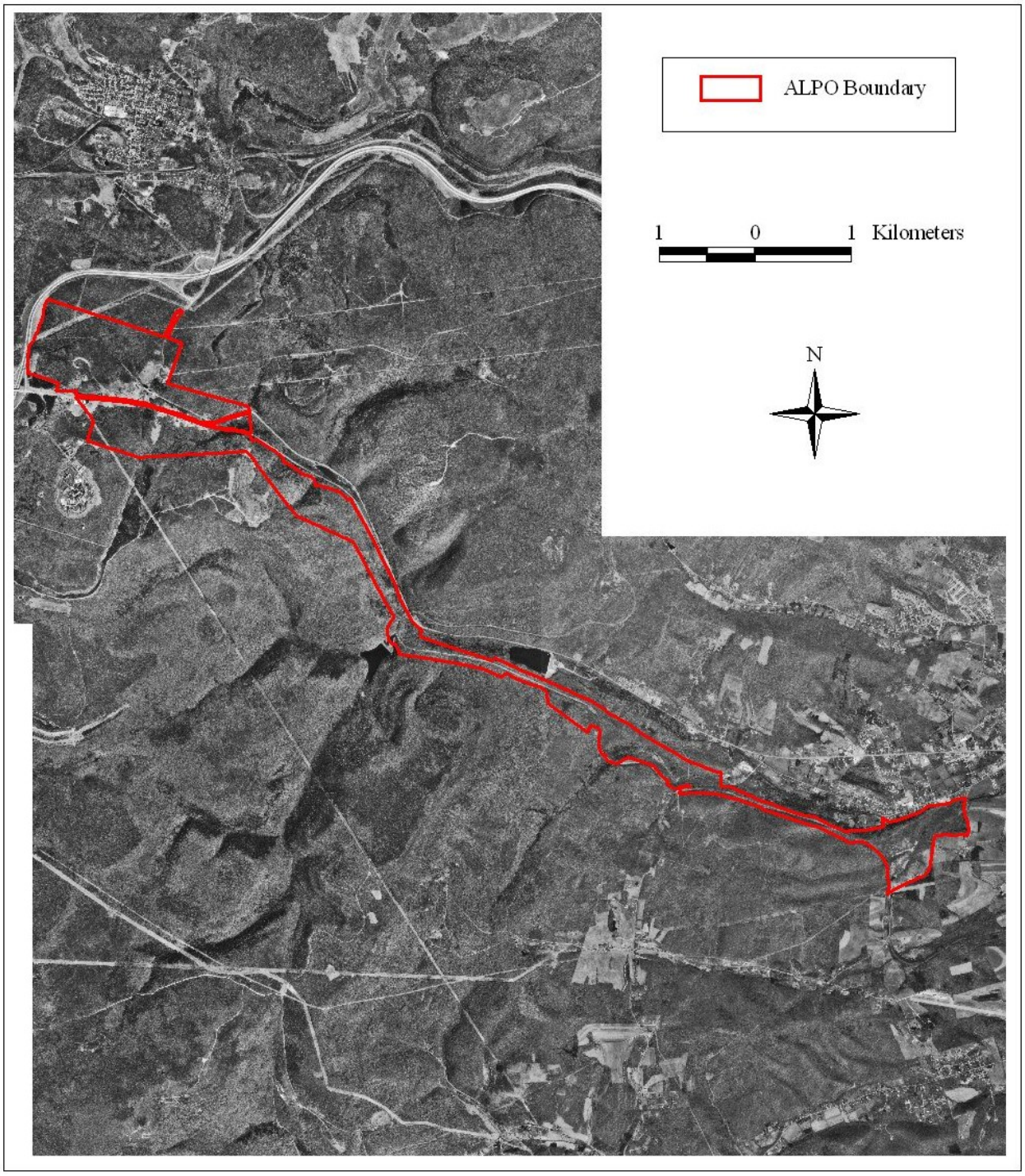

Figure 2. Park boundary of the Main unit of Allegheny Portage Railroad National Historic Site (ALPO), Cambria and Blair counties, Pennsylvania.

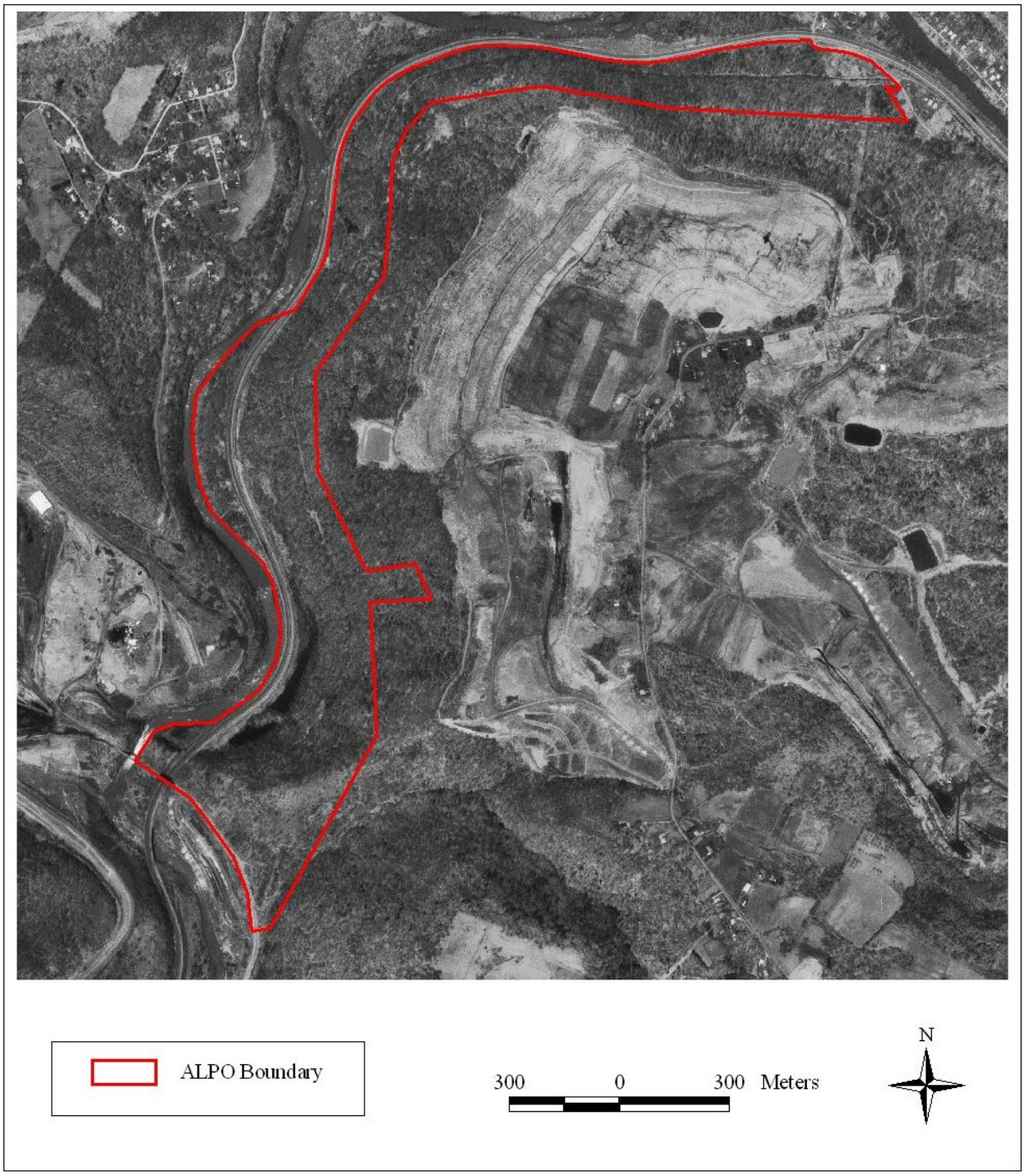

Figure 3. Park boundary of the Staple Bend Tunnel unit of Allegheny Portage Railroad National Historic Site (ALPO), Cambria county, Pennsylvania.

Figure 4. Park boundary of Johnstown Flood National Memorial (JOFL), Cambria county, Pennsylvania.

Methods

Lists of known and potential amphibian, reptile, and mammal species at ALPO and JOFL were based primarily on the NPSpecies database, which contains references to all species known to occur within the park boundaries (National Park Service 2004). The NPSpecies database documents the occurrence of vertebrates and vascular plants in national parks derived from a variety of resources, such as published reports and museum records. Additionally, other reports and publications were searched for amphibian, reptile, and mammal species known to occur within and surrounding these parks (Burt and Grossenheider 1980; Merritt 1987; Shaffer 1991; Hulse et al. 2001).

To meet objective two, we surveyed amphibian, reptile, and mammal communities from March through October 2004 and 2005 at ALPO and JOFL. Protocols for inventorying amphibians, reptiles, and mammals were selected based on taxonomic groups of interest, habitats, special needs, and infrastructure of each park. Amphibian and reptile surveys included visual-encounter, artificial cover-object, pitfall-trapping, anuran-calling, and general-search surveys (Yahner et al. 1999; Yahner et al. 2001b). Mammal surveys included live-trapping and vehicular-road surveys (Yahner et al. 1997). Opportunistic observations (aural, visual, and individuals handled for identification of certain salamander, snake, and bat species) of amphibians, reptiles, and mammals not detected during surveys were included in species lists and calculation of species richness for each park.

To some extent, park size and infrastructure and abundance and distribution of cover types within and surrounding ALPO and JOFL affected types of surveys conducted and numbers of plots, sample points, and stations established for inventorying amphibians, reptiles, and mammals. For example, ALPO consists of a larger total area than does JOFL, so the number of plots and sample points established at ALPO was greater than the number located at JOFL.

To meet objective three, we discuss which species were detected using the different survey protocols and where to locate species that possibly exist at the parks but were not documented during our inventory project. In the "Developing a Monitoring Program" section of this report, we discuss the benefits and shortcomings of the survey protocols that we employed during the project and provide recommendations for initiating a monitoring program for herpetofauna and mammals at the parks.

During October and November 2000, we visited ALPO and JOFL to view the different sections and habitats within the parks and met with resource management specialists to identify species and habitats of concern within the parks. Prior to conducting the inventories, we developed a study plan titled "Inventory Program for Amphibians, Reptiles, and Mammals at Allegheny Portage Railroad National Historic Site and Johnstown Flood National Memorial." After the study plan was reviewed by John Karish, Chief Scientist, Northeast Region and Brian Eick, former Resource Management Specialist at ALPO and JOFL, meetings were held to discuss alterations and additions to the plan prior to conducting the inventories. A final study plan, incorporating suggested modifications, was agreed upon by all parties prior to initiating the research.

Geographic Analyses

For an earlier project titled "Comprehensive Inventory Program for Birds at Six National Parks" (Yahner et al. 2001a), we conducted geographic analyses to determine coarse-scale cover type, spatial location, and elevation information for ALPO and JOFL. Using this habitat information, we selected sample points for birds at ALPO and JOFL. In order to get a cross-taxa representation of flora and fauna at these locations (vegetation data associated with the sample points also was collected during the bird inventory), the same sample points were used during the current project to inventory amphibians, reptiles, and mammals at the parks. Geographic analyses were conducted using the ArcView version 3.2a geographic information system software (Environmental Systems Research Institute 1997). Geographic coverages and associated metadata used for these analyses were obtained in fall 1998 and are available via the Pennsylvania Spatial Data Access (PASDA) at www.pasda.psu.edu.

Park boundaries were obtained from resource managers at each park prior to the bird inventory project (Yahner et al. 2001a) and were used to confine all subsequent analyses to NPS-owned land. Digital orthophoto quarterquadrangles (DOQQs) with 1-m (3.3-ft) ground resolution were obtained from the PASDA website and used to derive cover types for each park based on thematic mapper imagery classifications (Table 1).

We obtained Pennsylvania Department of Transportation road and stream coverages from the PASDA website to classify spatial locations within each park (Table 1). All roads and blue-line streams appearing on topographic maps (1:24,000) were included in the coverages, and no distinctions were made based on road type or stream order. Buffers (50-m [164-ft] width) were constructed around roads and streams to identify significant linear features of the landscape that may affect flora and fauna. The spatial location of each area was classified as interior (i.e., not contained within the buffer), road edge, stream edge, or road and stream edge overlap habitats. Areas in which road and stream edge overlapped were eliminated from integration to prevent confounding factors when analyzing associations between fauna and habitats.

Elevation was determined from 2-arc-second (30 min), United States Geological Survey digital elevation models (DEM) with 100- x 100-m (328- x 328-ft) pixel resolution (Table 1). Total relief for each park was calculated based on DEMs. No elevation categories were used at JOFL because the park contains less than 100 m (328 ft) total relief. However, at ALPO, we designated three levels of elevation: low (346-415 m [1,135-1,362 ft]), high (416-599 m [1,365-1,965 ft]), and plateau (600-734 m [1,968-2,408 ft]).

We integrated levels of each data layer (cover type, spatial location, and elevation) to categorize habitat for each park. The area used for geographic analyses differed slightly from actual boundaries of parks because of resolution differences in the data layers used to generate habitat information. Total area of all habitats for each park was used to allocate sample points for the inventories, based on proportion of total area in a given habitat.

Table 1. Description of levels within cover types, spatial locations, and elevations used to define habitat categories specific to Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania.

Habitat Categories	Descriptions
Cover type:	Data levels were derived from thematic mapper imagery (TM) at 30- x 30-m (98- x 98-ft) resolution. TM was obtained from the Pennsylvania Spatial Data Access (PASDA) website in October 1998.
Water	Area dominated by water
Coniferous forest	Forested area dominated by coniferous-tree species
Mixed forest	Forested area dominated by a mixture of coniferous- and deciduous-tree species
Deciduous forest	Forested area dominated by deciduous-tree species
Early successional	Area dominated by early successional habitats
Perennial herbaceous	Area dominated by perennial-herbaceous cover (e.g., pasture, lawn, grasslands)
Annual herbaceous	Area dominated by annual-herbaceous cover (e.g., cropland)
Terrestrial unvegetated	Terrestrial area dominated by lack of vegetation (e.g., urbanized land, roads, strip mines, bare ground)
Spatial location:	Data levels were derived from Pennsylvania Department of Transportation digital road and stream coverage obtained from the PASDA website in October 1998.
Interior	Area >50 m (164 ft) from a road or stream
Road edge	Area ≤50 m (164 ft) from a road
Stream edge	Area ≤50 m (164 ft) from a stream
Elevation (ALPO only):	Data levels were derived from 100- x 100-m (328- x 328-ft) digital elevation models obtained from the PASDA website in October 1998.
Low	Area ≤ mean (non-plateau) park elevation
High	Area > mean (non-plateau) park elevation
Plateau	Areas 600-734 m (1,968-2,408 ft) park elevation

Sample Point Identification

We generated systematic grids (150 x 150 m [492 x 492 ft]) for ALPO and JOFL to identify sample points for a bird inventory project completed in 2001 (Yahner et al. 2001a) and to inventory amphibians, reptiles, and mammals at the parks during the current project. The southwest corner of each park was used as the origin of the grid. Potential sample points were placed in the center of each cell in the grid. The potential sample points subsequently were characterized by cover type, spatial location, and elevation at ALPO and by cover type and spatial location at JOFL (Tables 1-3). We used this information to select random sample points in proportion to availability of habitats at each park. Location of each sample point was mapped using a global positioning system for future reference.

Each park contained approximately one sample point for every 20 ha (49 ac) of park area. Cover types comprising at least 15% of the total park area were divided into either interior (>50 m [164 ft] from edge) or edge (0-50 m [0-164 ft] from edge) spatial locations. For ALPO, if a cover type within a given spatial location (i.e., deciduous forest in an interior location) comprised at least 15% of the total park area, then it was divided into elevations. If 50% of the total park area was located within deciduous forest in an interior location at high elevation, then 50% of the sample points for the inventory were established within this habitat.

The same 28 and 10 sample points established at ALPO and JOFL, respectively, for the bird inventory (Yahner et al. 2001a) also were used as sample points for visual-encounter, artificial-cover object, and pitfall-trapping surveys for amphibians and reptiles and live-trapping surveys for mammals. During initial visits to each park to discuss and develop the study plan for inventorying amphibians, reptiles, and mammals, we visited sample points to ensure the proper classification of each point according to geographic analyses. We eliminated two of the 28 sample points at ALPO in fall 2003 prior to installing artificial cover-objects because they were located in areas where artificial cover-objects and live-traps easily would be disturbed or destroyed by the public. Another sample point at ALPO was eliminated because it was located on land that is no longer under NPS ownership. We eliminated one sample point at JOFL in fall 2003 from amphibian and reptile visual-encounter and artificial cover-object surveys because it was located adjacent to a public parking area where large artificial cover-objects easily would be visible to the public. However, we were able to conceal live-traps well enough to inventory small mammals at the sample point.

A limited number of the additional sample points was included in amphibian and reptile visual-encounter, artificial cover-object, and pitfall-trapping surveys and mammal live-trapping surveys to address habitats or species of special concern within each park (i.e., vernal wetlands containing breeding amphibians, areas proposed for management, etc.). Six additional sample points were added at ALPO (Table 2). Three sample points were added in the Staple Bend Tunnel (SBT) unit of ALPO because the SBT unit was not included in the bird inventory project (Yahner et al. 2001a). Three points were added in the Main unit of ALPO in grassland or forest-edge habitat to increase the opportunity of detecting amphibians, reptiles, and mammals associated with these habitats. We added four sample points at JOFL, two adjacent to temporary wetlands to try and identify amphibians, reptiles, and mammals associated with water sources, and two to increase the opportunity of live-trapping small mammals along forest edges (Table 3).

Table 2. Number of initial sample points (points eliminated in fall 2003 in parentheses) and number of additional sample points for amphibian and reptile visual-encounter, artificial cover-object, and pitfall-trapping surveys and mammal live-trapping surveys at Allegheny Portage Railroad National Historic Site, Pennsylvania. Allocation of sample points was based on cover type, spatial location, and elevation.

Cover Type	Spatial Location	Elevation	No. Initial Sample Points	No. Additional Sample Points
Deciduous Forest	Interior	Plateau	11 (1)	0
		High	1	0
		Low	1	0
	Road Edge		2 (1)	1
	Stream Edge		6 (1)	10
Coniferous Forest			1	0
Early Successional	Interior		2	1
	Road Edge		2	0
Perennial Herbaceous	Interior		1	1
	Stream Edge		1	0
Total			28 (3)	13

Table 3. Number of initial sample points (points eliminated in fall 2003 from amphibians and reptile visual-encounter and artificial cover-object surveys in parentheses) and number of additional sample points for amphibian and reptile visual-encounter, artificial cover-object, and pitfall-trapping surveys and mammal live-trapping surveys at Johnstown Flood National Memorial, Pennsylvania. Allocation of sample points was based on cover type and spatial location.

Cover Type	Spatial Location	No. Initial Sample Points	No. Additional Sample Points
Deciduous Forest	Interior	2	1
	Road Edge	1	0
Early Successional	Interior	2	0
	Road Edge	1 (1)	1
	Stream Edge	1	2
Perennial Herbaceous	Interior	2	0
	Road Edge	1	0
Total		10	4

Amphibian and Reptile Surveys

Sampling effort for surveying amphibians and reptiles was stratified among cover types, spatial locations (with special emphasis on water sources such as streams, ponds, and vernal pools), and elevation. Survey data were used to derive species richness, abundance, and distribution, thereby allowing the development of habitat-specific recommendations for future management. Sampling protocols consisted of techniques modified from established monitoring protocols (Crump and Scott 1994; Zimmerman 1994; Mertz 1996; Yahner et al. 1999; Yahner et al. 2001b; Tiebout 2003a) and included visual-encounter, artificial cover-object, pitfall-trapping, anuran-calling, and general-search surveys. Observer, location, date, cover type, survey type, time elapsed, and weather conditions were recorded for all surveys. Weather conditions were recorded at the beginning and end of each survey and included an estimate of cloud cover, wind speed, and ambient air temperature (in shade). In addition to animals identified during surveys, opportunistic observations (visual, aural, and individuals handled for identification of certain herpetofauna species) of herpetofauna were documented and included in species lists and calculation of species richness for each park.

Visual-encounter Surveys

We surveyed amphibians and reptiles from April through October 2004 and 2005 using monthly visual-encounter surveys (VES) (Yahner et al. 2001b). A VES consisted of searching the surface of leaf litter and beneath substrates within each survey plot. Substrates included rocks (>15 cm [5.9 in] in diameter), logs (woody material >7 cm [3 in] in diameter and >30 cm [12 in] long), woody debris (e.g., bark, piles of woody material <7 cm [3 in] in diameter and <30 cm [12 in] long), and moist leaf-litter. We recorded total number of individuals by species and type of substrate where each was located. In addition, we noted total number of logs and rocks searched.

A VES was conducted within a 15- x 15-m (49- x 49-ft) plot centered on each sample point (Crump and Scott 1994; Yahner et al. 2001b; Kjoss and Litvaitis 2001; Kubel et al. 2002; Figures 5-8). We also conducted additional VES along seven stream sections at ALPO, with six in the Main and one in the SBT unit (Figures 5-7). To conduct VES associated with stream sections, we established a 100- x 2-m (328- x 6.6-ft) plot bisected by a stream edge.

Artificial Cover-object Surveys

We surveyed amphibians and reptiles from April through October 2004 and 2005 using monthly artificial cover-object surveys (ACO) (Yahner et al. 2001b). Artificial cover-objects (coverboards and plastic sheets) are effective tools for inventorying and monitoring terrestrial salamanders and some reptiles (DeGraaf and Yamasaki 1992; Fitch 1992; Kjoss and Litvaitis 2001; Kubel et al. 2002). Boards and plastic sheets were turned and number and species of amphibians or reptiles occurring beneath were identified and recorded by sampling location during each survey. Amphibians and reptiles encountered were returned to the ground near cover objects in order to replace objects without harming animals (Fellers and Drost 1994; Droege et al. 1997; Yahner et al. 2001b).

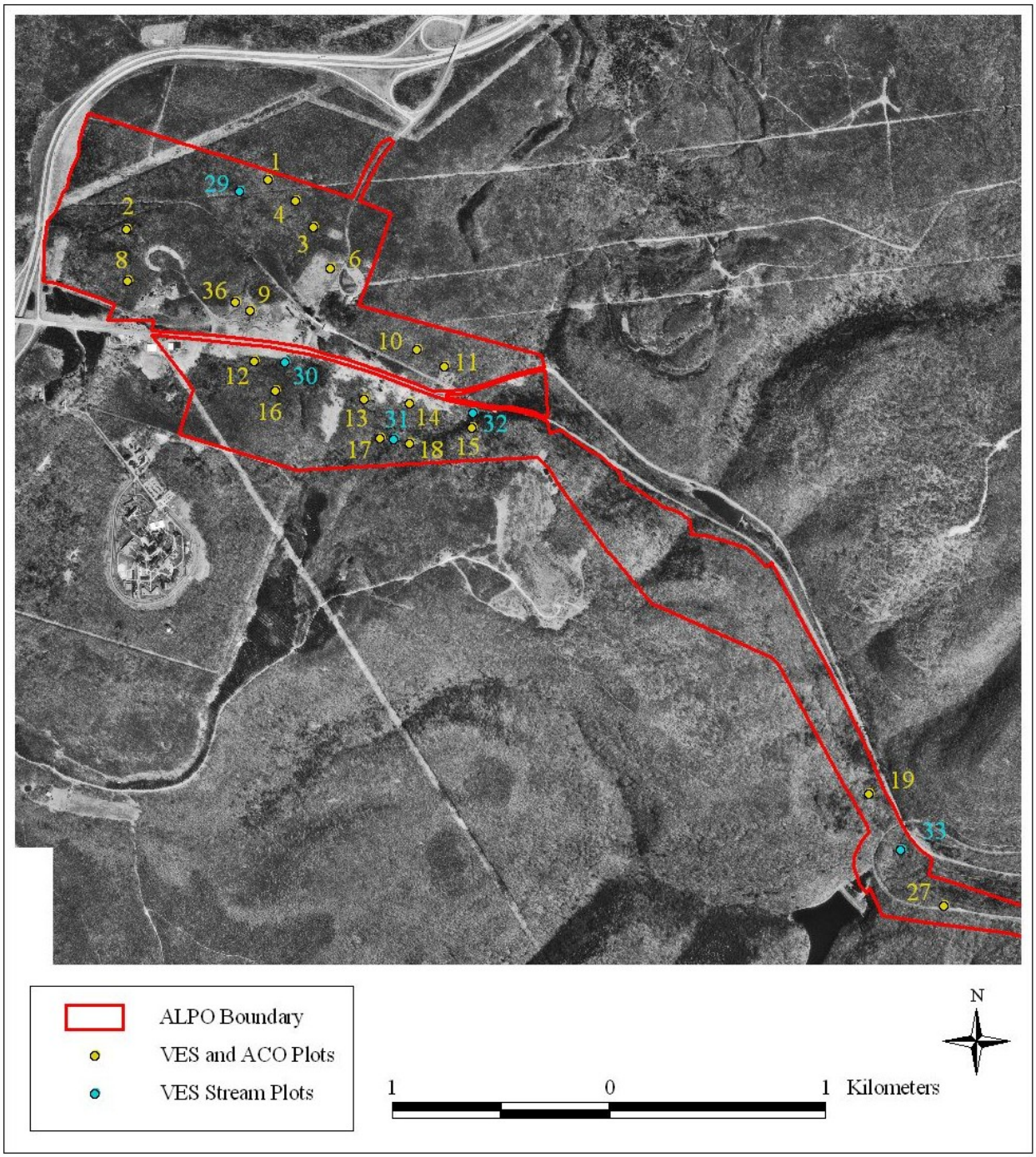

Figure 5. Location of visual-encounter (VES) and artificial cover-object (ACO) plots established for surveys of amphibians and reptiles during 2004 and 2005 on the plateau and Mule Shoe Curve Bridge portions of the Main unit of Allegheny Portage Railroad National Historic Site (ALPO), Pennsylvania.

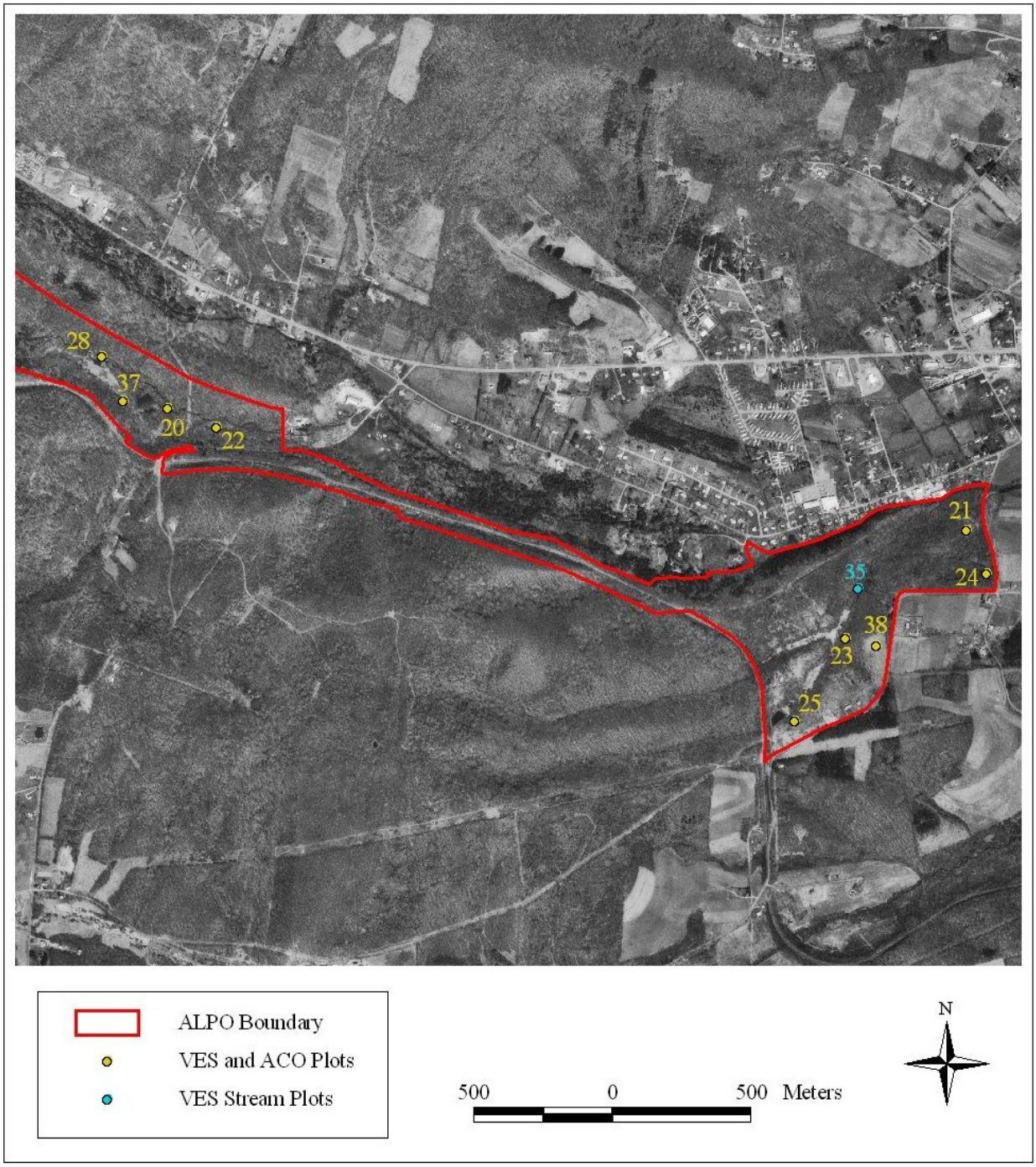

Figure 6. Location of visual-encounter (VES) and artificial cover-object (ACO) plots established for surveys of amphibians and reptiles during 2004 and 2005 on the Incline Nine and Foot of Ten portions of the Main unit of Allegheny Portage Railroad National Historic Site (ALPO), Pennsylvania.

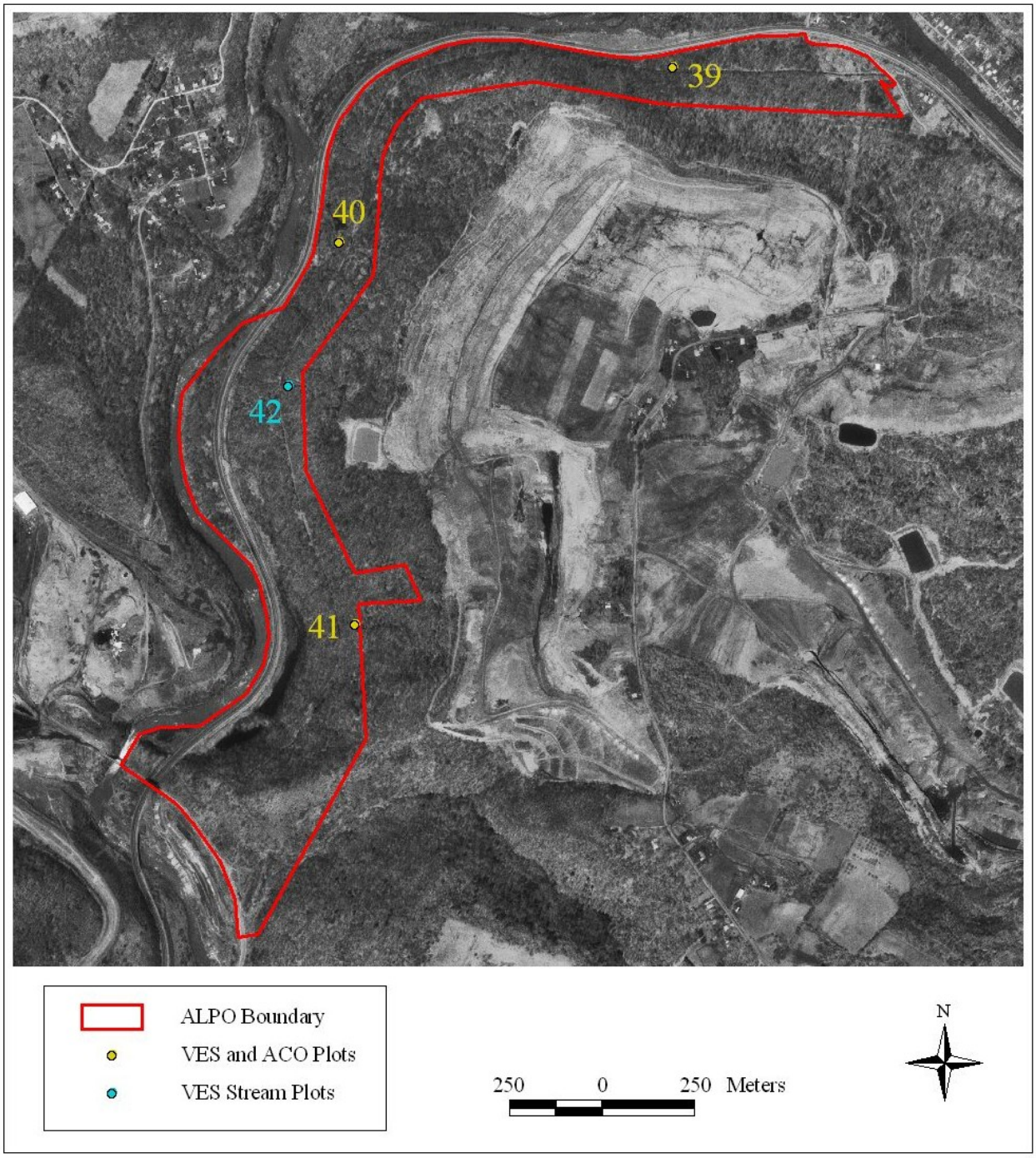

Figure 7. Location of visual-encounter (VES) and artificial cover-object (ACO) plots established for surveys of amphibians and reptiles during 2004 and 2005 on the Staple Bend Tunnel unit of Allegheny Portage Railroad National Historic Site (ALPO), Pennsylvania.

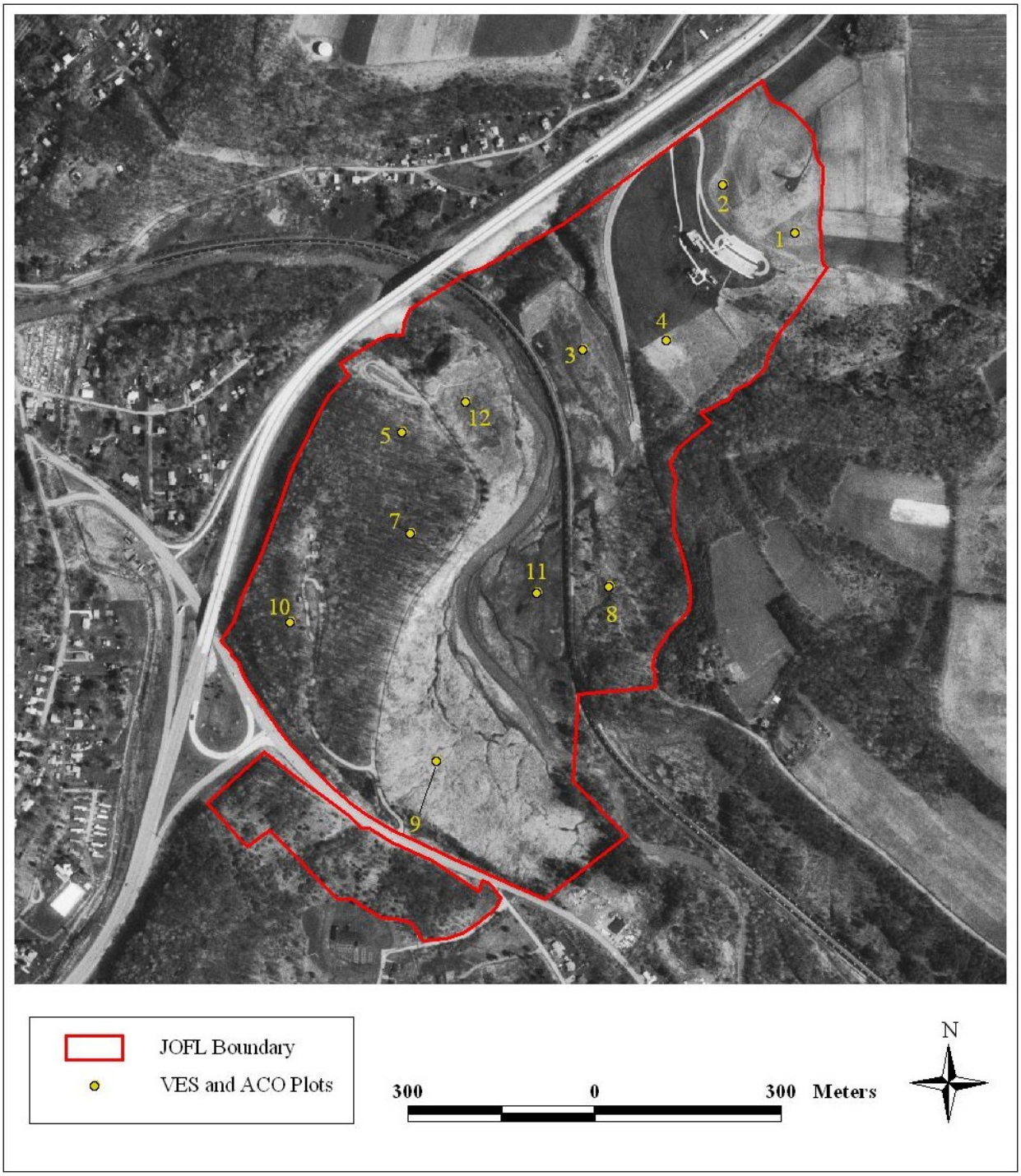

Figure 8. Location of visual-encounter (VES) and artificial cover-object (ACO) plots established for surveys of amphibians and reptiles during 2004 and 2005 at Johnstown Flood National Memorial (JOFL), Pennsylvania

An array of cover objects was placed outside north, south, and either east or west corners of each VES plot centered on a sample point (Figures 5-8), but ACO were not associated with the seven VES plots bisected by streams. At the north corner, one medium coverboard (plywood, 1 x 50 x 100 cm [0.4 x 20 x 39 in]) and two small coverboards (pine board, 2.5 x 20.0 x 100.0 cm [1.0 x 8 x 39 in]) were placed at least 0.5 m (1.6 ft) apart. At the south corner, one large coverboard (plywood, 1 x 100 x 100 cm [0.4 x 39 x 39 in]) and two small coverboards were placed at least 0.5 m (1.6 ft) apart. Because some salamander species are territorial, we used two small coverboards at the north and south corners to minimize the effects of territoriality on the presence or abundance of salamanders (Droege et al. 1997). At either the east or west corner, we placed a black plastic sheet (305 x 122 cm [120 x 48 in]) (Kjoss and Litvaitis 2001; Kubel et al. 2002). We cleared loose substrate (i.e., twigs, leaves, rocks) from the soil surface so that each small board remained flush with the ground. We partially cleared loose debris from under large and medium boards and plastic sheets to improve our ability to detect amphibians and reptiles using the cover objects. Large and medium boards were propped several centimeters at one end to allow large-bodied amphibians and reptiles to crawl beneath. Plastic sheets were anchored at the corners with staples or nails. We expected to encounter salamanders under small boards, salamanders and snakes under medium boards, and snakes under large boards and plastic sheets.

Pitfall-trapping Surveys

We conducted pitfall-trapping surveys (PTS) for amphibians and reptiles during two 3-day time periods (mid-July to mid-August and again in mid-September to mid-October in both 2004 and 2005) at ALPO and JOFL (Yahner et al. 1999; Yahner et al. 2001b). Prior to each PTS, we recorded observer, date, starting time, temperature (^{o}C), and precipitation. We checked traps each morning and recorded number and species of amphibians and reptiles identified and location of each capture.

One-third of the ACO sample points were selected randomly using a stratified sampling design (stratified according to habitat) to include pitfall traps (Tables 2 and 3; Figures 9-12). We placed pitfall traps in the center of selected sample points at least 1 week prior to trapping to ensure minimal soil disturbance during the trapping period (Yahner et al. 1997). Traps consisted of plastic containers (15.2-cm height and 16.5-cm diameter [6.0-in height and 6.5-in diameter]) sunk into the ground, with rims flush with the soil surface. Traps were removed and replaced upside down in the ground between trapping sessions. Pitfall traps with drift fences were not used in this study because capture success does not tend to be greater with pitfall traps associated with a drift fences compared to pitfall traps without drift fences (Dr. Rich Yahner, pers. obs.).

Anuran-calling Surveys

We conducted five and four anuran-calling surveys (ACS) at ALPO and JOFL in 2004 and 2005, respectively, between the first warm (>10° C) day in March and late June in an attempt to identify calls of different species of frogs or toads that peak at different times during spring (Zimmerman 1994; Mertz 1996; Yahner et al. 1999; Yahner et al. 2001b). Surveys began 0.5 hr after sunset and were not conducted on rainy or windy (>25 km/hr [16 mi/hr]) nights. Prior to each survey, we recorded observer, date, starting time, temperature (^{o}C), wind velocity

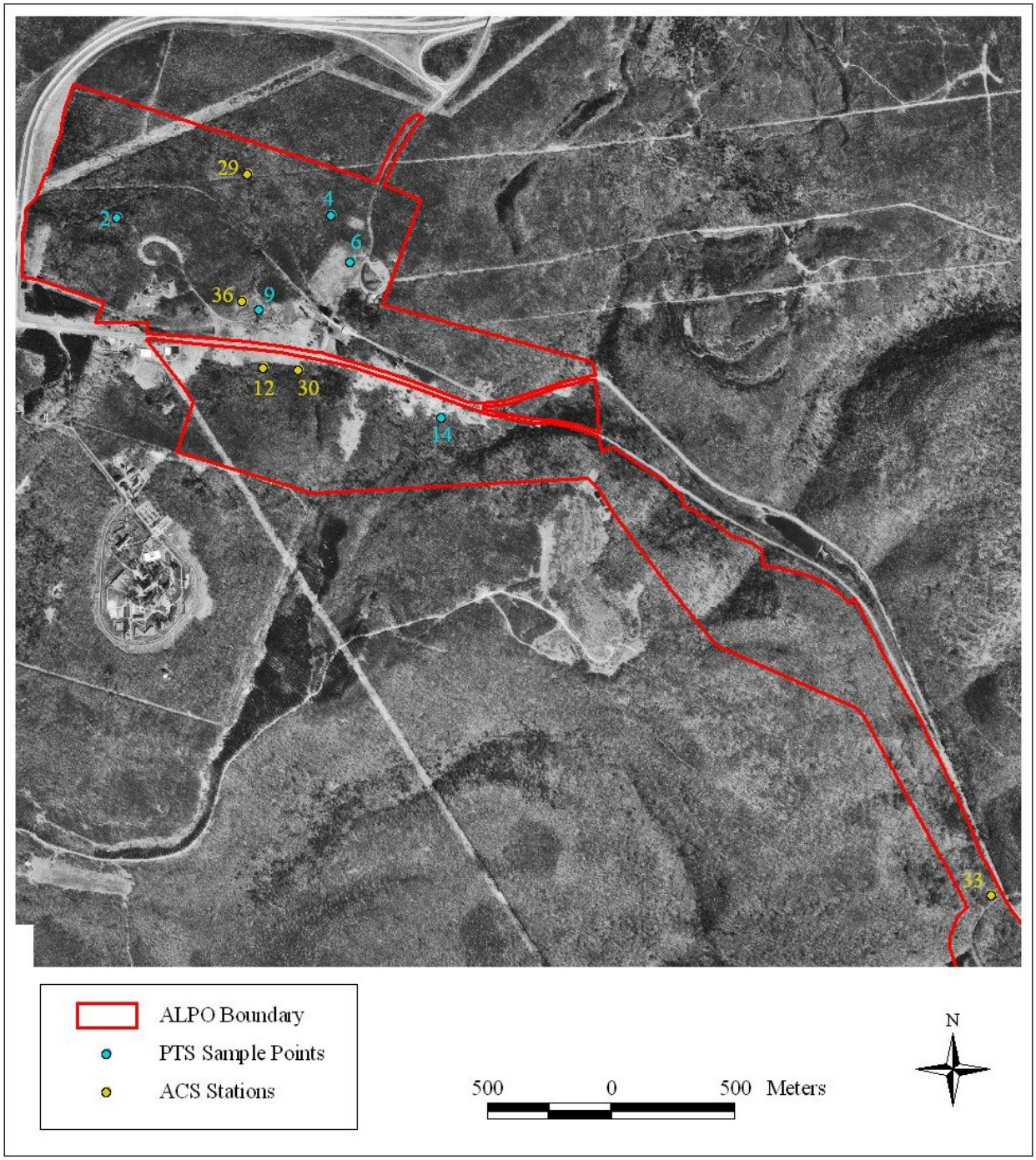

Figure 9. Location of pitfall-trapping (PTS) sample points and anuran-calling (ACS) stations established for surveys of amphibians and reptiles during 2004 and 2005 on the plateau and Mule Shoe Curve Bridge portions of the Main unit of Allegheny Portage Railroad National Historic Site (ALPO), Pennsylvania.

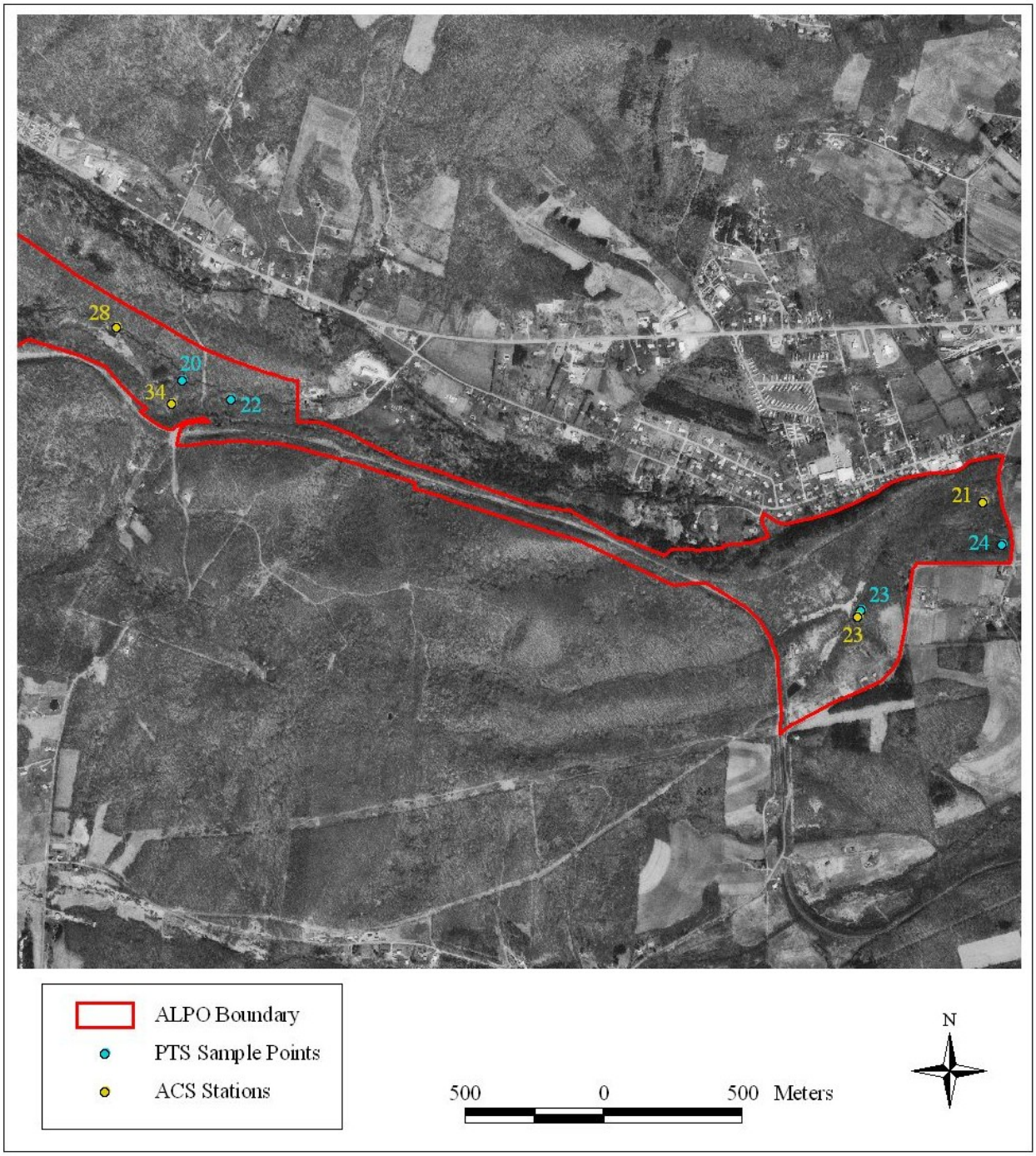

Figure 10. Location of pitfall-trapping (PTS) sample points and anuran-calling (ACS) stations established for surveys of amphibians and reptiles during 2004 and 2005 on the Incline Nine and Foot of Ten portions of the Main unit of Allegheny Portage Railroad National Historic Site (ALPO), Pennsylvania.

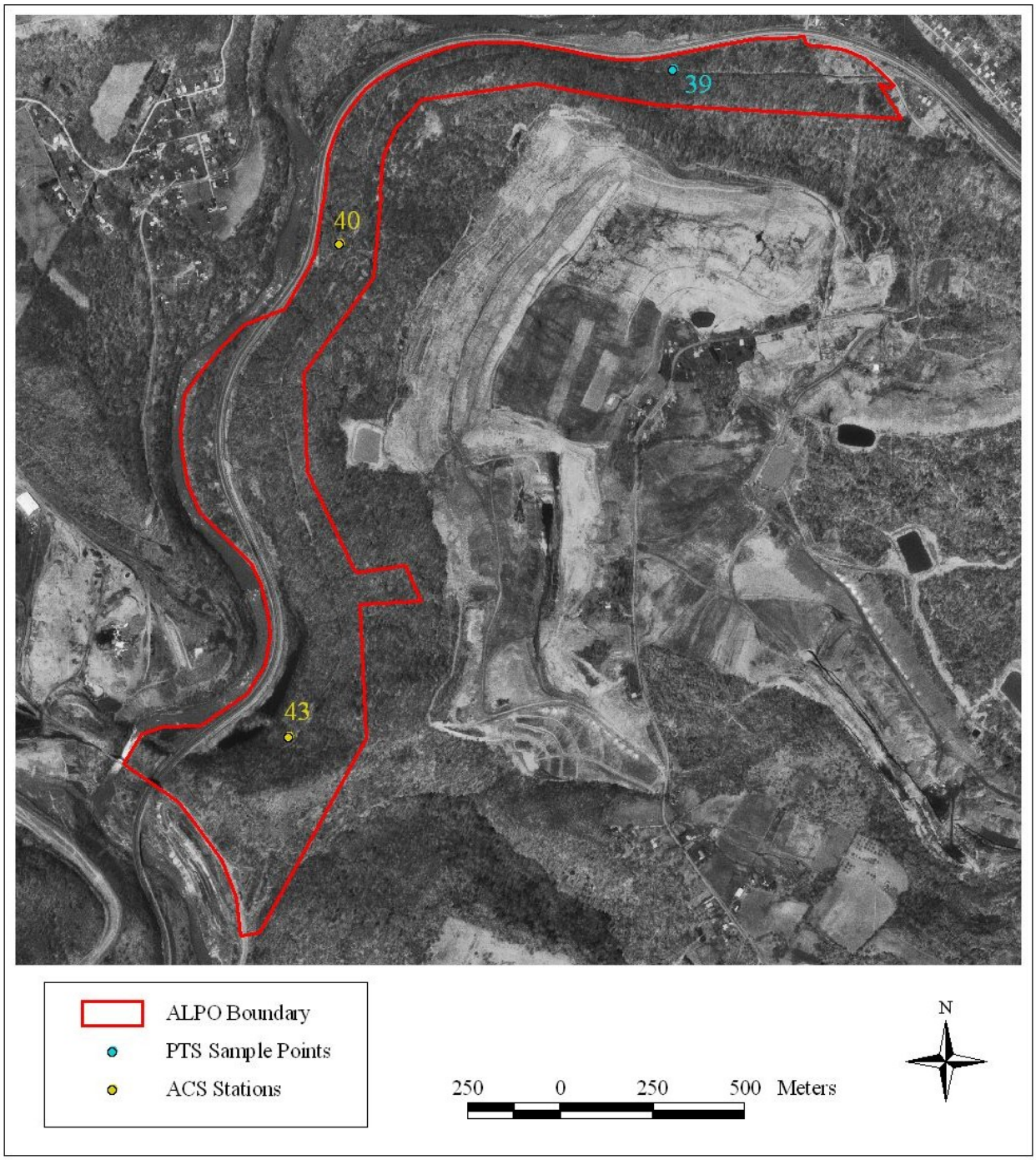

Figure 11. Location of pitfall-trapping (PTS) sample points and anuran-calling (ACS) stations established for surveys of amphibians and reptiles during 2004 and 2005 on the Staple Bend Tunnel unit of Allegheny Portage Railroad National Historic Site (ALPO), Pennsylvania.

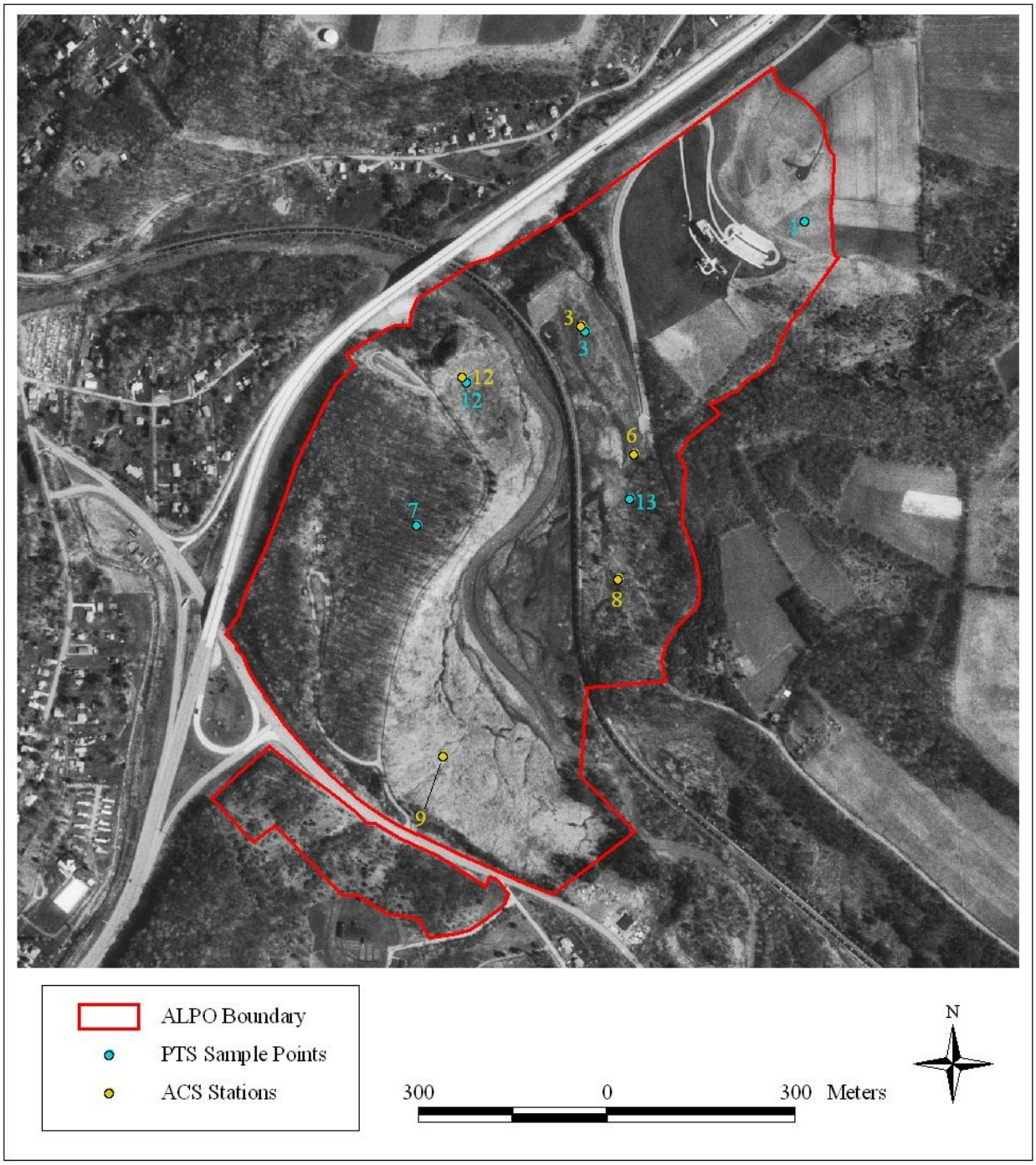

Figure 12. Location of pitfall-trapping (PTS) sample points and anuran-calling (ACS) stations established for surveys of amphibians and reptiles during 2004 and 2005 at Johnstown Flood National Memorial (JOFL), Pennsylvania.

(kph), cloud cover (%), precipitation, and survey location. At each station we surveyed for 5 minutes following a 1-min equilibrium period. We identified species of vocalizing frogs and toads and estimated abundance of each species calling.

We located ACS stations adjacent to water sources (emergent wetlands, vernal pools, permanent ponds, slow moving streams and rivers) likely to contain breeding anurans (Figures 9-12). Stations were separated by >150 m (492 ft) to minimize double counting calling individuals. Ten and five survey stations were used to conduct each anuran-calling survey at ALPO and JOFL, respectively, during 2004. Nine and four survey stations were used to conduct each anuran-calling survey at ALPO and JOFL, respectively, during 2005. A station (station 21) associated with a temporary standing-water source was added to, and three stations (stations 29, 30, and 34) associated with small headwater streams (unlikely to contain calling anurans) were deleted from anuran-calling surveys at ALPO in 2005. One station (station 12) located adjacent to the South Fork of the Little Conemaugh River but not associated with any standing water (e.g., vernal pools) was not surveyed at JOFL in 2005.

General-search Surveys

We conducted general-search surveys (GSS) for amphibians and reptiles from April through June 2004 and March through October 2005 using general searching techniques at ALPO and JOFL (Yahner et al. 2001b). GSS can be very effective in determining the presence of aquatic and terrestrial salamanders and snakes (Yahner et al. 2001b; Kubel et al. 2002; Tiebout 2003a). Researchers reported that general searching accounted for all or almost all species detected during inventories that used several other sampling techniques (Yahner et al. 2001b; Kubel et al. 2002; Tiebout 2003a). We supplemented standardized sampling techniques (VES, ACO, and PTS) for amphibians and reptiles by surveying areas not otherwise represented in the sampling scheme. As part of GSS, we turned existing substrates in terrestrial and aquatic habitats during daytime hours and used dip nets to help capture and identify individuals while sampling in streams. Substrates included rocks (>15 cm [5.9 in] in diameter), logs (woody material >7 cm [3 in] in diameter and >30 cm [12 in] long), woody debris (e.g., bark, piles of woody material <7 cm [3 in] in diameter and <30 cm [12 in] long), and leaf litter. We expected to encounter salamanders and snakes beneath and within these substrates. Substrates too large to turn were not searched. Captured animals were identified to species and released adjacent to the cover object once the object was returned to its original position. In addition, we scanned and searched the ground surface of forest, grassland, and other habitats and the water surface of ponds, vernal pools, and streams during both daytime and nighttime hours to identify herpetofauna not residing under cover items. We recorded observer, number and species of amphibians and reptiles or egg masses, a description of the location of each specimen, and starting and ending times for each survey.

GSS were conducted at vernal pools, ponds, or other forms of standing water (e.g., culverts and slow seeps) at least once per month from March to June to locate turtles, amphibians, and amphibian egg masses. Identifying egg masses of pond-breeding amphibians is more consistent and reliable than sampling for larval amphibians later in the season (Matt Laposata, Pennsylvania State University, pers. comm., 1999). Additionally, vegetation overhanging water sources was scanned. We wore hip waders and entered ponds or large emergent wetlands to scan the

shoreline and interior of the water bodies. We expected to encountered breeding, foraging, or migrating amphibians during wet and dark conditions and basking reptiles during warm and sunny conditions when scanning water surfaces.

We conducted GSS along rock walls located within or adjacent to grassland and early successional cover types in an attempt to encounter snakes and lizards. We searched rock walls that run approximately east-west in the morning, when reptiles were likely to be basking on the south-facing side of the wall to increase their body temperature.

Mammal Surveys

Sampling effort for surveying mammals was stratified among cover types, spatial locations, and elevation. Survey data were used to derive species richness, abundance, and distribution, thereby allowing the development of habitat-specific recommendations for future management. Sampling protocols consisted of techniques modified from established monitoring protocols (Crump and Scott 1994; Zimmerman 1994; Mertz 1996; Yahner et al. 1999; Yahner et al. 2001b) and included live-trapping and vehicular-road surveys. Observer, location, date, survey type, and weather conditions were recorded for all surveys. Weather conditions were recorded at the beginning of each survey and included ambient air temperature (in shade) and a description of precipitation. In addition to animals identified during surveys, opportunistic observations (visual and individuals handled for identification of bats) of mammals were documented and included in species lists and calculation of species richness for each park.

Live-trapping Surveys

We conducted live-trapping surveys (LTS) for mammals from July through October 2004 and 2005 at ALPO and JOFL. Mammal trapping was conducted for two 3-day time periods at each park (mid-July to mid-August and again mid-September to mid-October) during 2004 and 2005. Prior to each LTS, we recorded observer, date, starting time, temperature (^{o}C), and precipitation. Traps were checked each morning, and we toe-clipped or nail-clipped first-time captures to identify recaptured mammals without permanently marking individuals. We recorded number and species of mammals captured and location of each capture. Shrews (*Sorex* spp.) were identified using a combination of body measurements and dentition characteristics (Glass 1973; Burt and Grossenheider 1980; Merritt 1987).

Live-trapping sample points for mammals corresponded to sample points previously identified for ALPO and JOFL (Tables 2 and 3; Figures 13-16). At each sample point, we placed two small live-traps (Sherman non-collapsible traps with dimensions 8 x 8 x 26 cm [3 x 3 x 10 in]) 3 m (10 ft) east and west, and a medium live-trap (Tomahawk cage traps with dimensions 13 x 13 x 41 cm [5 x 5 x 16 in]) 3 m (10 ft) north of each point. For one-third of the sample points located in forest habitat, we placed the medium live-trap at the base of a tree to target flying squirrels (*Glaucomys* spp.). At sample points associated with the edge habitat, we positioned a large live-trap (Tomahawk cage traps with dimensions 26 x 32 x 81 cm [10 x 13 x 32 in]) along the edge interface and 20 m (66 ft) from the point center to target animals unable to be captured by small or medium live-traps (Figures 13-16). We baited each live trap with peanut butter and oatmeal and added bedding material.

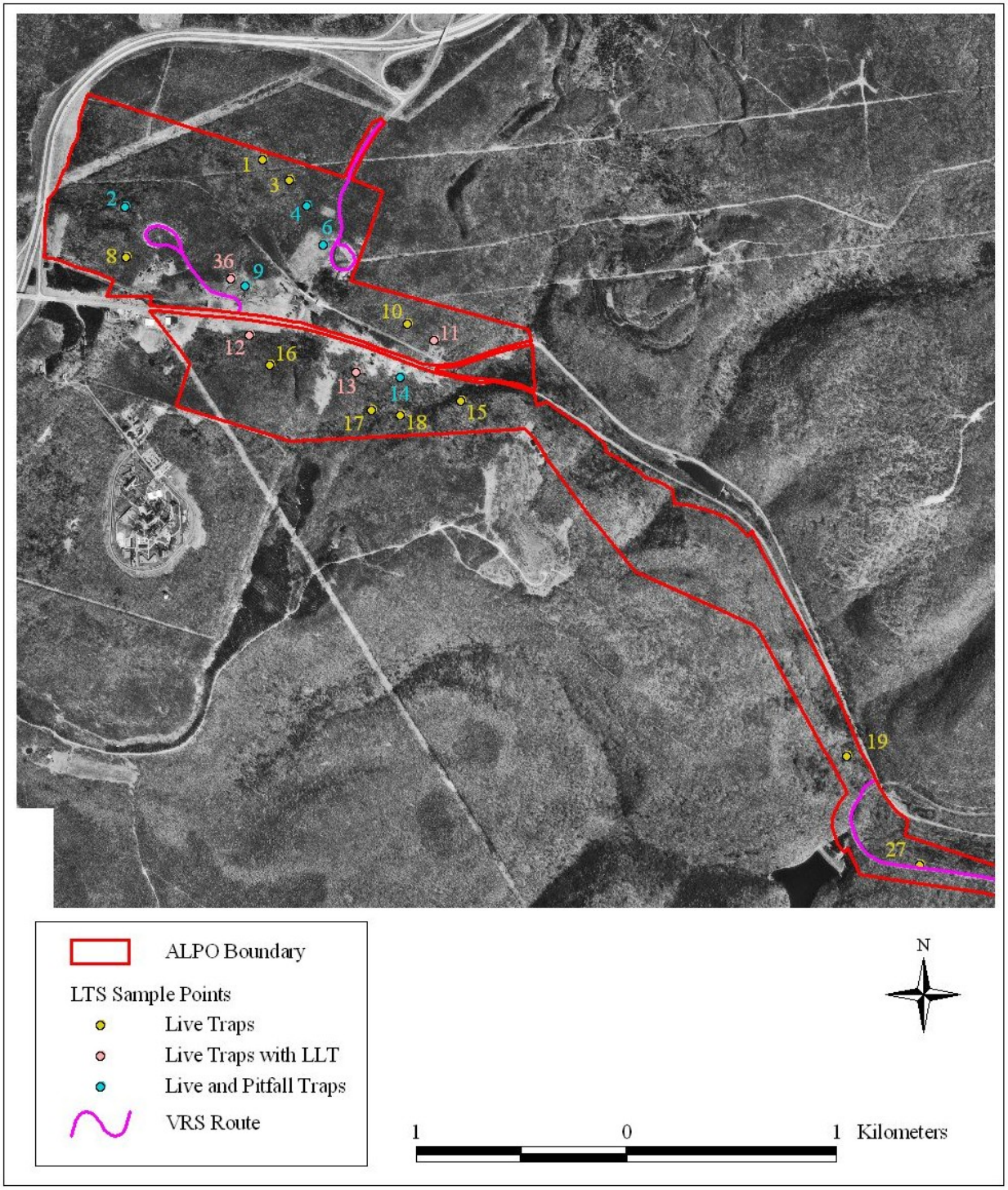

Figure 13. Location of live-trapping (LTS) sample points and vehicular-road survey (VRS) route established for surveys of mammals during 2004 and 2005 on the plateau and Mule Shoe Curve Bridge portions of the Main unit of Allegheny Portage Railroad National Historic Site (ALPO), Pennsylvania. All LTS points contained small and medium live-traps (Live Traps). Select points also contained large live-traps (Live Traps with LLT) or pitfall traps (Live and Pitfall Traps).

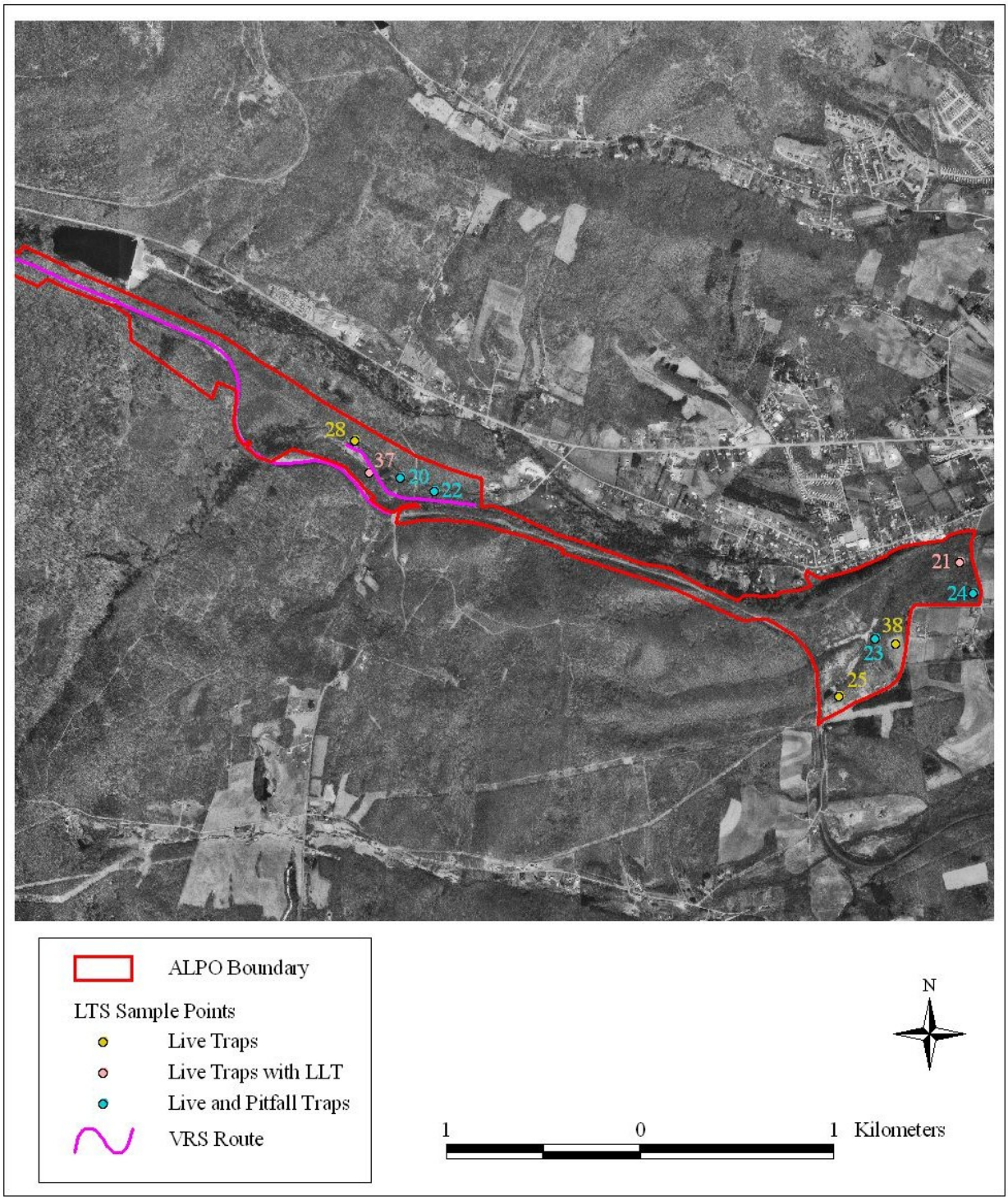

Figure 14. Location of live-trapping (LTS) sample points and vehicular-road survey (VRS) route established for surveys of mammals during 2004 and 2005 on the Incline Nine and Foot of Ten portions of the Main unit of Allegheny Portage Railroad National Historic Site (ALPO), Pennsylvania. All LTS points contained small and medium live-traps (Live Traps). Select points also contained large live-traps (Live Traps with LLT) or pitfall traps (Live and Pitfall Traps).

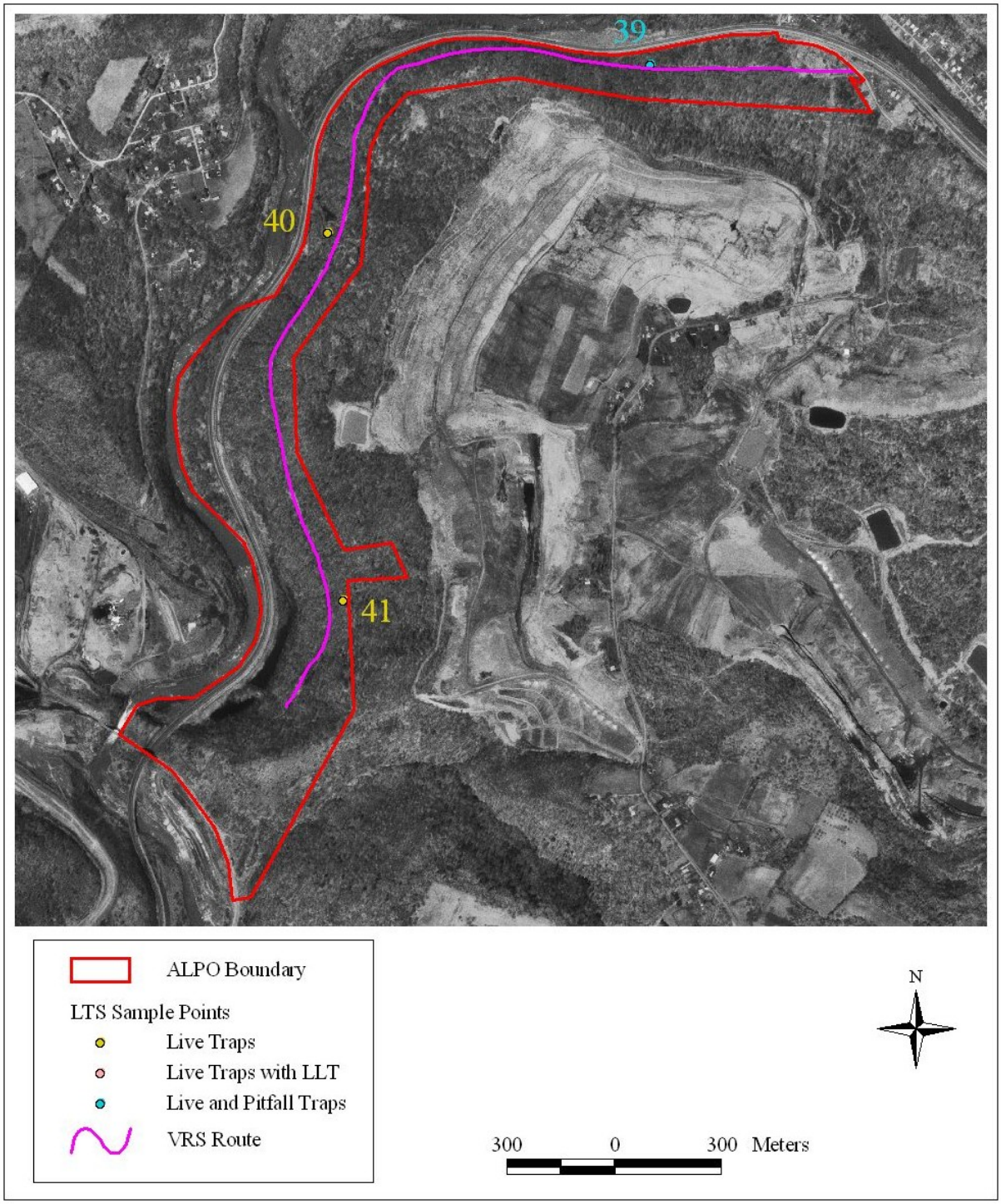

Figure 15. Location of live-trapping (LTS) sample points and vehicular-road survey (VRS) route established for surveys of mammals during 2004 and 2005 on the Staple Bend Tunnel unit of Allegheny Portage Railroad National Historic Site (ALPO), Pennsylvania. All LTS points contained small and medium live-traps (Live Traps). Select points also contained large live-traps (Live Traps with LLT) or pitfall traps (Live and Pitfall Traps).

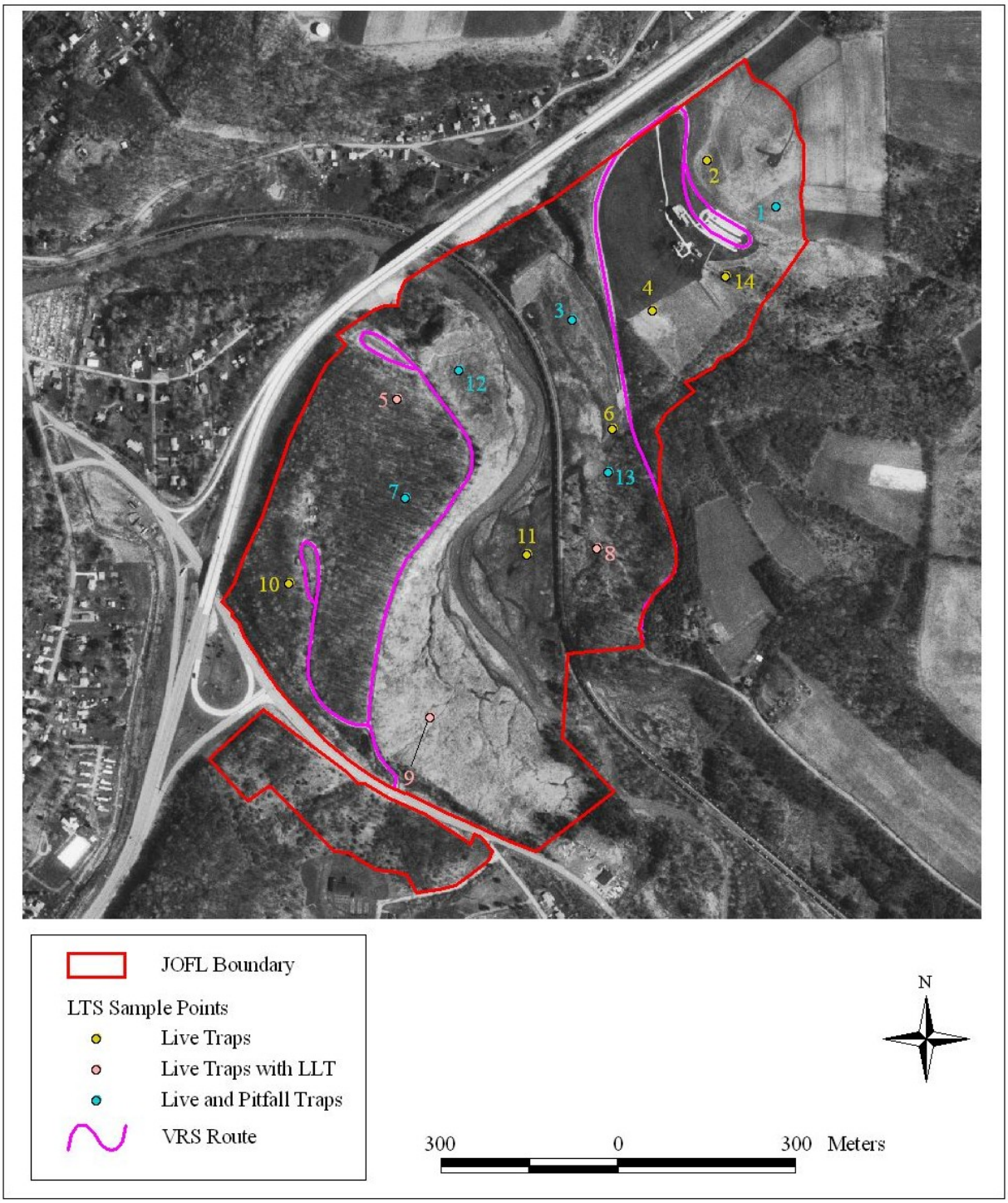

Figure 16. Location of live-trapping (LTS) sample points and vehicular-road survey (VRS) route established for surveys of mammals during 2004 and 2005 at Johnstown Flood National Memorial (JOFL), Pennsylvania. All LTS points contained small and medium live-traps (Live Traps). Select points also contained large live-traps (Live Traps with LLT) or pitfall traps (Live and Pitfall Traps).

One-third of the sample points were selected using a stratified (according to habitat) sampling design to include pitfall traps (Figures 13-16). We placed pitfall traps at the center of selected sample points. Pitfall traps consisted of plastic containers (15.2-cm height and 16.5-cm diameter [6.0-in height and 6.5-in diameter]) sunk into the ground, with rims flush with the soil surface. Pitfall traps without drift fences were installed at least 1 week prior to trapping to ensure minimal soil disturbance during the trapping period (Yahner et al. 1997). Traps were removed and replaced upside down in the ground between trapping sessions. Drift fences were not used in this study because capture success does not tend to be greater with pitfall traps associated with drift fences compared to pitfall traps without drift fences (Dr. Rich Yahner, pers. obs.).

Vehicular-road Surveys

We conducted two morning and two evening vehicular-road surveys (VRS) during the last two weeks of July or first two weeks of August and again two morning and two evening VRS during the last two weeks of September or October 2004 and 2005 at ALPO and JOFL. Morning surveys were conducted between 15 min before and 2 hr after sunrise; evening surveys occurred between 2 hr before and 15 min after sunset. We expected to encounter and identify mammal species larger in body size than eastern chipmunk during the VRS. We recorded observer, number and species of identified mammals, distance the mammal was from the VRS route, and mileage reading to identify the precise location of individuals (Yahner et al. 1997).

VRS routes were designed for use on secondary roads that encompassed a variety of habitats represented within each park (Figures 13-16). At ALPO we designed a VRS route (9.9 km [6.1 mi]) that included five separate sections: the picnic area loop off of old Route 22 (0.9 km [0.6 mi]; Figure 13), the entrance road to the visitor center from route 22 (1.0 km [0.6 mi]; Figure 13), the Conrail trace between the Muleshoe Curve Bridge and Valley Forge Road (3.9 km [2.4 mi]; Figures 13 and 14), the gravel road leading to culvert 1624 located in the Incline Nine section of the park (0.8 km [0.5 mi]; Figure 14), and the old railroad trace in the SBT unit of the park (3.2 km [2.0 mi]; Figure 15). We included the two sections of VRS route (3.0 km [1.8 mi]) established for birds at JOFL (Yahner et al. 2001a; Figure 16). One section located on the south side of the South Fork of the Little Conemaugh River included the park access road leading to the south abutment and turnoff to the picnic and maintenance areas (1.5 km [0.9 mi]). On the north side of the river, the second section included Lake Road within JOFL boundary and the turnoff leading to the visitor center (1.4 km [0.9 mi]).

Data Analyses

Information derived from amphibian, reptile, and mammal surveys at ALPO and JOFL included species richness, an index to relative abundance by park, survey method, cover-item or trap-type, and distribution.

Species richness of amphibians and reptiles was calculated as the total number of different species of amphibians and reptiles inventoried using VES, ACO, PTS, ACS, GSS, and opportunistic observations (OOB). Relative abundances of amphibians and reptiles were calculated as the total number of individual amphibians and reptiles by species detected during VES, ACO, PTS, ACS, and GSS. All survey types were used in calculations of relative abundance of amphibians and reptiles, but results were reported by survey type or a combination of certain survey methods when applicable. For example, relative abundance of each salamander species was presented using a combination of results for VES, ACO, and GSS because salamanders are not vocal and were not targeted using ACS. Besides presenting species richness and relative abundance of amphibians and reptiles, data on species richness and relative abundance were calculated and presented separately for salamanders, anurans, turtles, lizards, and snakes. Information concerning distribution and location of individuals at ALPO and JOFL is available in the Microsoft Access database that accompanies our final report.

Species richness of mammals was calculated as the total number of different species of mammals inventoried using LTS, VRS, and OOB. Relative abundances of small- and large-sized mammals were calculated as the total number of individual mammals detected by species during LTS and VRS. Both survey types were used in calculations of relative abundances of mammals, but results were reported by survey type when applicable. For example, relative abundances of mammals are presented separately for LTS and VRS because VRS were designed to detect large-sized mammal species (e.g., white-tailed deer) not targeted by live-trapping. Information concerning distribution and location of individuals of each species at ALPO and JOFL is available in the Microsoft Access database that accompanies our final report.

Voucher Specimens

Amphibians, reptiles, and mammals were not captured as voucher specimens for this low-impact inventory. Instead, voucher photos were taken with a digital camera and stored as JPG image files. We provided copies of the JPG files to the resource management specialists at the parks upon conclusion of the inventory project.

Information Storage and Deliverables

The species inventory data are available in the "Inventory of Amphibians, Reptiles, and Mammals at Allegheny Portage Railroad National Historic Site and Johnstown Flood National Memorial" final report and in a Microsoft Access file. In addition to individual observations, data include calculations of species richness and an index of the relative abundance of amphibians, reptiles, and mammals, global positioning system (GPS) locations of plots, sample points, stations, and vehicular-road routes. Metadata describing the Microsoft Access file and GPS work for each park are stored in electronic format. Geographic information system (GIS) shape files containing GPS locations of plots, sample points, survey stations, and vehicular-road routes were created using Arc View version 3.2a software. Information on plots, sample points, survey stations, and vehicular-road routes is available in hard copy in the final report and electronically in a Microsoft Access table and as Arc View shape files.

Hard copies and electronic files of the original field data and GPS survey locations are available at The Pennsylvania State University and were provided to each park with the final report. The final report and electronic files are on file with Dr. Richard H. Yahner, Professor of Wildlife Conservation, The Pennsylvania State University; Mr. John Karish, Chief Scientist, Northeast Region, NPS; Dr. Matthew Marshall, Coordinator, Eastern Rivers and Mountains Network, NPS; and Ms. Kathy Penrod, Resource Management Specialist, ALPO and JOFL.

Information collected during our inventory will be used to update the NPSpecies Data Catalogue and the Park-Species section of the NPSpecies Data Catalogue for ALPO and JOFL. Additionally, information from our project was transferred into Microsoft Access format to satisfy requirements for the Vouchers and Observations section of the NPSpecies Data Catalogue.

Results

Amphibians and Reptiles

Forty-seven species of herpetofauna potentially occurred at ALPO (17 salamander, 10 anuran, four turtle, two lizard, and 14 snake) and 45 species (17 salamander, 10 anuran, four turtle, two lizard, and 12 snake) at JOFL based on individual species accounts and range maps (Shaffer 1991; Hulse et al. 2001; Table 4). We detected 29 species at ALPO and JOFL, including 13 salamander, six anuran, two turtle, and eight snake species using a combination of 14 VES, 15 ACO, 12 days of PTS, nine ACS, and OOB at each park, plus 39.2 hours and 24.5 hours of GSS at ALPO and JOFL, respectively. We identified 60% (28 species) of the species that potentially occurred at ALPO, including 12 salamander, six anuran, two turtle, and eight snake species. We detected 53% (24 species) of the species that potentially occurred at JOFL, including 10 salamander, six anuran, and eight snake species. Nine salamander, six anuran, and eight snake species were identified at both parks. Jefferson salamander (see Table 4 for scientific names), valley and ridge salamander, northern red salamander, common snapping turtle, and eastern box turtle were detected only at ALPO, whereas Wehrle's salamander was found only at JOFL. All of the herpetofauna species (n = 29) documented during our inventory are new records for the parks, as no historical records of herpetofauna existed within the NPSpecies database for ALPO or JOFL prior to September 2004 (National Park Service 2004).

At ALPO, redback (n = 151) and northern slimy salamanders (n = 137) were the most abundant terrestrial salamanders, and mountain dusky (n = 688 individuals) and northern two-lined salamanders (n = 115) were the most abundant aquatic salamanders (Appendix A). Northern slimy (n = 80) and Wehrle's salamanders (n = 26) were the most abundant terrestrial salamanders, and mountain dusky (n = 30) and northern two-lined salamanders (n = 5) were the most abundant aquatic salamanders at JOFL (Appendix A). VES was the most effective method for detecting salamanders, with 10 species and 1,032 individuals identified at the two parks combined (Appendixes B and C). Over 95.6% (1,380 of 1,443 individuals) of all salamanders detected during our inventory project were located beneath cover items. Streamside VES yielded the highest number of individuals per cover item surveyed (6.4 individuals/100 cover items) (Appendix B).

Northern spring peeper (n = 444 and 665 individuals) and wood frog (n = 96 and 115) were the most abundant anurans at ALPO and JOFL, respectively (Appendix A). GSS and ACS were the most effective methods for identifying anurans, with six species and 290 individuals detected visually within ponds, wetlands, or vernal pools during GSS and five species and 1096 individuals detected aurally during ACS at the two parks combined (Appendixes B-D). Northern spring peeper (4.9 individuals/station) and wood frog (0.4) were the most abundant anurans detected during ACS at ALPO and northern spring peeper (14.3) and green frog (0.8) were the most abundant anurans detected during ACS at JOFL (Appendix D). Unlike salamanders, only 1.3 % (19 of 1,421 individuals) of anurans was detected under cover items.

Table 4. Amphibian and reptile species detected (X) from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania. Amphibian and reptile species not detected but that potentially occur (P) at the parks are included. No historical records of any species were documented within the NPSpecies database prior to October 2004 (National Park Service 2004).

Species	ALPO	JOFL
Salamanders		
Mudpuppy (*Necturus maculosus*)	P	P
Jefferson salamander (*Ambystoma jeffersonianum*)	X	P
Spotted salamander (*Ambystoma maculatum*)	X	X
Marbled salamander (*Ambystoma opacum*)	P	P
Red-spotted newt (*Notophthalmus viridescens*)	X	X
Northern dusky salamander (*Desmognathus fuscus*)	X	X
Seal salamander (*Desmognathus monticola*)	P	P
Mountain dusky salamander (*Desmognathus ochrophaeus*)	X	X
Northern two-lined salamander (*Eurycea bislineata*)	X	X
Longtail salamander (*Eurycea longicauda*)	P	P
Northern spring salamander (*Gyrinophilus porphyriticus*)	X	X
Four-toed salamander (*Hemidactylium scutatum*)	X	X
Redback salamander (*Plethodon cinereus*)	X	X
Northern slimy salamander (*Plethodon glutinosus*)	X	X
Valley and ridge salamander (*Plethodon hoffmani*)	X	P
Wehrle's salamander (*Plethodon wehrlei*)	P	X
Northern red salamander (*Pseudotriton ruber*)	X	P

Table 4. Amphibian and reptile species detected (X) from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania. Amphibian and reptile species not detected but that potentially occur (P) at the parks are included. No historical records of any species were documented within the NPSpecies database prior to October 2004 (National Park Service 2004) (continued).

Species	ALPO	JOFL
Anurans		
Eastern American toad (*Bufo americanus*)	X	X
Fowler's toad (*Bufo fowleri*)	P	P
Gray treefrog (*Hyla versicolor*)	P	P
Mountain chorus frog (*Pseudacris brachyphona*)	P	P
Northern spring peeper (*Pseudacris crucifer*)	X	X
Bullfrog (*Rana catesbeiana*)	X	X
Green frog (*Rana clamitans*)	X	X
Pickerel frog (*Rana palustris*)	X	X
Northern leopard frog (*Rana pipiens*)	P	P
Wood frog (*Rana sylvatica*)	X	X
Turtles		
Common snapping turtle (*Chelydra serpentina*)	X	P
Painted turtle (*Chrysemys picta*)	P	P
Wood turtle (*Glyptemys insculpta*)	P	P
Eastern box turtle (*Terrapene carolina*)	X	P
Lizards:		
Northern fence lizard (*Sceloporus undulates hyacinthinus*)	P	P
Five-lined skink (*Eumeces fasciatus*)	P	P

Table 4. Amphibian and reptile species detected (X) from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania. Amphibian and reptile species not detected but that potentially occur (P) at the parks are included. No historical records of any species were documented within the NPSpecies database prior to October 2004 (National Park Service 2004) (continued).

Species	ALPO	JOFL
Snakes		
Eastern worm snake (*Carphophis amoenus*)	P	---
Northern black racer (*Coluber constrictor*)	X	X
Northern ringneck snake (*Diadophis punctatus*)	X	X
Rat snake (*Elaphe obsoleta*)	P	P
Eastern hognose snake (*Heterodon platirhinos*)	P	P
Eastern milk snake (*Lampropeltis triangulum*)	X	X
Northern water snake (*Nerodia sipedon*)	X	X
Smooth green snake (*Opheodrys vernalis*)	X	X
Northern brown snake (*Storeria dekayi*)	X	X
Northern redbelly snake (*Storeria occipitomaculata*)	X	X
Eastern ribbon snake (*Thamnophis sauritus*)	P	---
Eastern garter snake (*Thamnophis sirtalis*)	X	X
Northern copperhead (*Agkistrodon contortrix mokasen*)	P	P
Timber rattlesnake (*Crotalus horridus*)	P	P
Total Number of Species	28	24

Eastern garter (*n* = 74 and 73 individuals) and northern redbelly snakes (*n* = 45 and 12) were the most abundant snakes at ALPO and JOFL, respectively (Appendix A). ACO was the most effective method for identifying snakes with seven species and 182 individuals (76.8% of the total individuals inventoried) detected using this protocol at the two parks combined (Appendixes B and C). All but nine of the 238 individual snakes (96.2%) were detected under artificial or natural cover items. Additionally, we detected eastern box turtle (*n* = 2 individuals) while conducting VES and common snapping turtle (*n* = 1) during GSS at ALPO.

Mammals

Fifty-five species of mammals potentially occurred at ALPO and JOFL based on species accounts and range maps (Burt and Grossenheider 1980; Merritt 1987; Table 5). A total of 25 mammal species was detected from March-October 2004 and 2005 at ALPO and JOFL, using a combination of 12 nights of LTS, eight VRS, and opportunistic observations at each park. We identified 42% (23 species) of the species that potentially occurred at ALPO, and 29% (16 species) of the species that potentially occurred at JOFL. Of these mammal species, 14 were identified at both parks. Virginia opossum (see Table 5 for scientific names), smoky shrew, big brown bat, fox squirrel, woodland jumping mouse, porcupine, gray fox, long-tailed weasel, and feral cat were detected only at ALPO, whereas southern bog lemming and red fox were found only at JOFL. At both parks, the total number of species inventoried during our project was greater than the number of species recorded historically. We documented 13 and 16 species at ALPO and JOFL, respectively, that previously were not recorded at the parks (National Park Service 2004). No species were confirmed at JOFL prior to our inventory.

Eastern chipmunk (*n* = 249 individuals) and white-footed mouse (*n* = 72) were the most abundant mammal species at ALPO (Appendix E). At JOFL, eastern chipmunk (*n* = 44), white-footed mouse (*n* = 22), and meadow vole (*n* = 20) were the most abundant mammals. LTS was the most effective method for detecting small mammals (eastern chipmunk and smaller), with a total of 13 species (eight small mammal species) and 247 individuals (233 small mammals) detected using this protocol at both parks combined. At ALPO, white-footed mouse was the most abundant species captured using small live-traps (9.7 individuals/100 trap nights), eastern chipmunk using medium live-traps (3.4), raccoon using large live-traps (2.8), and masked shrew using pitfall traps (5.8, Appendix F). White-footed mouse and meadow vole were the most abundant species captured using small live-traps (6.5 and 6.0 individuals/100 trap nights, respectively) and eastern chipmunk the most abundant captured using medium live-traps (8.3) at JOFL.

VRS was the most effective method for detecting medium to large-sized mammal species (larger than eastern chipmunk), with 13 mammal species (11 medium to large-sized mammal species) and 356 individuals (96 medium to large-sized mammals and 259 eastern chipmunk) detected using this protocol at both parks combined (Appendix E). At ALPO eastern chipmunk and white-tailed deer were the most abundant species detected during morning VRS (14.5 and 2.9 individuals/survey, respectively), and eastern chipmunk and eastern cottontail were the most abundant species detected during evening VRS (13.6 and 0.8, respectively, Appendix G).

Table 5. Mammal species noted (X) from historical records and detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania. Mammal species not detected but that potentially occur (P) at the parks are included. Historical records include only confirmed species within the NPSpecies database prior to September 2004 (National Park Service 2004).

Species	ALPO		JOFL	
	Historical Records	2004-2005 Inventory	Historical Records	2004-2005 Inventory
Virginia opossum (*Didelphis virginiana*)		X		P
Masked shrew (*Sorex cinereus*)	X	X		X
Smoky shrew (*Sorex fumeus*)	X	X		P
Long-tailed shrew (*Sorex dispar*)		P		P
Pygmy shrew (*Sorex hoyi*)		P		P
Northern short-tailed shrew (*Blarina brevicauda*)	X	X		X
Least shrew (*Cryptotis parva*)		P		P
Hairy-tailed mole (*Parascalops breweri*)		P		P
Star-nosed mole (*Condylura cristata*)		P		P
Little brown bat (*Myotis lucifugus*)	X	P		P
Northern long-eared bat (*Myotis septentrionalis*)	X	P		P

Table 5. Mammal species noted (X) from historical records and detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania. Mammal species not detected but that potentially occur (P) at the parks are included. Historical records include only confirmed species within the NPSpecies database prior to September 2004 (National Park Service 2004) (continued).

Species	ALPO		JOFL	
	Historical records	2004-2005 Inventory	Historical records	2004-2005 Inventory
Indiana bat (*Myotis sodalis*)		P		P
Eastern small-footed myotis (*Myotis leibii*)		P		P
Silver-haired bat (*Lasionycteris noctivagans*)		P		P
Eastern pipistrelle (*Pipistrellus subflavus*)	X	P		P
Big brown bat (*Eptesicus fuscus*)	X	X		P
Red bat (*Lasiurus borealis*)		P		P
Hoary bat (*Lasiurus cinereus*)		P		P
Eastern cottontail (*Sylvilagus floridanus*)	X	X		X
New England cottontail (*Sylvilagus transitionalis*)		P		P
Snowshoe hare (*Lepus americanus*)		P		P
Eastern chipmunk (*Tamias striatus*)	X	X		X
Woodchuck (*Marmota monax*)		X		X

Table 5. Mammal species noted (X) from historical records and detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania. Mammal species not detected but that potentially occur (P) at the parks are included. Historical records include only confirmed species within the NPSpecies database prior to September 2004 (National Park Service 2004) (continued).

Species	ALPO		JOFL	
	Historical records	2004-2005 Inventory	Historical records	2004-2005 Inventory
Gray squirrel (*Sciurus carolinensis*)		X		X
Fox squirrel (*Sciurus niger*)		X		P
Red squirrel (*Tamiasciurus hudsonicus*)		X		X
Southern flying squirrel (*Glaucomys volans*)		P		P
Northern flying squirrel (*Glaucomys sabrinus*)		P		P
American beaver (*Castor canadensis*)		P		P
Deer mouse (*Peromyscus maniculatus*)	X	X		X
White-footed mouse (*Peromyscus leucopus*)		X		X
Appalachian woodrat (*Neotoma magister*)		P		P
Southern red-backed vole (*Clethrionomys gapperi*)	X	X		X
Meadow vole (*Microtus pennsylvanicus*)	X	X		X
Woodland vole (*Microtus pinetorum*)		P		P

Table 5. Mammal species noted (X) from historical records and detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania. Mammal species not detected but that potentially occur (P) at the parks are included. Historical records include only confirmed species within the NPSpecies database prior to September 2004 (National Park Service 2004) (continued).

Species	ALPO		JOFL	
	Historical Records	2004-2005 Inventory	Historical Records	2004-2005 Inventory
Southern bog lemming (*Synaptomys cooperi*)	X	P		X
Muskrat (*Ondatra zibethicus*)		P		P
Norway rat (*Rattus norvegicus*)		P		P
House mouse (*Mus musculus*)		P		P
Meadow jumping mouse (*Zapus hudsonius*)		P		P
Woodland jumping mouse (*Napaeozapus insignis*)	X	X		P
Porcupine (*Erethizon dorsatum*)		X		P
Coyote (*Canis latrans*)		P		P
Red fox (*Vulpes vulpes*)		P		X
Gray fox (*Urocyon cinereoargenteus*)		X		P
Black bear (*Ursus americanus*)		P		P
Raccoon (*Procyon lotor*)		X		X

Table 5. Mammal species noted (X) from historical records and detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania. Mammal species not detected but that potentially occur (P) at the parks are included. Historical records include only confirmed species within the NPSpecies database prior to September 2004 (National Park Service 2004) (continued).

Species	ALPO		JOFL	
	Historical Records	2004-2005 Inventory	Historical Records	2004-2005 Inventory
Ermine (*Mustela erminea*)		P		P
Least weasel (*Mustela nivalis*)		P		P
Long-tailed weasel (*Mustela frenata*)	X	X		P
Mink (*Mustela vison*)		P		P
Striped skunk (*Mephitis mephitis*)		X		X
Feral cat (*Felis catus*)		X		
Bobcat (*Lynx rufus*)		P		P
White-tailed deer (*Odocoileus virginianus*)		X		X
Total Number of Species	15	23	0	16

Eastern chipmunk and eastern cottontail were the most abundant species detected during morning VRS (2.9 and 0.8 individuals/survey, respectively), and eastern chipmunk, red squirrel, and raccoon were the most abundant species detected during evening VRS (1.4, 0.4, and 0.4, respectively) at JOFL.

Discussion

The objectives of our biotic inventory were to develop a database for historic and potential occurrence of herpetofauna and mammals, conduct an inventory of presence, relative abundance, and distribution of herpetofauna and mammals, and provide general recommendations for monitoring these species at ALPO and JOFL.

Amphibians and Reptiles

Species richness of herpetofauna at ALPO and JOFL during March-October 2004 and 2005 included 12 and 10 salamander, six and six anuran, two and no turtle, and eight and eight snake species, respectively (13 salamander, six anuran, two turtle, and eight snake species for the two parks combined). However, many additional species could be present that have not been located at these parks (Shaffer 1991; Hulse et al. 2001). Several herpetofauna that possibly exist at one or both of the parks, but have yet to be recorded, include four salamanders (mudpuppy, marbled, seal, and longtail salamander), four anurans (Fowler's toad, gray treefrog, mountain chorus frog, and northern leopard frog), two turtles (painted and wood), two lizards (northern fence lizard and five-lined skink), and six snakes (eastern worm, black rat, eastern hognose, ribbon, northern copperhead, and timber rattlesnake). ALPO and JOFL are at the edge of the geographic distribution for mudpuppy, seal salamander, northern leopard frog, northern fence lizard, and eastern worm and eastern ribbon snake. Although suitable habitat exists for these species at the parks, it is unlikely they were present during our inventory. Two species, gray treefrog and painted turtle, are conspicuous and relatively easy to detect while calling and basking, respectively. Neither of these species was detected during our 2-year inventory and likely did not occur at ALPO or JOFL during the inventory.

Although marbled salamander and timber rattlesnake were not detected within the parks during our inventory, both species likely occur at ALPO. Both species have been documented within 5 km of the main unit of ALPO prior to or concurrent with our inventory (Kathy Derge, Pennsylvania Fish and Boat Commission, pers. comm.). Marbled salamanders predominantly are located within upland forest supporting vernal pools (Hulse et al. 2001). Similar to most mole salamanders, marbled salamanders occupy subterranean retreats, and their occurrence on the forest floor or under surface cover items is rare. The best opportunity for detecting marbled salamander is under cover items in close proximity to dry stream beds or dried vernal pools during early fall when they are reproductively active. Timber rattlesnakes are a state vulnerable species (an animal that could become threatened or endangered) in Pennsylvania due to risk of exploitation by humans and destruction of habitat, especially den sites (Hulse et al. 2001; Pennsylvania Natural Heritage Program 2005). Further GSS concentrated on forested talus slopes or boulder fields containing canopy openings likely will yield the documentation of timber rattlesnake at ALPO.

Mammals

Species richness of mammals at each park during March-October 2004 and 2005 included 23 species at ALPO and 16 species at JOFL (*n* = 25 for the parks combined). Similar to the herpetofauna community, all mammal species inventoried at ALPO and JOFL likely bred within the parks. We documented 13 species at ALPO that previously were not recorded at the parks and all of the species (*n* = 16) recorded at JOFL were new to the park (National Park Service 2004). Several factors contributed to the discrepancy between historically recorded versus currently observed number of mammals. Historically, little emphasis was placed on inventorying mammal species at ALPO and JOFL, as exemplified by the low number of species previously documented at the parks. Eleven terrestrial mammal species (three shrews, eastern cottontail, eastern chipmunk, deer mouse, woodland jumping mouse, two moles, southern bog lemming, and long-tailed weasel) were identified at ALPO in the early 1900s by S. N. Rhoads, and voucher specimens were placed in the Carnegie Museum of Natural History. In 1997, the Pennsylvania Game Commission (PGC) conducted surveys of bat hibernacula throughout Pennsylvania and detected four bat species within Staple Bend Tunnel at ALPO. After combining historical records and data from our project, 28 mammal species have been recorded at the two parks. However, many additional species could be present that have not been located at one or both parks (Burt and Grossenheider 1980; Merritt 1987).

Several terrestrial mammals that possibly exist at one or both of the parks, but have yet to be recorded, include shrews (least, pygmy, and long-tailed shrew), moles (hairy-tailed and star-nosed mole), lagomorphs (New England cottontail and snowshoe hare), rodents (southern and northern flying squirrel, American beaver, Appalachian woodrat, woodland vole, muskrat, Norway rat, house mouse, and meadow jumping mouse), coyote, black bear, weasels (ermine, least weasel, and mink), and bobcat. To increase the likelihood of capturing and identifying flying squirrels, medium live-traps (13 x 13 x 41 cm [5 x 5 x 16 in]) should be placed on cavity trees 1-2 m above ground level, rather than at the base of the tree (Dr. Carolyn Mahan, Pennsylvania State University, pers. comm.). Although our inventory project did not include appropriate protocols to survey for bat species, we recorded big brown bat, and PGC researchers documented little brown bat, northern long-eared bat, and eastern pipistrelle within Staple Bend Tunnel. Besides these bats, there are five additional bat species that could possibly exist at ALPO and JOFL during different times of the year (Merritt 1987). Although a large number of terrestrial mammals have been documented at the two parks, future monitoring accompanied by an inventory specific to bat species will continue to increase the number of mammals observed within each park.

Developing a Monitoring Program

Herpetofauna

A monitoring program for herpetofauna at ALPO and JOFL should include GSS, ACO, VES, and ACS. GSS should serve as a cornerstone for future monitoring efforts at the parks. Similar to results of other herpetofauna inventories (Yahner et al. 2001b; Kubel et al. 2002; Tiebout 2003a; Tiebout 2003b), we detected the highest richness of herpetofauna species using general search surveys (22 of 29 herpetofauna including nine of 13 salamander, all six anuran, one of two turtle, and six of eight snake species). Additionally, pickerel frog and common snapping turtle were detected only while conducting GSS.

Tiebout (2003a) recommended that inventory projects focus on general search and artificial cover-object surveys. To complement GSS, we support previous recommendations (Kjoss and Litvaitis 2001; Kubel et al. 2002) that a monitoring program for herpetofauna include ACO with plastic sheets. Seventeen of the 29 species of herpetofauna detected during our project were observed while conducting ACO, and we encountered four-toed and valley and ridge salamanders only while conducting ACO. Additionally, the highest number of individual snakes was located under plastic sheets (119 of 238 [50%]) and six of the eight snake species detected during our project were observed under plastic sheets.

We recommend incorporating VES into future monitoring of herpetofauna because these surveys are inexpensive, non-labor intensive, and can be conducted in conjunction with and at the same location as ACO. We recorded 20 of 29 species of herpetofauna while conducting VES, and northern red salamander and eastern box turtle only were detected during VES. Additionally, VES will increase the likelihood of encountering secretive and rarely encountered herpetofauna, such as mole salamanders and eastern box turtle.

As previously mentioned, we conducted ACS to survey for vocalizing frogs and toads. We recorded five of six anuran species and 1,096 of 1,421 individuals (77.1%) during these surveys. ACS provide the best chance of encountering undocumented or rare species such as Fowler's toad, gray treefrog, mountain chorus frog, and northern leopard frog via vocalizations during their respective breeding seasons.

Results of inventorying based on GSS, ACO, VES, and ACS provided information on species richness, relative abundance, and distribution of herpetofauna. With future monitoring conducted at our survey locations, results can be compared among years and time periods and to results from this project because of standard survey protocols. Conducting monitoring of herpetofauna using these survey protocols will increase the likelihood of incorporating variable weather conditions (i.e., drought, heavy rains), provide the most reliable data, and provide information on long-term trends in herpetofauna populations.

Mammals

A monitoring program for small-sized mammals (eastern chipmunk and smaller) at ALPO and JOFL should be based on LTS. The highest species richness of small mammals at each park was recorded using trapping surveys (8 small-mammal species at ALPO and 7 at JOFL). Results from LTS conducted at our sampling locations will provide information on species richness and abundance and can be compared among years and time periods. Monitoring mammal populations using LTS will ensure the most reliable data, include different phases of small-mammal population cycles, and provide information on long-term trends in small mammal populations.

As a supplement to LTS, a monitoring program should include VRS to increase information on species richness and abundance of medium to large-sized mammals (larger than eastern chipmunk) at ALPO and JOFL. These surveys provide information on presence and relative abundance of medium to large-sized mammals (e.g., gray squirrel, raccoon, and white-tailed deer) that is unattainable from LTS. VRS are inexpensive, non-labor intensive, and can be conducted during the same years as trapping surveys. However, VRS were designed based on the presence and availability of secondary and low-use roadways and do not traverse randomly the many habitats within the park. Additionally, VRS are not particularly suitable for monitoring mammals smaller than eastern chipmunks or rare or elusive species (e.g., weasels), and not all species respond edge created by roads and associated edge effects in the same manner (Yahner 2000a). For these reasons, VRS should be used in combination with LTS to monitor mammals at the parks.

Although our inventory project did not target bat species, our records of big brown bat combined with PGC records of little brown bat, northern long-eared bat, and eastern pipistrelle confirmed the presence of four bat species at the Staple Bend Tunnel Unit of ALPO. If time, money, and experienced personnel are available, we recommend a formal inventory of bat species be conducted at the parks (especially Staple Bend Tunnel) using a combination of echolocation detectors, mist netting, and general searches to document additional species that could possibly exist at ALPO and JOFL.

Conclusions

National parks are becoming more insular because of increased habitat fragmentation in the surrounding landscape, making these parks valuable for the long-term maintenance of faunal diversity. The National Park Service has determined the need to obtain an inventory of amphibian, reptile, and mammal populations to complement inventories of birds and butterflies at ALPO and JOFL (Yahner and Keller 2000b; Yahner et al. 2001a) and guidance for establishing a long-term monitoring program for fauna at parks. The objectives of our inventory project were to (1) review existing literature and documentation of the National Park Service and other sources and develop a database for historic and potential occurrence of amphibians, reptiles, and mammals at ALPO and JOFL, (2) conduct an inventory of presence, relative abundance, and distribution of amphibians, reptiles, and mammals at ALPO and JOFL, and (3) provide general recommendations for monitoring amphibians, reptiles, and mammals at ALPO and JOFL.

We surveyed amphibian and reptile populations from March through October 2004 and 2005, using visual-encounter (VES), artificial cover-object (ACO), pitfall-trapping, anuran-calling (ACS), and general-search surveys (GSS) and opportunistic observations. We detected 12 salamander, six anuran, two turtle, and eight snake species at ALPO and 10 salamander, six anuran, and eight snake species at JOFL. We did not encounter lizards at either park during 2004 or 2005. Jefferson salamander, valley and ridge salamander, northern red salamander, common snapping turtle, and eastern box turtle were detected only at ALPO, whereas Wehrle's salamander was found only at JOFL. Mountain dusky and northern two-lined salamanders were the most abundant aquatic salamanders at each park. Redback and northern slimy salamanders were the most abundant terrestrial salamanders at ALPO, whereas northern slimy and Wehrle's salamanders were the most abundant terrestrial salamanders at JOFL. Northern spring peeper and wood frog were the most abundant anurans and eastern garter and northern redbelly snakes were the most abundant snakes at ALPO and JOFL. Results of future monitoring efforts based on GSS, ACO, VES, and ACS at our survey locations will provide information on species richness, relative abundance, and distribution of herpetofauna and can be compared among years and to results from our project because of standard survey protocols. Conducting monitoring of herpetofauna using these survey protocols will provide the most reliable data and provide information on long-term trends in herpetofauna populations.

We inventoried mammal populations between March-October 2004 and 2005, using live-trapping (LTS) and vehicular-road surveys (VRS) and opportunistic observations. We observed 23 mammal species at ALPO and 16 mammal species at JOFL. Virginia opossum, smoky shrew, big brown bat, fox squirrel, woodland jumping mouse, porcupine, gray fox, long-tailed weasel, and feral cat were detected only at ALPO, whereas southern bog lemming and red fox were found only at JOFL. Eastern chipmunk and white-footed mouse were the most abundant mammal species at each park. A monitoring program for mammals at ALPO and JOFL should be based on LTS for small-sized mammals (eastern chipmunk and smaller) and supplemented with VRS to increase information on species richness and abundance of medium to large-sized mammals (larger than eastern chipmunk). If resources are available, we recommend a formal inventory of bat species be conducted at the parks.

In conjunction with recently conducted bird and butterfly inventories and vegetation mapping at ALPO and JOFL, information acquired during our project establishes the foundation for an extensive long-term database of flora and fauna at the parks. By developing a monitoring program based on survey protocols and locations from recently conducted inventory projects, resource management specialists can create an extensive long-term database of flora and fauna while adding to information already accumulated on presence, relative abundance, and distribution of species at ALPO and JOFL. Based on knowledge and information derived from amphibian, reptile, and mammal inventories, resource management specialists are able to make informed decisions on how best to manage natural resources within national parks.

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Appendix A. Herpetofauna species and number of individuals (No. Ind.) by survey type detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania.

Species	Park	Survey Type[a]					Total
		VES	ACO	ACS	GSS	OOB	
		No. Ind.	No. Ind.	No. Ind.	No. Ind.	No. Ind.	
Salamanders:							
Jefferson salamander	ALPO	0	0	0	0	Eggs	0
	JOFL	0	0	0	0	0	0
Spotted salamander	ALPO	2	0	0	3	0	5
	JOFL	1	1	0	3	0	5
Red-spotted newt	ALPO	54	1	0	6	0	61
	JOFL	1	0	0	0	0	1
Northern dusky salamander	ALPO	50	0	0	12	0	62
	JOFL	0	0	0	3	0	3
Mountain dusky salamander	ALPO	547	34	0	107	0	688
	JOFL	0	0	0	30	0	30
Northern two-lined salamander	ALPO	86	11	0	18	0	115
	JOFL	0	0	0	5	0	5
Northern spring salamander	ALPO	53	0	0	14	0	67
	JOFL	0	0	0	2	0	2
Four-toed salamander	ALPO	0	1	0	0	0	1
	JOFL	0	1	0	0	0	1
Redback salamander	ALPO	96	44	0	11	0	151
	JOFL	1	0	0	0	0	1
Northern slimy salamander	ALPO	77	46	0	14	0	137
	JOFL	52	5	0	23	0	80

Appendix A. Herpetofauna species and number of individuals (No. Ind.) by survey type detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania (continued).

Species	Park	Survey Type[a]					Total
		VES	ACO	ACS	GSS	OOB	
		No. Ind.	No. Ind.	No. Ind.	No. Ind.	No. Ind.	
Salamanders (continued):							
Valley and ridge salamander	ALPO	0	1	0	0	0	1
	JOFL	0	0	0	0	0	0
Wehrle's salamander	ALPO	0	0	0	0	0	0
	JOFL	11	2	0	13	0	26
Northern red salamander	ALPO	1	0	0	0	0	1
	JOFL	0	0	0	0	0	0
Totals for Salamanders:	**ALPO**	**966**	**138**	**0**	**185**	**0**	**1289**
	JOFL	**66**	**9**	**0**	**79**	**0**	**154**
Anurans:							
Eastern American toad	ALPO	5	2	6	0	0	13
	JOFL	1	0	4	6	0	11
Northern spring peeper	ALPO	3	0	398	43	0	444
	JOFL	3	0	585	77	0	665
Bullfrog	ALPO	1	0	2	0	0	3
	JOFL	0	0	1	4	0	5
Green frog	ALPO	6	0	12	2	0	20
	JOFL	0	0	31	8	0	39
Pickerel frog	ALPO	0	0	0	5	0	5
	JOFL	0	0	0	5	0	5

Appendix A. Herpetofauna species and number of individuals (No. Ind.) by survey type detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania (continued).

Species	Park	Survey Type[a]					Total
		VES	ACO	ACS	GSS	OOB	
		No. Ind.	No. Ind.	No. Ind.	No. Ind.	No. Ind.	
Anurans (continued):							
Wood frog	ALPO	14	0	33	49	0	96
	JOFL	0	0	24	91	0	115
Totals for Anurans:	**ALPO**	**29**	**2**	**451**	**99**	**0**	**581**
	JOFL	**4**	**0**	**645**	**191**	**0**	**840**
Turtles:							
Common snapping turtle	ALPO	0	0	0	1	0	1
	JOFL	0	0	0	0	0	0
Eastern box turtle	ALPO	2	0	0	0	0	2
	JOFL	0	0	0	0	0	0
Totals for Turtles:	**ALPO**	**2**	**0**	**0**	**1**	**0**	**3**
	JOFL	**0**	**0**	**0**	**0**	**0**	**0**
Snakes:							
Northern black racer	ALPO	0	0	0	0	2	2
	JOFL	0	2	0	0	0	2
Northern ringneck snake	ALPO	0	1	0	1	0	2
	JOFL	0	0	0	2	0	2
Eastern milk snake	ALPO	0	4	0	1	0	5
	JOFL	1	4	0	5	0	10

Appendix A. Herpetofauna species and number of individuals (No. Ind.) by survey type detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania (continued).

Species	Park	Survey Type[a]					Total
		VES	ACO	ACS	GSS	OOB	
		No. Ind.	No. Ind.	No. Ind.	No. Ind.	No. Ind.	
Snakes (continued):							
Northern water snake	ALPO	0	1	0	1	0	2
	JOFL	0	1	0	0	0	1
Smooth green snake	ALPO	1	0	0	1	0	2
	JOFL	1	0	0	3	0	4
Northern brown snake	ALPO	1	0	0	0	0	1
	JOFL	0	1	0	0	0	1
Northern redbelly snake	ALPO	0	37	0	8	0	45
	JOFL	0	9	0	3	0	12
Eastern garter snake	ALPO	6	62	0	6	0	74
	JOFL	2	60	0	11	0	73
Totals for snakes:	**ALPO**	**8**	**105**	**0**	**18**	**2**	**133**
	JOFL	**4**	**77**	**0**	**24**	**0**	**105**
Totals for all herpetofauna:	**ALPO**	**1005**	**245**	**451**	**303**	**2**	**2006**
	JOFL	**74**	**86**	**645**	**294**	**0**	**1099**

[a] Survey types: VES = visual-encounter surveys; ACO = artifical cover-object surveys; ACS = anuran-calling surveys; GSS = general-search surveys; OOB = opportunistic observation.

Appendix B. Number of species (No. Spp.), individuals (No.), and individuals per 100 cover items (No./CI) for salamanders, anurans, and snakes, by survey type (Survey) detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania. Individuals detected while conducting surface searches of leaf litter, ponds, wetlands, and vernal pools during visual-encounter and general-search surveys were not included.

Survey[a]	Park	Salamanders			Anurans			Snakes		
		No. Spp.	No.	No./CI	No. Spp.	No.	No./CI	No. Spp.	No.	No./CI
VES (T)	ALPO	9	395	4.4	3	7	0.08	2	4	0.04
	JOFL	5	66	3.9	1	1	0.06	3	4	0.2
VES (S)	ALPO	6	517	6.4	2	8	0.05	---	---	---
ACO	ALPO	7	138	4.2	1	2	0.06	5	105	3.2
	JOFL	4	9	0.8	---	---	---	6	77	6.7
GSS	ALPO	7	178	4.3	1	1	0.02	6	17	0.4
	JOFL	7	77	2.2	---	---	---	5	23	0.6

[a] Survey types: VES (T) = visual-encounter surveys associated with terrestrial sample points; VES (S) = visual-encounter surveys associated with streams; ACO = artifical cover-object surveys; GSS = general-search surveys.

Appendix C. Number of species (No. Spp.) and individuals (No. Ind.) for salamanders, anurans, and snakes detected while conducting surface searches of leaf litter, ponds, wetlands, and vernal pools during visual-encounter (VES) and general-search surveys (GSS) from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania.

Survey Type	Park	Salamanders		Anurans		Snakes	
		No. Spp.	No. Ind.	No. Spp.	No. Ind.	No. Spp.	No. Ind.
VES	ALPO[a]	2	54	4	14	2	4
	JOFL	---	---	1	3	---	---
GSS	ALPO[b]	2	7	4	98	1	1
	JOFL	1	2	6	191	1	1

[a] Two eastern box turtles (*Terrapene carolina*) were detected during VES at ALPO.

[b] A common snapping turtle (*Chelydra serpentina*) was detected during GSS at ALPO.

Appendix D. Anuran species, number of individuals (No. Ind.), and average number of individuals per station (No./Station) detected during anuran-calling surveys from March-June 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania.

Species	ALPO		JOFL	
	No. Ind.	No./Station	No. Ind.	No./Station
Eastern American toad	6	0.1	4	0.1
Northern spring peeper	398	4.9	585	14.3
Bullfrog	2	0.02	1	0.02
Green frog	12	0.2	31	0.8
Wood frog	33	0.4	24	0.6

Appendix E. Mammal species and number of individuals (No. Ind.) by survey type detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania.

Species	Park	Survey Type[a]			Total
		LTS[b]	VRS	OOB	
		No. Ind.	No. Ind.	No. Ind.	
Virginia opossum	ALPO	4	2	0	6
	JOFL	0	0	0	0
Masked shrew	ALPO	21	0	0	21
	JOFL	3	0	0	3
Smoky shrew	ALPO	1	0	0	1
	JOFL	0	0	0	0
Northern short-tailed shrew	ALPO	8	0	0	8
	JOFL	10	1	0	11
Big brown bat	ALPO	0	0	2	2
	JOFL	0	0	0	0
Eastern cottontail	ALPO	0	15	0	15
	JOFL	0	7	0	7
Eastern chipmunk	ALPO	24	225	0	249
	JOFL	10	34	0	44
Woodchuck	ALPO	0	10	0	10
	JOFL	0	1	0	1
Gray squirrel	ALPO	0	6	0	6
	JOFL	0	3	0	3

Appendix E. Mammal species and number of individuals (No. Ind.) by survey type detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania (continued).

Species	Park	Survey Type[a]			Total
		LTS[b]	VRS	OOB	
		No. Ind.	No. Ind.	No. Ind.	
Fox squirrel	ALPO	0	0	1	1
	JOFL	0	0	0	0
Red squirrel	ALPO	4	6	0	10
	JOFL	1	4	0	5
Deer mouse	ALPO	21	0	0	21
	JOFL	1	0	0	1
White-footed mouse	ALPO	72	0	0	72
	JOFL	22	0	0	22
Southern red-backed vole	ALPO	4	0	0	4
	JOFL	1	0	0	1
Meadow vole	ALPO	15	0	0	15
	JOFL	20	0	0	20
Southern bog lemming	ALPO	0	0	0	0
	JOFL	0	0	Feces	0
Woodland jumping mouse	ALPO	0	0	1	1
	JOFL	0	0	0	0
Porcupine	ALPO	0	3	0	3
	JOFL	0	0	0	0

Appendix E. Mammal species and number of individuals (No. Ind.) by survey type detected from March-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania (continued).

Species	Park	Survey Type[a]			Total
		LTS[b]	VRS	OOB	
		No. Ind.	No. Ind.	No. Ind.	
Red fox	ALPO	0	0	0	0
	JOFL	0	1	0	1
Gray fox	ALPO	0	0	1	1
	JOFL	0	0	0	0
Raccoon	ALPO	2	3	0	5
	JOFL	0	4	0	4
Long-tailed weasel	ALPO	2	0	0	2
	JOFL	0	0	0	0
Striped skunk	ALPO	1	0	0	1
	JOFL	0	1	0	1
Feral cat	ALPO	0	2	0	2
	JOFL	0	0	0	0
White-tailed deer	ALPO	0	25	0	25
	JOFL	0	3	0	3
Total	**ALPO**	**179**	**297**	**5**	**481**
	JOFL	**68**	**59**	**0**	**127**

[a] Survey types: LTS = live-trapping surveys; VRS = vehicular-road surveys; OOB = opportunistic observations.

[b] Number of individuals for LTS does not include recaptures.

Appendix F. Mammal species and number of individuals per 100 trap nights (No. Ind./TN) by trap type for first time captures (New) and recaptures (Recap) identified during live-trapping surveys from July-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL).

Species	Trap Type[a]	ALPO		JOFL	
		New	Recap	New	Recap
		No. Ind./TN	No. Ind./TN	No. Ind./TN	No. Ind./TN
Virginia opossum	MLT	0.9	0.0	0.0	0.0
	LLT	1.4	0.0	0.0	0.0
Masked shrew	SLT	1.9	0.0	0.6	0.0
	PIT	5.8	0.0	1.7	0.0
Smoky shrew	SLT	0.1	0.0	0.0	0.0
Northern short-tailed shrew	SLT	0.9	0.0	3.0	0.0
	PIT	0.8	0.0	0.0	0.0
Eastern chipmunk	SLT	1.8	0.0	0.9	0.0
	MLT	3.4	0.3	8.3	1.2
Red squirrel	SLT	0.1	0.0	0.0	0.0
	MLT	0.9	0.3	1.2	1.2
Deer mouse	SLT	2.8	2.2	0.3	0.0
White-footed mouse	SLT	9.7	8.1	6.6	6.6
Southern red-backed vole	SLT	0.5	0.3	0.3	0.0
Meadow vole	SLT	2.0	0.0	6.0	1.5
Raccoon	LLT	2.8	0.0	0.0	0.0

Appendix F. Mammal species and number of individuals per 100 trap nights (No. Ind./TN) by trap type for first time captures (New) and recaptures (Recap) identified during live-trapping surveys from July-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania (continued).

Species	Trap Type[a]	ALPO		JOFL	
		New	Recap	New	Recap
		No. Ind./TN	No. Ind./TN	No. Ind./TN	No. Ind./TN
Long-tailed weasel	MLT	0.6	0.0	0.0	0.0
Striped skunk	MLT	0.3	0.0	0.0	0.0

[a] Trap types: SLT = small live-trap (Sherman non-collapsible traps with dimensions 8 x 8 x 26 cm [3 x 3 x 10 in]); MLT = medium live-trap (Tomahawk cage traps with dimensions 13 x 13 x 41 cm [5 x 5 x 16 in]); LLT = large live-trap (Tomahawk cage traps with dimensions 26 x 32 x 81 cm [10 x 13 x 32 in]); PIT = pitfall trap (15.2-cm height and 16.5-cm diameter [6.0-in height and 6.5-in diameter]).

Appendix G. Mammal species and average number of individuals per survey (No./Survey) for morning (AM) and evening (PM) vehicular-road surveys from July-October 2004 and 2005 at Allegheny Portage Railroad National Historic Site (ALPO) and Johnstown Flood National Memorial (JOFL), Pennsylvania.

Species	ALPO - AM	ALPO - PM	JOFL - AM	JOFL - PM
	No./Survey	No./Survey	No./Survey	No./Survey
Virginia opossum	0.1	0.1	0.0	0.0
Northern short-tailed shrew	0.0	0.0	0.1	0.0
Eastern cottontail	1.1	0.8	0.8	0.1
Eastern chipmunk	14.5	13.6	2.9	1.4
Woodchuck	0.9	0.4	0.0	0.1
Gray squirrel	0.4	0.4	0.4	0.0
Red squirrel	0.5	0.3	0.1	0.4
Porcupine	0.3	0.1	0.0	0.0
Red fox	0.0	0.0	0.0	0.1
Raccoon	0.1	0.3	0.1	0.4
Striped skunk	0.0	0.0	0.0	0.1
Feral cat	0.1	0.1	0.0	0.0
White-tailed deer	2.9	0.3	0.1	0.3

As the nation's primary conservation agency, the Department of the Interior has responsibility for most of our nationally owned public land and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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