FISHES, AMPHIBIANS, REPTILES, AND MAMMALS OF LYNDON B. JOHNSON NATIONAL HISTORICAL PARK GILLESPIE AND BLANCO COUNTIES, TEXAS

RESULTS OF A 2002-2003 ZOOLOGICAL INVENTORY
AND RELATED RESEARCH AND REVIEWS

DRAFT FINAL REPORT
10 JUNE, 2004
(REVISED NOVEMBER 23, 2004)

REPORT PREPARED BY

MICHAEL PATRIKEEV

TEXAS CONSERVATION DATA CENTER
THE NATURE CONSERVANCY
FOR
THE NATIONAL PARK SERVICE

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Edited and submitted under cooperative agreement number CA7350010004 to
U.S. National Park Service by

Mark Gallyoun
Program Coordinator
Texas Conservation Data Center
The Nature Conservancy
P.O. Box 1440
San Antonio, Texas 78295-1440

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Fishes, amphibians, reptiles, and mammals of Lyndon B. Johnson National Historical Park Gillespie and Blanco Counties, Texas

INTRODUCTION

This project was undertaken by the Texas Conservation Data Center (TxCDC), as a part of a larger project with the National Park Service (NPS) and the Botanical Research Institute of Texas (BRIT) to perform inventories of vascular plants and vertebrate animals. The project's basis was the "Study Plan for Biological Inventories, Southern Plains Network, and National Park Service" (National Park Service 2000). The plan was written as a cooperative effort between the NPS and the Colorado and New Mexico Natural Heritage Programs, the Kansas Natural Heritage Inventory, and the Texas Conservation Data Center. The goal of this portion of the project was to provide park managers with documented vertebrate inventory information in an accessible and useful format.

Study objectives followed those laid out in the "Study Plan for Biological Inventories, Southern Plains Network, and National Park Service" (National Park Service 2000). They were to:

1. Compile and critically review historic data for vertebrates believed to occur at Lyndon B. Johnson National Historical Park (LYJO) from a variety of sources including museum records of voucher specimens, previous studies, park databases, etc.
2. Conduct field investigations, where quality data did not exist, to document the occurrence of a majority of the species of vertebrates (excluding birds) occurring in this park.
3. Evaluate existing and new data to determine the completeness of the inventories. The goal was to document 90% of the species.
4. Describe the need for future studies to determine the distribution and relative abundance of species of special concern, such as threatened and endangered species, exotics, and other species of special management concern occurring within LYJO boundaries.
5. Gather inventory data by methods that will assist Southern Plains Network parks in developing park "vital signs" monitoring programs.

Documentation Standards

Documentation standards for this biological inventory project call for investigators to document all pre-existing data and reports, pertinent proposed sampling effort information, and the resulting information from any sampling efforts undertaken into the appropriate NPS databases. They also require that all rules and regulations that pertain to biological sampling on NPS lands be followed. Specimens collected in NPS areas are considered property of the NPS. The collection data were entered into the NPS Automated National Catalog System Plus (ANCS+). Copies of field notes, raw data, final reports, and other records associated with the research were accessioned and cataloged with the specimens.

Voucher Standards

For information on vertebrate species uncovered in initial information research, records were to be accepted and included in NPS databases only if adequately vouched. The acceptable types of vouchers for all animal taxa included certified documentation, physical specimens, photographic evidence, auditory evidence, and positive visual identification. Types of acceptable certified documentation included scientific journal articles and technical reports by qualified professionals in the field. TxCDC staff determined whether existing records were adequately documented as part of the information review. In cases where the investigator was unable to confidently identify a physical specimen, a qualified

professional was consulted. West Texas A&M University collection that has a standing agreement with the NPS will curate specimens collected in this study. Threatened and endangered species were not collected (unless found dead). Auditory evidence was in the form of a recording, when possible. When not possible, an expert in that field of study must be used in order for the record to be considered valid. Positive visual identification was performed by qualified personnel, and was used when other types of identification were not possible. Each taxon has a separate level of acceptability for voucher types, and not all of the types mentioned above are used for all.

Fish Species

Vouchers for fish species were allowed to be in the form of photographic evidence, scientific journal articles and technical reports, visual identification, and physical specimens. Qualified personnel identified specimens when photographic evidence did not give positive identification.

Amphibians and Reptiles

Vouchers for amphibian and reptile species were allowed to be in the form of photographic evidence, scientific journal articles and technical reports, auditory recognition, visual identification, and physical specimens. Photographic evidence was used whenever possible. Photographic vouchers are included as deliverable items related to this technical report provided to NPS. Only journal articles and technical reports accepted as verifying and species presence. Auditory recognition was performed by the investigator, who has considerable experience as a field herpetologist.

Mammals

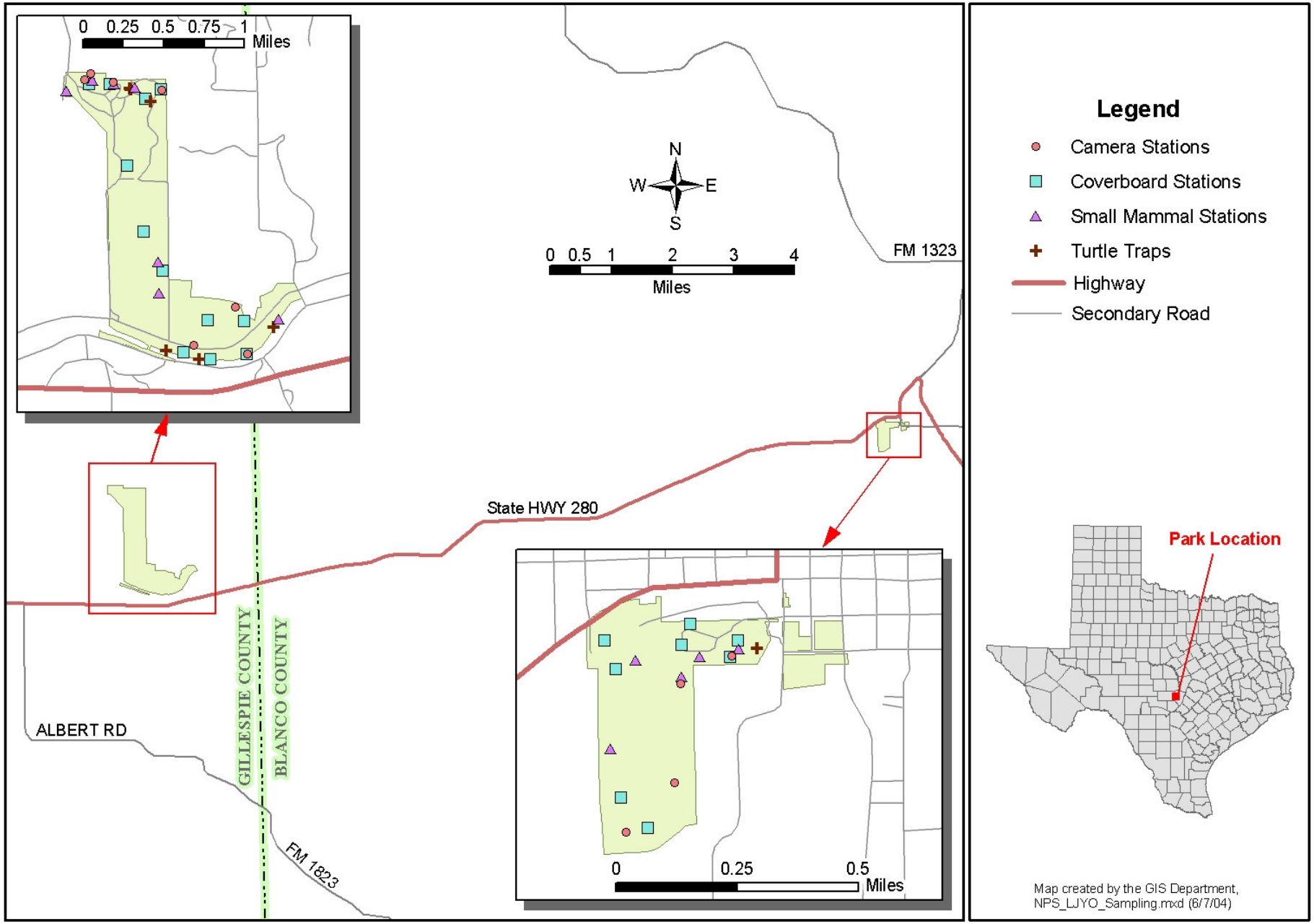
Vouchers for mammal species were acceptable in the form of photographic evidence, scientific journal articles and technical reports, and physical specimens. Photographic evidence was used whenever possible. Photographic vouchers are included as deliverable items related to this technical report provided to NPS. Only journal articles and technical reports written by qualified biologists were accepted to verify species presence. Physical specimens were only taken in cases of species that were difficult to identify otherwise.

Study Area

Lyndon B. Johnson National Historical Park (LYJO) consists of two units (districts) situated on the Llano uplift, in the Pedernales River Valley of the central Texas Hill Country, in Blanco and Gillespie counties, respectively (Map 1). LYJO was originally established in 1969, as a national historic site. The designation was changed to a national historical park in 1980. The combined area of the two districts, which lie about 15 miles from one another, is about 270 ha (674 acres). The Johnson City District is located in the southwest portion of Johnson City (Blanco County), and consists of the park headquarters and visitor center, the LBJ boyhood home, some adjacent homes, historic Johnson Settlement buildings and exhibits, a nature trail, semi-natural creek and prairie habitats, a demonstration herd of longhorn cattle and horses and associated pastures, volunteer camping sites, and maintenance sheds (see Map 2). The LBJ Ranch unit stretches along the Pedernales River in eastern Gillespie County from the bridge connecting Ranch Road 1 and Park Road 49 to the LBJ Ranch. It includes several historic sites, including the LBJ birthplace, Johnson family cemetery, grandparent's farmhouse, the White House (Ranch House), as well as the private airstrip, communications tower, ranching and show barns, maintenance barns, ranch pastures, cultivated fields and orchards (National Park Service 1999; Sanders 2004).

Historically, when the area was first settled in the mid-1800s, it was covered with natural grasslands; live-oaks and Ashe juniper occurred on slopes. Presently, only tiny patches of semi-natural

Map 1: Lyndon B. Johnson National Historical Park, Texas
Sampling Locations



vegetation remains at LYJO: mostly at the prairie restoration site and along Town Creek on the Johnson Settlement, and along the Pedernales River at the LBJ Ranch District (Sanders 2004). An extensive brush control program was implemented in the 1950s-1960s, and the area was seeded with exotic grasses: Coastal Bermuda, plains lovegrass, Klein grass and King Ranch Bluestem. Many pecan trees were also planted on the property (Brandenberger 1979, National Park Service 1999, Sanders 2004) during this period.

Permits

Research activities conducted in the duration of this project were governed by the following permits:

- National Park Service Scientific Research and Collecting Permit # LYJO-2002-SCI-0001
- Texas Scientific Collection Permit # SPR-0102-193

METHODS

General

Surveys were carried out for fishes, amphibians, reptiles, and mammals using a variety of techniques as detailed below. Some methods were opportunistically or comprehensively applied, while others were done at systematically chosen locations. For example, bat survey locations were in areas where conditions were expected to maximize results, and road surveys were done on all available roadways in the park, while coverboard stations were set up at randomly selected locations. Map 1 displays sampling localities for various survey methods involving systematic selection of location. The map distinguishes the types of sampling in a relative context of park boundaries and other sampling methods used.

Fish Surveys

Seines were used to sample fish during this study. Nine stations were sampled in May 2002: five in the Pedernales River between the White House and the bridge by the school, two in cattle ponds at the north end of the LBJ Ranch District (James Burns Tank and Fish Tank), one in Town Creek (Johnson City District) and one in a dugout pond at the Johnson Settlement. All surveys were done during three consecutive days, when weather was sunny and fair. For each station, twenty meter transects were sampled whenever possible. However, some areas were sampled over a lesser extent, for example in fish habitats at the Johnson City District. Due to the paucity of fish habitat that could be surveyed with a seine, effort was made to survey all such habitats present. Deeper sections of water where the weighted line of the seine would not reach bottom were left unsurveyed. Transect locations and site descriptions can be found in Appendix 1.

Amphibians, Reptiles and Mammals

As originally planned, most of the sampling for amphibians and reptiles were to be performed jointly with surveys for mammal species (National Park Service 2000) with a combination of trapping array stations and coverboard stations. However, it was determined that sampling and techniques for amphibians, reptiles, and small mammals in the study area should be modified as indicated below.

Coverboard stations

Originally, 12 sets of coverboards were laid in the study area in March 2002. Later (November 2002) eight additional sets were placed in the park at NPS request. Coverboard stations consisted of three coverboards placed at randomly selected sites (Map 1; also locations and coordinates of coverboard stations are provided in Appendix 2). Coverboards were placed flat on the ground, and propped up with

enough room underneath to allow reptile, amphibian, and small mammal species to crawl under them. Two of the coverboards at each station were made of chipboard, and one of roofing tin. Chipboard coverboards measured approximately 0.7 x 1.3 m, and roofing tin coverboards were about 0.8 x 1.5 m. It was assumed that species that prefer dry microhabitats would be found under coverboards made of roofing tin, and species preferring wetter microhabitats under coverboards made of wood (National Park Service 2000). During this study, coverboards were checked in April, May, August and October 2002. No vertebrate animals were found under coverboards during this study; only fire ants, paper wasps, and crickets were commonly encountered. Presence of fire ants (*Solenopsis invicta*) may have deterred some vertebrates from using cover boards. While conducting botanical surveys done in conjunction with this project, R. O'Kennon (pers. comm.) also checked some coverboards on an opportunistic basis and failed to find any amphibians, reptiles, or mammals.

Night road surveys

Night surveys along roadways were undertaken mostly on rainy or warm and humid nights to find amphibians and reptiles, but also to record mammals. Night surveys were conducted after dark by slowly driving roads looking for reptiles, amphibians, and mammals crossing roadways. All paved and unpaved park roads were covered on these surveys with the exception of roads immediately adjacent to the White House where access was controlled by Secret Service. No amphibians and reptiles were found during these searches, but some mammals were recorded. In total, 10 night road surveys were conducted: March 7 and 8, April 4 and 9, May 13, and August 21-25.

Amphibians and Reptiles only

Some field techniques were utilized only to record amphibians and reptiles. For example, systematic and opportunistic searches such as turning over rocks, logs, and other debris, looking into crevices in rock and cracks in structures.

Auditory amphibian surveys

Auditory surveys for amphibians were conducted near freshwater habitats to listen for and record frog and toad choruses. This was done on warm and humid nights in March, April, May and August 2002 on an opportunistic basis. Due to the relative scarcity of freshwater habitats in the study area, the number of listening points was minimal, and distance between such points arbitrary. Auditory amphibian surveys were carried out near Town Creek and the dugout pond at the Johnson Settlement, along the Pedernales River, and by all cattle ponds at the LBJ Ranch District that held water at the time of survey.

Tadpoles

Although tadpoles were not specifically targeted in this study, many were caught in seines during fish surveys.

Turtle Surveys

Large hoop traps were used to carry out two rounds of turtle trapping in April and May 2002. Seven traps were set on April 7 and removed on April 11. Five of these were at the LBJ Ranch District (three in the Pedernales River above the riffles and two in James Burns Tank) and two at the Johnson Settlement (one in the dugout pond and one in Town Creek). Four traps were set in James Burns Tank (LBJ Ranch) overnight on May 13. Trap locations were selected both randomly within appropriate habitats, and subjectively near turtle basking sites. Locations and results of turtle surveys can be found in Appendix 3 and are displayed on Map 1. In addition, basking turtles were observed, photographed, and identified from blinds set near known multi-species basking sites.

Mammals only

Small-medium mammal stations

Small-medium mammal stations (SMS) consisted of two Tomahawk and four Sherman traps each: 1) one large Tomahawk trap (6" x 6" x 24"), baited with meat and vegetable foodstuffs; 2) one small Tomahawk trap (5" x 5" x 16"), baited with a combination of meat or fish, and vegetarian bait: apples, peanut butter, carrots, cracked corn, etc.; 3) One large (4" x 5" x 15") Sherman trap, baited with peanut butter and oats; 4) Three small (3" x 3" x 9") Sherman traps, baited with peanut butter and oats; 5) Five one gallon (#10 food cans) pitfall traps, located approximately five to six meters from station center.

Twelve small-medium mammal stations were run at LYJO November 23-28, 2002: five in Johnson Settlement and seven on the LBJ Ranch District. In total, Tomahawk traps were run for 104 trap-nights, Sherman traps for 208 trap-nights, and pitfalls for 260 trap-nights. Station locations were selected randomly as desired by the NPS, but sites surveyed were chosen from among a larger set of randomly selected points in a way that enabled the survey to cover both park sections and as many habitat types present in the park as possible (Map 1). More stations were placed in widely distributed habitats (those predominant on the park, i.e. pastures and cultivated fields.) Locations, coordinates, and habitat descriptions of SMS can be found in Appendices 4 and 5, followed by results of small mammal surveys in Appendix 6. Small and medium mammals caught in live traps or pitfalls were identified, some photographed, and almost all released. Some were kept as voucher specimens (see species accounts).

Comments on Trapping Methods

Some traps were swarmed with ants (e.g., fire ants) on warmer days because ants were attracted to peanut butter and seed in the Sherman traps and to meat and canned fish bait in Tomahawk traps. Ant presence might have discouraged some mammals from entering the traps. This problem was less prominent on colder and rainy days. A suggested solution (by Dr. Robert Dowler, Angelo State University) was to use cotton dipped in peanut butter oil instead of peanut butter. Apparently, ants are unable to remove peanut butter fragrance from cotton and eventually leave it alone. A better solution was to use seed only.

Tomahawk traps (both sizes used), baited with meat and fish and set in close proximity to Sherman traps and pitfalls, attracted mammalian scavengers (raccoons, opossums and perhaps domestic cats). These Tomahawk traps were generally too small to catch scavengers (only a few were caught), yet attracted them to the stations. At many stations, all Sherman traps were set off by scavengers trying to reach peanut butter bait or captured mice. Scavengers also could have easily picked up any small mammals caught in the relatively shallow cans used as pitfall traps. Experience in the field dictates recommending not to run Sherman and Tomahawk traps at the same stations simultaneously. Also, pitfall surveys would benefit from using deeper cans in conjunction with drift fences. Placing stations along a transect within the same habitat (instead of scattering them throughout the park) might increase yields.

Bat surveys

Mist-nets were used to catch bats. Five surveys were carried out in August 2002. These were, at the Johnson Settlement: one net on August 21, two nets on August 22, and five nets on August 23; and at the LBJ Ranch District: four nets by Pedernales River on August 24, and three nets by the hay barn on the August 25.

Camera and tracking plate surveys

Seven *Trailmaster* modified *Canon* all-weather automatic cameras with TM-550 sensors/trigger mechanisms were set in both sections of LYJO, April 6-11, 2002 (three in Johnson Settlement and four at

the LBJ Ranch District, see Map 1). Four cameras were set on November 27, 2002 (three at the LBJ Ranch District and one in the Settlement). These cameras were removed by J. Lott on January 16, 2003. Cameras and sensors were mounted on two-inch wooden stakes next to a bait station. In April, a bait station consisted of a piece of raw meat or chicken placed into a cricket cage attached to a metal pipe (two inch diameter), and other food items (cracked corn, apples, canned fish, etc.) placed around the base of the pipe. In November, cameras were mounted nearby animal carcasses (deer and blackbuck). When warm-blooded wildlife investigated the bait, an infrared sensor activated the camera to take a photograph. In April 2002, the cameras were used in combination with tracking plates covered with a suspension of carpenter's chalk in alcohol. However, use of tracking plates was discontinued due to ineffectiveness. Cameras were placed arbitrarily in locations where detection of predators/scavengers was more likely, e.g., along hedgerows, fences, creeks, piles of logs, etc. Locations of cameras and results of camera surveys are in Appendices 8 and 9.

Spotlight Surveys

Three spotlight surveys were carried out through this study: on April 4 (Johnson Settlement), April 5, and May 13 (LBJ Ranch District). All stretches of paved and unpaved vehicle-accessible park roads were driven on such surveys. Results of the three spotlight surveys are summarized in Appendix 10.

Sampling efforts and access

Vertebrate inventory of LYJO was carried out simultaneously with a similar inventory at Lake Meredith National Recreation Area and Alibates Flint Quarries National Monument (Texas Panhandle), 650 km from the current study site. Because the two latter NPS properties constitute a much larger area, and also because breeding bird surveys were to be carried out there, our efforts were concentrated at the Panhandle sites, while visits to LYJO were made during critical periods to detect amphibians, reptiles, fish and small mammals.

We believe that our sampling efforts (see Map 1) were comprehensive, representative of all habitats, and cover a significant portion of the study area at LYJO.

RESULTS

General

A complete list of vertebrate species recorded in the course of this study is included in Appendix 11. This list includes bird species, which were not a subject of this study. They were nonetheless observed in the course of surveying for other taxa, so a list of the investigator's observations is presented for the record. Birds are not otherwise addressed in this report. Appendix 12 presents a list of all vertebrate species collected in carrying out this study. In the species accounts below, introduced species are identified as "Exotic" or "Locally introduced" while all other species listed are native.

Fishes

A total of eighteen fish species were detected in this study. During seine sampling in May 2002, sixteen fish species were identified (see Appendix 13 for a complete listing). A seventeenth species (white crappie) was found on July 3, 2002 by J. Lott in puddles left by a flood just prior to that date. One additional species (European carp) was caught with a dip net during the study, but not preserved.

Seine surveys conducted at LYJO adequately sampled shallower parts of the Pedernales River (up to a depth of 1.3 m), dugout ponds at the LBJ Ranch District and the Johnson Settlement, and Town Creek in the Johnson City District. Seining in deeper portions of the Pedernales (up to 1.5 m) proved ineffective, as

the seine weight line was not touching the river bottom. Deeper sections would have been best sampled with a boat-mounted electro-shocker. Such equipment was not available to us at the time of this study.

American Gizzard Shad - *Dorosoma cepedianum*

One large adult was netted in a shallow to moderately deep section (0.3-1.0 m) of the Pedernales River with rocky and sandy bottom. The species' abundance was possibly under recorded, as deeper waters were not adequately sampled. J. Lott found nine immature specimens in pools left beside the Pedernales River by the flood of 2002.

Central Stoneroller - *Campostoma anomalum*

Relatively common in the Pedernales River at the LBJ Ranch District (a total of twelve were netted in May 2002). Highest number (n=7) caught in shallow sections (0.1-0.7 m) with rocky bottom at and above the lower riffles near Old Johnson School. Three specimens deposited with West Texas A&M University (WTAMU 28208-210).

Red Shiner - *Cyprinella lutrensis*

Common and widespread throughout the Pedernales River (>100 netted in May 2002). Also found in James Burns Tank at the LBJ Ranch District where it was likely stocked as forage for sport fishes.

Black-tailed Shiner - *Cyprinella venusta*

Common and widespread throughout the Pedernales River at the LBJ Ranch District. At least 146 were netted in May 2002.

European Carp – *Cyprinus carpio* (Exotic)

Observed spawning in the Pedernales River between the bridge and the White House in April 2002. One was caught with a dip net in a deeper section at the first set of riffles on May 15, 2002, but not preserved.

Mimic Shiner - *Notropis volucellus*

Very common in shallow sections (0.1-0.7 m) of the Pedernales River with rocky bottom, between the bridge at Old Johnson School and the first two riffles on Pedernales River, where a total of 42 were netted on May 15. Two collected (WTAMU 28207).

Bullhead Minnow - *Pimephales vigilax*

Common (47 caught). Recorded from two sampled sites of the Pedernales River, in shallow sections (< 0.7 m) with sandy or rocky bottom, near riffles and away from them. Not recorded in similar situations on other transects in the Pedernales.

Grey Redhorse - *Scartomyzon congestus*

Uncommon: only two caught in the Pedernales River between the bridge at the Old Johnson School and the second set of rapids (well below the H. A. Jordan Dam) at depths not exceeding 1 m. Possibly more common in unsampled deeper waters. Likely occurs above and below the sampled area.

Channel Catfish - *Ictalurus punctatus*

Uncommon, but perhaps under recorded (n=10). Eight out of ten channel catfish caught during this study were juveniles. Found throughout the Pedernales River at the LBJ Ranch District, but not in dugout ponds or Town Creek. Use of an electro-shocking device greatly increased detection of this species during a similar survey at Lake Meredith National Recreation Area (Patrikeev 2004).

Western Mosquitofish – *Gambusia affinis*

Common and widespread (>50 caught). Recorded in the Pedernales River at the LBJ Ranch District, in Town Creek, and the dugout pond at the Johnson Settlement.

Brook Silverside - *Labidesthes sicculus* (Locally introduced)

Relatively common. Previously unknown from the Pedernales River or Edwards Plateau. According to Hubbs et al. (1991) "in Texas, this species restricted to the Sabine and portions of the Red River of eastern Texas." At least fourteen individuals were netted in shallow sections of the Pedernales River (<1 m deep) at the LBJ Ranch District in May 2002. Nine additional specimens were received from J. Lott who found them stranded in small pools left by the 2002 flood, beside the Pedernales at the LBJ Ranch District. Two specimens were collected during this study, and along with the nine received from J. Lott, deposited at West Texas A&M University (WTAMU 28192-93, 28213).

The population recorded in the Pedernales River likely results from deliberate or accidental introduction. Apparently, the species is often introduced as forage for sport fishes (Page and Burr 1991). Presence of young indicates successful breeding in the area. Likely successfully established, as longevity is only about 17 months (Pflieger 1975).

Green Sunfish - *Lepomis cyanellus*

Surprisingly uncommon or rare, perhaps under recorded. Only three were caught during this study: two in the Pedernales River and one in Town Creek in the Johnson City District.

Warmouth - *Lepomis gulosus*

Probably stocked. Found only in one dugout pond (Fish Tank) at the LBJ Ranch District (n=9).

Bluegill - *Lepomis macrochirus*

Uncommon (or under recorded) in the Pedernales River, common in Town Creek in the Johnson City District, and in James Burns Tank at the LBJ Ranch District. A total of 75 were caught during this study.

Largemouth Bass - *Micropterus salmoides*

Recorded throughout the Pedernales River and in Fish Tank at the LBJ Ranch District where the species was undoubtedly stocked. One was caught in Town Creek in the Johnson City District. A total of 22 were caught in this study. Four additional specimens were received from J. Lott who collected them from pools left by the receding Pedernales River after a major flood in July 2002.

Guadalupe Bass - *Micropterus treculii*

Relatively common in the Pedernales River. A minimum of 24 were caught on five 20-m transects between the White House and the bridge at Old Johnson School. Specimens 5-15 cm long mostly caught in riffles and shallow sections at depths not exceeding 1 m. It is quite possible that larger individuals occurred in deeper waters. Probably occurs above and below the sampled area. Presence of small individuals (c. 5 cm) indicates successful reproduction.

Texas Logperch - *Percina carbonaria*

Uncommon to common (n=9). Found in four out of five sampled sections of the Pedernales River.

White Crappie - *Pomoxis annularis*

This species was not netted in the Pedernales River or elsewhere in the park in May 2002. J. Lott collected six individuals on July 3, 2002 from pools beside the Pedernales at LBJ Ranch.

Herpetofauna

Blanco and Gillespie counties support a diverse herpetofauna (75 species) including 17 species of amphibians and 58 species of reptiles (Dixon 2000). In total, only four species of amphibians were recorded in this study. Visits to potential breeding sites and incidental tadpole captures (while seining for

fishes) proved more revealing than other techniques. No amphibians were found during night road searches, under coverboards, or in pitfall traps. Employment of drift fences along with pitfall traps might increase detection of amphibian species.

Five species of turtles were caught in turtle traps or observed basking on rocks, logs, or emergent vegetation. Appendix 15 presents the results of turtle trapping efforts undertaken in this study at LYJO. One lizard species was observed in man-made structures, but none were found neither under rocks, woody debris, or coverboards, nor on cross-country hikes or while driving paved roads. One or two species of watersnakes were observed or caught during various activities by the Pedernales River and other water bodies. No snakes were found under rocks, ground litter, or coverboards, or during night road searches or daytime cross-country hikes. However, one species was photographed and another found road-killed and preserved by LYJO staff. Use of drift fences and funnel traps would possibly result in capture of additional species of lizards and snakes.

Amphibians

Blanchard's Cricket Frog – *Acris crepitans blanchardi*

Very common throughout both sections of the park, occurring along the Pedernales River, Town Creek, in flooded areas, and in all dugout ponds that held water at the time of the survey. Probably breeds throughout most of the year. Heard calling as early as March 8 and as late as November 27, choruses from May through August. Perhaps calls on warmer days throughout the year. Few individuals found at the LBJ Ranch District exhibited green dorsal stripes (see Appendix 16).

Gray Tree Frog – *Hyla versicolor*

Photographed by J. Lott at the Bus Barn, LBJ Ranch District, July 11, 2002 (Appendix 16). Few heard calling along Pedernales River on August 24, 2002.

Rio Grande Leopard Frog – *Rana berlandieri*

Common and widespread at the LBJ Ranch District where it occurred in all dugout ponds that held water at the time of survey, as well as in the dugout pond at the Johnson Settlement. Calls recorded from March through August. Many juvenile frogs and hundreds of tadpoles in the dugout ponds at the LBJ Ranch District (especially in the drying North Airstrip Tank and James Burns Tank) and in Johnson Settlement in May 2002.

Bullfrog – *Rana catesbeiana*

In the Pedernales River, Town Creek, and dugout ponds at both sites. Calling from early April. Most common along the Pedernales River and in James Burns Tank at the LBJ Ranch District. Tadpoles were collected at both sites (WTAMU 15117-18).

Reptiles

Common Snapping Turtle – *Chelydra serpentina serpentina*

Two adults were caught in the same turtle trap in the dugout pond at the Johnson Settlement on April 9, 2002. Carapace lengths 30.2 and 25.4 cm, weights 3,800 and 2,500 g, respectively. May occur in other stock tanks elsewhere on the property.

Texas Map Turtle – *Graptemys versa*

An endemic species of the Colorado River system, Texas. At least three individuals were observed basking on rocks in the mid-section of the Pedernales River at LBJ Ranch on April 9, 2002 and several (including three females) by the bridge on April 10. One male, seen hiding on the bottom of the river by the bridge, was caught by hand on the same day (carapace length 8.9 cm, weight 94 g). Twelve to fourteen were observed basking on small rocks upstream from the bridge on April 11.

Red-eared Slider – *Trachemys scripta elegans*

At least four were observed in Fish Tank at LBJ Ranch on April 9, 2002. One was caught in a turtle trap in the Pedernales on April 11 (carapace length 15.4 cm, 549 g). On the same day, up to 36 individuals were observed in ponds at LBJ Ranch (Fish Tank and James Burns Tank). Six were caught in turtle traps in James Burns Tank on May 14. One also was observed in the dugout pond at the Johnson Settlement in the period of the study.

Texas Cooter – *Pseudemys texana*

A Texas endemic. At least 45 were seen basking on three rocks below the Johnson Dam on the Pedernales River, March 9, 2002, and at least 12 basking at the same location on April 9. A juvenile was found and photographed by J. Lott, July 18, 2002, after a summer flood (Appendix 16).

Guadalupe Spiny Softshell – *Apalone spinifera guadalupensis*

A taxon endemic to the Guadalupe-San Antonio-Nueces Rivers. One was caught in a turtle trap in the Pedernales River below Johnson Dam on April 8, 2002 (carapace length = 16.1 cm, weight 494 g) where at least 10 (including two large females) were observed basking on April 9. One was caught in a seine in the Pedernales during a fish survey on May 17, 2002.

Mediterranean Gecko – *Hemidactylus turcicus* (Exotic)

Common on and inside park buildings in the Johnson City District (see Appendix 16). One desiccated individual, found in the park office by J. Lott, was preserved (WTAMU No. 15125). J. Lott also provided the photograph of this species included in Appendix 16 (taken July 17, 2002).

Diamondback Watersnake – *Nerodia rhombifer rhombifer*

One caught by the Johnson Dam on the Pedernales River on May 17, 2002. Escaped before a photo could be taken.

Water snakes (*Nerodia* sp.)

A small water snake was observed in the pond at the Johnson Settlement and a large one in James Burns Tank at the LBJ Ranch District on April 7, 2002. Also numerous sightings along the Pedernales River, e.g., on May 17, 2002. Recorded in Town Creek in November 2001. It is quite possible that most or indeed all records of unidentified water snakes were of the previous species.

Texas Brown Snake – *Storeria dekayi texana*

One was photographed at the LBJ Ranch District by J. Lott, July 11, 2002 (Appendix 16).

Texas Rat Snake – *Elaphe obsoleta lindheimerii*

A road kill was picked up by Brian Carey at the LBJ Ranch District on the way to the White House (WTAMU 15108). Possibly, this species was also seen near a chicken coop at the Johnson Settlement by NPS staff in previous years. According to R.J. O'Kennon (pers.comm.) this species was once very common at the LBJ Ranch, but our surveys did not detect it so it may be less so at present.

Mammals

Seventeen species of mammals were recorded during this study. Seven species were photographed with sensor-triggered cameras, two caught in Tomahawk traps, two in Sherman and one species in pitfall traps, two bat species were mist-netted, seven species recorded during spotlight and others observed during night road searches.

Opossum – *Didelphis virginiana*

Common. One recorded at the LBJ Ranch District during a spotlight survey on May 13, 2002. Two caught in large Tomahawk traps during the small-medium mammal survey on November 26, 2001: an immature individual was caught by a draw with thick vegetation at the Johnson Settlement and a large adult in an Ashe juniper-live oak enclosure at the LBJ Ranch District.

Cave Myotis – *Myotis velifer*

Not shown for Blanco County by Davis and Schmidly (1994) while Goetze (1998) mentioned an unspecified locality from Blanco County. One male was mistnetted in a savanna-like situation close to the small pond at the Johnson Settlement on August 22, 2002 (measurements: forearm 43 mm, foot 8 mm, ear 15 mm). Other unidentified bats were observed in the area. Perhaps a small roost exists in one of the historic buildings in LBJ park or in nearby buildings in Johnson City.

Eastern Red Bat – *Lasiurus borealis*

Probably common at both sites. Collected in Blanco and Gillespie counties according to Davis and Schmidly (1994) and Goetze (1998), but no specified locations given. Specimens from "Gillespie County" and "c. 10 miles NE from Johnson City, Blanco County" were found in the Museum of Texas Tech University. Four eastern red bats were mist-netted in the park in August 2002: a female by a dugout pond at the Johnson Settlement on August 22, 2002 and two males and a female by the Pedernales River at the LBJ Ranch District on August 24, 2002. One male that died shortly after capture is in the Angelo State University (ASU) collection which NPS is developing a collections agreement with.

Nine-banded Armadillo - *Dasypus novemcinctus*

Occurs at both sites, although more frequently seen along the Pedernales River at the LBJ Ranch District where three were seen on August 25, 2002. A remote camera at the northwest corner of the LBJ Ranch District photographed an armadillo investigating a blackbuck carcass in November 2002 (Appendix 16). This species was formerly regularly trapped and apparently shot by park rangers acting on an assumption that this was an exotic species (which it is not). No excessive armadillo burrowing was seen and therefore the reason for persecution is unclear. An exception might be made in a special case such as if an armadillo is burrowing under a historic building, but generally, the species should not be considered a nuisance.

Eastern Cottontail – *Sylvilagus floridanus*

Common in a mosaic of tree and bush patches and open habitats in Johnson Settlement. One photographed by J. Lott, May 17, 2002 (see Appendix 16). Not observed at the LBJ Ranch District, although it likely occurs in the northwestern section where patches of shrubs and trees remain.

Black-tailed Jackrabbit – *Lepus californicus*

Fairly common in both sections o the park, e.g., six in the maintenance yard of Johnson Settlement during a spotlight survey on April 4, 2002. Occurs in moderately and heavily modified open shortgrass habitats including pasture at the LBJ Ranch District and prairie restoration patches at the Johnson Settlement.

Fox Squirrel – *Sciurus niger*

Common in Johnson Settlement and at the LBJ Ranch District. At the LBJ Ranch District, observed near the hay barn, but also in trees along the Pedernales River, near buildings, and in the pecan orchard.

Photographed by J. Lott at the Johnson City District, July 2, 2002.

Pygmy Mouse – *Baiomys taylori*

Perhaps the first record for Blanco County: not shown for the county by Davis and Schmidly (1994) or by Goetze (1998). A male and a female were trapped in the same small Sherman trap in a grassy area with *Opuntia* cactus in the Johnson Settlement on November 27, 2001. Another one was caught in a pitfall trap near the longhorn enclosure in the Settlement on the same day. The latter one is in the ASU collection which NPS is developing a collections agreement with. Overall success rate for this species was 0.7/100 trap-nights (1.3/100 trap-nights with Sherman traps and 0.4/100 trap-nights with pitfalls).

(Note on how success rate was calculated: pygmy mice are a very small species that is unlikely to trigger large Sherman traps. Thus, we do not use number of trap-nights run with large Sherman traps to calculate success rate for this species. For the following species (house mouse) we use number of trap-nights run on both large and small Sherman traps, because this species was actually caught in large Sherman traps and is usually caught with smaller traps also.)

House Mouse – *Mus musculus*

One was trapped in a grassy area next to a woodpile at the LBJ Ranch District on November 26, 2001 (in ASU collection which NPS is developing a collections agreement with). Success rate: 0.5/100 trap-nights with Sherman traps.

Nutria – *Myocastor coypus* (Exotic)

Recorded in the Pedernales River and at least one dugout pond (James Burns Tank) at the LBJ Ranch District. May be temporarily present at the pond and Town Creek in the Johnson Settlement (although not seen there in 2002). A female with four juveniles was observed in James Burns Tank on the LBJ Ranch District on May 13, 2002. On several occasions nutria entered turtle traps and caused considerable damage to the traps while getting out. These are subject to removal by park rangers, e.g., a minimum of two juveniles were shot at James Burns Tank in May 2002.

Gray Fox – *Urocyon cinereoargenteus*

Uncommon or rare. One record: photographed by a remote camera set by a blackbuck carcass east of the hay barn in the northwestern section of the LBJ Ranch District (Appendix 16). B. Flowers (NPS ranger) observed one on May 15, 2003.

Ringtail – *Bassariscus astutus*

The only evidence is a photo of a trapped animal provided by park rangers (the animal was trapped at the LBJ Ranch District near the White House) in April 2003.

Raccoon – *Procyon lotor*

Common. A disease outbreak probably affected the local raccoon population early in 2002 as at least three carcasses were found at the LBJ Ranch District (two of those floating in the river) and another two by the pond at the Johnson Settlement (a total of five). A sick raccoon (that had lost almost all hair) was observed and photographed by J. Lott in July 2002. Live raccoons were also observed at both sites, often by the dugout ponds, but also near roads during spotlight surveys. Remote cameras near mixed bait of meat and canned fish photographed several individuals in April, and cameras set at carcasses of blackbuck and deer in November documented others. One was trapped in a large Tomahawk trap in Johnson Settlement on November 28. Some others might have set off other traps: Tomahawk traps used in this study were barely large enough to accommodate raccoons.

Skunk sp. – *Mephitis* or *Spilogale*

Surprisingly rare or uncommon. Skunks were not detected by spotlight surveys, live trapping, or remote cameras. The only hint of their presence was obtained on April 5, 2002, when a skunk odor was present at one site along the western section of the perimeter roads. The species most likely present is the striped skunk (*Mephitis mephitis*) but proof is required.

Domestic Cat – *Felis domesticus* (Exotic)

Domestic or perhaps feral cats were seen in Johnson Settlement on several occasions. One was caught on film by a remote camera set by mixed baits of meat and sardines in April 2002. Also observed at the LBJ Ranch District during a spotlight survey on May 13.

White-tailed Deer – *Odocoileus virginianus*

Common throughout both sections of the park. Semi-tame deer occur throughout Johnson Settlement and adjacent properties, often wandering into Johnson City. A large herd occurs at the LBJ Ranch District, often forming a large mixed herd with blackbucks in the pecan orchard. Maximum daily count for Johnson Settlement was 25 (April 6, 2002) and for LBJ Ranch: 62 (spotlight survey on May 13, 2002). Hunted at the LBJ Ranch District, perhaps selectively: no adult males observed in autumn 2002.

Blackbuck – *Antilope cervicapra* (Exotic)

Common at the Johnson Ranch where it often occurs alongside the white-tailed deer (see above). Observed moving between the LBJ Ranch District and adjacent properties. A maximum count of 30 on March 7, 2002. Hunted at the LBJ Ranch District.

POTENTIALLY OCCURRING SPECIES

In addition to the species detected in this study, some other species might be present in the park, yet there are no verified occurrences. Included here is a discussion of species undetected in this study, but presently or formerly occurring in adjacent areas or elsewhere in the two counties.

Fishes

Fish collections (Texas A&M University, Texas Natural History Collection at Austin) yielded only one additional record: a specimen of **greenthroat darter** (*Etheostoma lepidum*) collected between "dam and Hodges Ranch house at Johnson Ranch, Gillespie County" in University of Texas Collection. It is not clear whether it was collected within the current boundaries of LYJO Park. No darters were caught during seining in May 2002.

The presence of fifteen species not found in this study but included in the Fish Master List of the Study Plan (National Park Service 2000) is strictly hypothetical. Eight of these species: **black bullhead** (*Ameiurus melas*), **yellow bullhead** (*Ameiurus natalis*), **river carpsucker** (*Carpoides carpio*), **plains killifish** (*Fundulus zebrinus*), **longnose gar** (*Lepisosteus osseus*), **redbreast sunfish** (*Lepomis auritus*), **longear sunfish** (*L. megalotis*), **redear sunfish** (*L. microlophus*) and **sand shiner** (*Notropis stramineus*) are common throughout most of Texas including the Edwards Plateau, and the **Texas shiner** (*Notropis amabilis*) is endemic to the plateau. Three other species: **pirate perch** (*Aphredoderus sayanus*), **Rio Grande cichlid** (*Cichlasoma cyanoguttatum*) and **golden shiner** (*Notemigonus crysoleucas*) are native to other parts of the state, but are presently widespread due to deliberate or accidental introduction (Hubbs et al. 1991). All of the above species could possibly occur at LYJO, and their absence from the final species list presented in this report may indicate insufficient sampling effort (deeper parts of Pedernales River were not surveyed adequately, because no boat mounted electro-shocker was available to us at the time of the study). Finding of the three remaining species from the Fish Master List of the Study Plan at LYJO is

highly unlikely. The **roundnose minnow** (*Dionda episcopa*) does occur in the Edwards Plateau, but it is usually confined to headwater areas (Hubbs et al. 1991) which are not present on the park. The **spotted bass** (*Micropterus punctulatus*) and **logperch** (*Percina caprodes*) are not known from the plateau, the first being mostly an East Texas species, and the second known only from middle sections of the Red River in the northern part of the state (Hubbs et al. 1991). We recommend exclusion of these three species from the Master List.

Amphibians

Examination of collections at the Texas Natural History Collection (University of Texas, Austin) and Texas A&M University (College Station) revealed four species collected within a 10 mile radius of Johnson City and/or Stonewall (just south of the LBJ Ranch District). Those are the **red-spotted toad** (*Bufo punctatus*), **Gulf Coast toad** (*B. valliceps*), **Woodhouse's toad** (*B. woodhousii*) and **spotted chorus frog** (*Pseudacris clarkii*). However, in addition to these four, Mr. R.J. O'Kennon (pers.comm.) observed four other amphibian species on or near the Johnson Ranch over a number of years: **green toad** (*Bufo debilis*), **Strecker's chorus frog** (*Pseudacris streckeri*), **Great Plains narrowmouth toad** (*Gastrophryne olivacea*), and **Couch's spadefoot** (*Scaphiopus couchii*). Full text of Mr. O'Kennon's e-mail communication can be found in Appendix 14. According to O'Kennon, Woodhouse's toad, Strecker's chorus frog, and Great Plains narrowmouth toad were once common, while red-spotted toad, Gulf Coast toad and Couch's spadefoot were encountered infrequently, and green toad only rarely. The present study failed to prove that LYJO supports a herpetofauna as diverse as recorded by O'Kennon. Only four species of amphibians were found during our surveys or photographed/found by the park staff during the period of this study. Mr. O'Kennon is knowledgeable of the regional fauna, but the precise locations of his observations are unknown, thus some may not be from lands presently within the park. Although his records do not confirm presence of these species on the park, it is likely that some may occur there.

The Herpetological Master List of the Study Plan (National Park Service 2000) includes seven additional species: **Texas toad** (*Bufo speciosus*), **New Mexico spadefoot** (*Spea multiplicata*), **cliff chirping frog** (*Syrrhophus marnocki*), **Cope's gray tree frog** (*Hyla chrysoscelis*), **southern leopard frog** (*Rana sphenocephala*), **Texas salamander** (*Eurycea neotenes*) and **western slimy salamander** (*Plethodon albagula*). Of these, the southern leopard frog is not known to occur in the Edwards Plateau, and Cope's gray tree frog is not found in Blanco and Gillespie counties. The other five species are recorded from one or both counties (Dixon 2000). But the cliff chirping frog is mostly found in rocky habitats alongside streams, the Texas salamander occurs in springs, seeps, and small caverns, and the western slimy salamander in woodland ravines and on moist hillsides (Conant and Collins 1991). These habitat types are absent from LYJO, so those three species would not be expected in the park. Thus, we recommend excluding those five species from the Master List. Of the amphibian species identified in the Study Plan but not confirmed by this study (National Park Service 2000), only the Texas toad and New Mexico spadefoot may possibly occur in the park.

Pitfalls set along drift fences (a technique not in this study design) may reveal other amphibians to be present. However, burgeoning fire ant populations might have had a negative impact on amphibians that spend most of their life cycle on or under the ground (see discussion). Interestingly, the four anuran

species recorded in this study were mostly aquatic or arboreal species rarely venturing far from water or the safety of the trees.

Reptiles

R.J. O'Kennon (pers.comm.) observed 44 reptilian species on or near the LBJ Ranch over a number of years (full text of Mr. O'Kennon's e-mail communication can be found in Appendix 14). His observations are at best considered here as anecdotal, for a few reasons: Mr. O'Kennon did not record with certainty all locations of his observations, thus they may or may not have been on the park property; he did not collect vouchers; nor does he refer to methods used to gather the information.

Turtles

Although five species of turtles have been recorded in this study, the presence of three to four additional species is very likely. Specimens of **yellow mud turtle** (*Kinosternon flavescens*) from the vicinity of Johnson City and Stonewall are preserved in the Texas Natural History Collections (University of Texas, Austin) and Texas A&M University (College Station, Texas). Mr. Robert O'Kennon (in litt.) frequently found road-killed yellow mud turtles along State Highway 290 in the vicinity of the LBJ Ranch. He also reported two additional species rarely found on the LBJ Ranch: **stinkpot or common musk turtle** (*Sternotherus odoratus*) and **ornate box turtle** (*Terrapene ornata*). The latter species was seen only twice in six years, both times in sandy parts of the Johnson Ranch probably not within the present park boundary, but on lands still owned by the Johnson family.

The Herpetological Master List of the Study Plan (National Park Service 2000) also includes **Mississippi mud turtle** (*Kinosternon subrubrum hippocrepis*), **Cagle's map turtle** (*Graptemys caglei*), **Mississippi map turtle** (*Graptemys pseudogeographica*) and **river cooter** (*Pseudemys concinna*). While Mississippi mud turtle does occur in Blanco and Gillespie counties, ranges of the three other species lie outside the area of interest (Dixon 2000), so they are not to be included in the potential fauna of the park and should be removed from the Master List.

Lizards

No native species of lizards have been recorded in this study. This is remarkable considering that Blanco and Gillespie counties feature a diverse lizard fauna. The Texas Natural History Collections and Texas A&M University Collection contain five species of lizards from the vicinity of Johnson City and Stonewall: **Texas horned lizard** (*Phrynosoma cornutum*), **Texas spiny lizard** (*Sceloporus olivaceus*), **southern prairie lizard** (*S. undulatus*), **tree lizard** (*Urosaurus ornatus*) and **short-lined skink** (*Eumeces tetragrammus brevilineatus*). These and seven additional species were observed on or near the LBJ Ranch by Mr. Robert O'Kennon (pers. comm.) over a 25 year period. The additional species reported by O'Kennon include **Texas earless lizard** (*Cophosaurus texanus texanus*), **plateau earless lizard** (*Holbrookia lacerata lacerata*), **eastern collared lizard** (*Crotaphytus collaris collaris*), **reticulate collared lizard** (*Crotaphytus reticulatus*), **ground skink** (*Scincella lateralis*), **Texas spotted whiptail** (*Cnemidophorus gularis gularis*) and **prairie racerunner** (*C. sexlineatus viridis*). According to O'Kennon the Texas horned lizard, Texas earless lizard, plateau earless lizard, eastern collared lizard, Texas spiny lizard, southern prairie lizard, tree lizard, ground skink, and prairie racerunner were at one time common at the LBJ Ranch, while the Texas spotted whiptail occurred infrequently, and the reticulate collared lizard and short-lined skink were rare. O'Kennon (pers. comm.) reported finding >20 ground skinks at the LBJ Ranch District in July 2002, however he did not provide photographs or specimens, and thus his record remains undocumented.

Overall, O'Kennon's lizard records could be accepted as historic/probably present with two exceptions: reticulate collared lizard is endemic to the Tamaulipan thornscrub region and has never been found in the

Edwards Plateau (Dixon 2000), and the prairie racerunner is replaced in the plateau by a different subspecies: **six-lined racerunner** (*Cnemidophorus sexlineatus sexlineatus*). In addition, it appears that O'Kennon might have observed some lizard species outside the present boundaries of the park or indeed outside the LBJ Ranch. In his remarks, he refers to habitats such as "rocky pasture," "rocky prairies," and "woods along Pedernales." None of these habitats were seen in the park in 2002.

The Master Species List of the Study Plan (National Park Service 2000) lists four other lizards as potentially occurring at LYJO: **green anole** (*Anolis carolinensis*), **Great Plains skink** (*Eumeces obsoletus*), **Texas alligator lizard** (*Gerrhonotus infernalis*) and **Big Bend tree lizard** (*Urosaurus ornatus schmidti*). While the first three species are known to occur in Blanco and Gillespie counties and could occur on the park, the fourth one (Big Bend tree lizard) is a West Texas species replaced in the Edwards Plateau by *U. o. ornatus* (Dixon 2000). An appropriate correction is suggested for the Master list.

Many (although not all) lizard species described above are conspicuous species readily seen on cross-country hikes and back road drives. However, none were detected during the current study. Perhaps timing of surveys was imperfect, but fire ants may be a primary reason behind what is the apparent disappearance of many species. According to Mr. O'Kennon (in litt.), many common animals, especially reptiles, have not only decreased but have been totally extirpated since 1978 (i.e., when red imported fire ants were first reported from Johnson Ranch). He has observed fire ants eating reptilian eggs, many times just as the young snakes, lizards, and turtles were hatching. He also reported that the Texas horned lizard "was common before fire ant invasion, now very rarely seen." When horned lizards encounter fire ants and try to eat them, they are immediately stung to death and eaten by the ants (O'Kennon pers.comm.). Similar effects of fire ant invasion on amphibians and reptiles were observed in Matagorda County by Dr. J. R. Dixon (pers. comm.) where numbers of reptiles decreased three-fold in just three years.

Snakes

A thorough examination of the Texas Natural History Collections (University of Texas, Austin) and the collection at Texas A&M University (College Station, Texas) revealed eight snake species collected within a 10 miles radius from Johnson City or Stonewall: **Texas blind snake** (*Leptotyphlops dulcis*), **prairie ringneck snake** (*Diadophis punctatus arnyi*), **western coachwhip** (*Masticophis flagellum testaceus*), **Central Texas whipsnake** (*M. taeniatus*), **rough green snake** (*Opheodrys aestivus*), **Texas patchnose snake** (*Salvadora grahamiae lineata*), **ground snake** (*Sonora semiannulata*), and **western ribbon snake** (*Thamnophis proximus*). The rough green snake has been collected within Johnson City limits (TAMU, TNHC). The Central Texas whipsnake was reported seen by Mr. R. O'Kennon (pers.comm.) at the LBJ Ranch District in July 2002; however no photographs or specimens were submitted to confirm this species for LYJO, so the species can only be listed here as potentially occurring. O'Kennon also recorded the following 15 species and their relative abundance at the Johnson Ranch and vicinity over a period of 25 or so years: **northern plains rat snake** (*Elaphe emoryi emoryi* -- common), **eastern hognose snake** (*Heterodon platirhinos* -- common), **western hognose snake** (*Heterodon nasicus* -- rare, one record, 1988), **Texas night snake** (*Hypsiglena torquata jani* -- infrequent), **blotched watersnake** (*Nerodia erythrogaster transversa* -- common), **bullsnake** (*Pituophis catenifer sayi* -- common), **Texas longnose snake** (*Rhinocheilus lecontei tessellatus* -- rare, only one record, 1988), **flathead snake** (*Tantilla gracilis* -- infrequent), **blackneck garter snake** (*Thamnophis cyrtopsis* -- infrequent), **Marcy's checkered garter snake** (*Thamnophis marcianus* -- infrequent), **Texas garter snake** (*Thamnophis sirtalis annectens* -- infrequent, about 10 observed in six years), **Texas coral snake** (*Micrurus fulvius tener* -- common, but rarely seen), **broad-banded copperhead** (*Agkistrodon contortrix laticinctus* -- rare), **cottonmouth** (*Agkistrodon piscivorus* -- very rare), and **western diamondback** (*Crotalus atro*x -- common).

The Master Species List of the Study Plan (National Park Service 2000) includes seven additional snakes: **corn snake** (*Elaphe guttata)*, **western hook-nosed snake** (*Gyalopion canum*), **speckled kingsnake**

(*Lampropeltis getula holbrooki*), **desert kingsnake** (*Lampropeltis getula splendida*), **Mexican milk snake** (*Lampropeltis triangulum annulata*), **lined snake** (*Tropidoclonion lineatum*) and **rough earth snake** (*Virginia striatula*). Of these, the hook-nosed snake, desert kingsnake, Mexican milk snake, and lined snake are known from Gillespie County, and the rough earth snake from both Blanco and Gillespie counties (Dixon 2000). Some of these might be found at LYJO. On the other hand, another *Elaphe* replaces the corn snake on the Edwards Plateau: *E. emoryi*, and the speckled kingsnake is replaced by *Lampropeltis getula splendida*. The appropriate corrections should be made to the Master list.

It is quite likely that some of the above species still occur at LYJO, although many species of snakes might have declined or disappeared from this area following the fire ant invasion in 1978. O'Kennon (in litt.) reports observations of fire ants eating snake eggs and newly hatched snakes at the LBJ Ranch. A similar impact of fire ants on lizards and small mammals likely reduced prey base for snakes, which along with a lack of proper habitat and shelter may have added to the decline of terrestrial and subfossorial species of snakes in the park. The report of negative effects of fire ant invasion on amphibian and reptile numbers in Matagorda County (Dr. J. R. Dixon, pers. comm.) supports the statement that negative effects on snakes at LYJO are possible. Thus it may be difficult to confirm any of these potentially occurring species.

Funnel and pitfall traps set along drift fences (a technique not included in this study design) are very effective in capturing snakes and lizards (C. M. Duran, pers. comm.), and the future use of such equipment may detect reptilian species not recorded in the current study.

Mammals

The collection of Texas Tech University (Lubbock) contains four species of mammals collected within a 10 mile radius of Johnson City, but not recorded during the current study. These species include **hoary bat** (*Lasiurus cinereus*), **evening bat** (*Nycticeius humeralis*), **Brazilian free-tailed bat** (*Tadarida brasiliensis*), and **white-ankled mouse** (*Peromyscus pectoralis*). Of these, the Brazilian free-tailed bat was reported in a building at the LBJ Ranch District by NPS staff (B. Carey, pers. comm.), but it was not photographed or collected and thus is unconfirmed from the park. Both of the other bat species may also occur in the park, but *P. pectoralis* is a species of rocky habitats (Davis and Schmidly 1994) which are absent from the study area.

According to the Master Species List of the Study Plan (National Park Service 2000) ten additional mammal species may be thought to occur at LYJO: **red squirrel** (*Tamiasciurus hudsonicus*), **beaver** (*Castor canadensis*), **Llano pocket gopher** (*Geomys texensis*), **white-footed mouse** (*Peromyscus leucopus*), **hispid cotton rat** (*Sigmodon hispidus*), **coyote** (*Canis latrans*), **red fox** (*Vulpes vulpes*), **long-tailed weasel** (*Mustela frenata*), **fallow deer** (*Dama dama*), and **axis deer** (*Axis axis*). The Llano pocket gopher occurs in Gillespie County (Goetze 1998), but no gopher excavations were ever found anywhere in the park. Beaver, coyote, long-tailed weasel, white-footed mouse, and cotton rat were recorded from either Blanco or Gillespie County, or both (Davis and Schmidly 1994, Goetze 1998), but no beaver habitat and very little of long-tailed weasel habitat presently exists within the park. Coyotes and the introduced red fox may wander in occasionally. Axis and fallow deer are bred in many exotic game ranches throughout Central Texas and have been deliberately or accidentally introduced in many counties of the Edwards Plateau (Davis and Schmidly 1994), and thus their presence at or near the park is possible. Finally, the inclusion of red squirrel (a boreal species never recorded from Texas) is probably an erroneous reference (maybe to the fox squirrel), so the species should be removed from the park's Master Species List.

According to Davis and Schmidly (1994) and Goetze (1998) the following 28 species also occur or have

occurred in Blanco and Gillespie counties: **eastern mole** (*Scalopus aquaticus*), **silver-haired bat** (*Lasionycteris noctivagans*), **eastern pipistrelle** (*Pipistrellus subflavus*), **big free-tailed bat** *(Nyctinomops macrotis*), **desert cottontail** (*Sylvilagus audubonii*), **swamp rabbit** (*S. aquaticus*), **Mexican ground squirrel** (*Spermophilus mexicanus*), **rock squirrel** (*S. variegatus*), **Merriam's pocket mouse** (*Perognathus merriami*), **hispid pocket mouse** (*Chaetodipus hispidus*), **plains harvest mouse** (*Reithrodontomys montanus*), **Texas mouse** (*Peromyscus attwateri*), **deer mouse** (*P. maniculatus*), **white-throated woodrat** (*Neotoma albigula*), **eastern woodrat** (*N. floridana*), **Norway rat** (*Rattus norvegicus*), **roof rat** (*R. rattus*), **woodland vole** (*Microtus pinetorum*), **porcupine** (*Erethizon dorsatum*), **American mink** (*Mustela vison*), **American badger** (*Taxidea taxus*), **western spotted skunk** (*Spilogale gracilis*), **eastern spotted skunk** (*S. putorius*), **striped skunk** (*Mephitis mephitis*), **common hog-nosed skunk** (*Conepatus mesoleucus*), **river otter** (*Lutra canadensis*), **mountain lion** (*Felis concolor*), and **bobcat** (*Felis rufus*). Some of these species (especially certain bats, rodents, and skunks) may occur in the park since it is very unlikely that *Peromyscus*, *Reithrodontomys*, *Sigmodon* and *Neotoma* are entirely absent from the park. Thus, the eastern mole, silver-haired bat, eastern pipistrelle, big free-tailed bat, desert cottontail, Mexican ground squirrel, Merriam's pocket mouse, Norway rat, roof rat, and striped skunk are included in the list of possibly occurring species at LYJO. Presence of the others is not likely due to the absence of preferred habitats and overall conditions in the park and surrounding areas.

CONCLUSIONS

The results of the current inventory highlighted unsatisfactory survival conditions for terrestrial vertebrate fauna at Lyndon B. Johnson National Historical Park. Our study reveals that the park may support an impoverished vertebrate fauna, particularly due to low numbers of terrestrial species. Presently, no natural terrestrial habitats remain anywhere in the park, although some aquatic habitats (in the Pedernales River) are in better condition, despite the fact that two dams are present in the park. A lack of natural habitats results from the objectives of past ranch managers who focused on cattle ranching. To increase area available for cattle grazing, brush was cleared and exotic grasses introduced throughout the Johnson Ranch (Brandenberger 1979). In addition, exotic fire ants invaded the area around 1978 and, over the years, may have caused irreversible damage to amphibian, reptile, and small mammal populations in the area, effectively driving some of those species to local extirpation (R. O'Kennon, pers. comm.). Impact of fire ants on terrestrial vertebrates is widely known, but not very well documented (Allen et al. 1994, Lechner and Ribble 1996). Experimental studies of fire ant impacts have been initiated recently (Early and Wilkins 2003).

The mammalian fauna of the park consists primarily of easily adaptable and parkland associated species (including three exotic species) that readily thrive in anthropogenic habitats. However, many common genera expected in human-modified habitats (*Peromyscus*, *Reithrodontomys*, *Sigmodon* and *Neotoma*) were completely absent from the park. Additionally, the overall density and diversity of small mammals was extremely low in 2002 (Appendix 6): only two rodent species caught, including one exotic anthropogenous species. Success rate: 0.85/100 trap-nights (or 1.4/100 trap-nights for Sherman traps and 0.4/100 trap-nights for pitfalls). We suspect the high density of fire ants might be responsible for this phenomenon. Although many researchers agree that red imported fire ants may have a significant impact on both vertebrate and invertebrate native species (including small mammals), only a few cases are documented in scientific literature (Allen et al. 1994, Early and Wilkins 2003, Lechner and Ribble 1996).

Amphibian fauna detection was very poor: only three semi-aquatic and one arboreal species were detected, and no sub-terrestrial species (toads, spadefoot toads) found. This and a very poor fauna of terrestrial reptiles suggest that fire ants, habitat modification, and perhaps other unknown factors have decimated the terrestrial herpetofauna of the park. Of the diverse herpetofauna (75 species) reported by Dixon (2000), 11 species of amphibians and 44 species of reptiles were observed on or near the LBJ Ranch by Mr. Robert O'Kennon over a number of years (full text of Mr. O'Kennon's e-mail

communication can be found in Appendix 14.) The present study failed to find anywhere near that number of species at LYJO. Only four species of amphibians and seven species of reptiles were found during the present investigation. This failure to detect more species likely resulted from too few field days spent on the property, too many techniques used, or too few plots actually sampled. It is also quite possible that the burgeoning fire ant population has greatly reduced abundance and diversity of amphibians and reptiles at LYJO.

Dustin Perkins (NPS staff) suggested that low numbers of small mammals and herpetofauna at LYJO could result from a prolonged regional drought. However, LYJO received heavy rainfall in late June and early July 2002, resulting in extensive flooding of the Pedernales Valley. Small mammal trapping was conducted in LYJO for four months after the flooding, without a notable difference in results. Also, visits made to LYJO after the rainfall event revealed only one amphibian species not recorded on previous visits, and no new reptile species. Thus, drought is unlikely the reason for low small mammal yields. Other similar studies were carried out simultaneously in the Texas Panhandle, which also experienced a prolonged drought. Yet that work detected almost all small mammal species expected in the area, and success rate was close to 20/100 trap-nights (Patrikeev 2004). Another factor at LYJO was the complete absence of natural habitats in this historical park. Perhaps, the observed phenomenon resulted from a combination of all three discussed factors (high fire ant density, drought, and a lack of natural habitats).

The aquatic and semi-aquatic fauna of the park probably still consists of a majority of the species occurring in the Pedernales River historically. The current study detected 16 native fish species (including the Guadalupe bass, a species of concern), five native turtle species, and at least one species of water snake. It is quite possible that other native fishes, turtles, and snakes will be found in the Pedernales River and other aquatic habitats.

The Master Species Lists prepared as part of the Study Plan (National Park Service 2000) prior to this investigation indicated that LYJO could potentially hold as many as 34 species of fish, 19 amphibians, 56 reptiles, and 23 mammals. Of these, only 18 species of fishes (53%), 4 species of amphibians (21%), 9 species of reptiles (16%), and 17 species of mammals (74%) were documented during the current study. However, the Master Species List includes taxonomic errors, synonyms, some species occurring elsewhere in Blanco, Gillespie, or adjacent counties, and erroneous species reports. Thus, a modified Master Species List can be devised based on the results of this investigation and including potentially occurring species reported through related research and reviews. The modified species list for LYJO (based on this study) shows the following total taxa confirmed compared to all potentially occurring taxa, and gives the detection success rate of this survey:

Fishes – 18 confirmed of 29 potentially occurring, or 62% detected
Amphibians – 4 confirmed of 14 potentially occurring, or 29 % detected
Reptiles – 9 confirmed of 56 potentially occurring, or 16% detected
Mammals – 17 confirmed of 38 potentially occurring, or 45% detected

Some of the species on the list might have disappeared from the park following the fire ant invasion or for other reasons. Thus, the actual success rate of this study is likely higher than indicated above.

It is important to note that many taxa counted here as potentially occurring may in fact be extremely unlikely to be found on LYJO, given the prevailing habitat conditions on the park and in adjacent areas within the region. Thus, the detection rate of this study may in fact be somewhat higher for some groups, yet we do not speculate further here because the possible presence of some of those species can not be ruled out without more detailed investigation.

On the other hand, it is quite probable that the current study has left undetected a few species presently occurring in the park. This study was conducted on a conflicting schedule with a vertebrate inventory at Lake Meredith National Recreation Area and Alibates Flint Quarries National Monument (Patrikeev 2004). The latter study sites are a much larger area (18,771 ha) about 650 km from the current study site, and required a greater effort to conduct a multiple group inventory that included breeding birds. Thus, visits to LYJO were rather short and may not have covered critical spring and summer periods when detection of other species of fish, amphibians, and reptiles was possible (such as periods following heavy rains and floods).

It is notable that only tadpoles of species detected as adults in the current study were caught in seines during fish surveys. While any adult toads in the area would not breed under the unfavorable conditions prevailing during this survey, they would have been present year round, emerging after even light rains, and would have been very conspicuous on paved roads in or near the park. Although opportunistic breeders, toads (also tree frogs and true frogs) will not remain underground throughout the year as is the case with spadefoot toads or narrowmouth toads. During surveys at Lake Meredith National Recreation Area (Patrikeev 2004) under similar drought conditions, even a slightest rain or simply a humid night would bring subfossorial amphibians out. Similar behavior would have been likely on the Edwards Plateau under such similar weather conditions. These observations may bolster that our survey provided a comprehensive detection of most amphibian species present at the time of the study.

Methods used in the current study do not guarantee detection of all species that might occur in the study area. This study did not cover deeper sections of the Pedernales River where seining was infeasible, and a boat-mounted electro-shocker was not available to us at the time of the study. The methods suggested by the Study Plan (National Park Service 2000) for this study did not include the use of funnel traps set along drift fences. That method has proven very effective at other Texas CDC study sites in south Texas, e.g., San Antonio Missions National Historical Park, Padre Island National Seashore, etc. (C. M. Duran, pers. com.). An alternative method of detecting amphibians and reptiles (coverboards) failed. Coverboards almost invariably attracted fire ants.

The sampling design of the small mammal study also carried a fault. According to the Study Plan (National Park Service 2000), only twelve small mammal stations were used in the inventory, with the station locations randomly selected to represent all habitats found in the park. However, some habitats such as corn fields and cattle pastures, which predominate the landscape at LYJO, proved sterile. A slightly higher success rate was recorded in semi-natural habitats. In the investigator's opinion, small mammal surveys might have enjoyed a higher success rate if stations were set where presence of small mammals would be concentrated (creek corridor, hedgerows, brush piles, etc.) rather than randomly across the park. In addition, the practice of setting larger traps baited with meat and fish near small mammal traps almost invariably attracted scavengers that tampered with small mammal traps.

RECOMMENDATIONS

This report would not be complete without addressing what has been learned about the process and practice of doing such a study at Lyndon B. Johnson National Historical Park. Our efforts pointed out the partial inadequacy of several methods used in this study. Several suggestions can be made for any future inventory efforts or other such animal surveys at Lyndon B. Johnson National Historical Park, based on the experience gained in this study. Recommendations for improving such efforts in the future are summarized below. Also, advice on other aspects of management of the biological resources of the park is offered here.

The following are recommended for additional fish, amphibian, reptile and small mammal inventory at Lyndon B. Johnson National Historical Park: 1) Survey deeper parts of the Pedernales River with a boat-

mounted electro-shocker. 2) set up several funnel traps along with drift fences to catch additional species of reptiles and possibly amphibians and small mammals, 3) run additional small mammal stations in riverine vegetation, hedgerows, and other semi-natural habitats where animals are more likely to be detected (these habitats were sampled but effort there may not have been adequate, due to the insistence to select sampling sites randomly). No other meat- or fish-baited traps should be placed in the vicinity. Trapping should be conducted in cooler periods to avoid attracting ants. Cotton dipped in peanut butter oil should be used as a bait to discourage ants from remaining in traps, 4) additional species of bats may be found with a bat-detector. It is also highly recommended that any future inventory be conducted by a person in residence for the duration of fieldwork, or one who can otherwise focus attention on surveying for all these different animal groups.

A comprehensive study to determine the impact of fire ants on native amphibians, reptiles, small mammals, and ground nesting bird populations is highly desirable. A similar control study should be carried in a natural area near the park but where fire ants have not invaded. Fire ant control is probably essential to any faunal recovery at the park. Priority should be given to potential turtle nesting sites along the Pedernales River.

It should be noted that raccoons may have some impact on turtle nesting sites along the Pedernales River. The large raccoon population likely feeds on a variety of organisms as well as human refuse in the park and its vicinity. However, it is very likely that some raccoons also prey heavily on eggs and hatchlings of native turtles as happens elsewhere in North America where raccoon numbers are high (Earnst et al. 1994). This impact may be within normal, natural limits, or it may be above normal due to an elevated population size of raccoons, which may have a survival advantage due to the proximity of developed areas around the LBJ Ranch District. Because the park supports healthy populations of at least five species of native turtles (three of which are taxa endemic to Texas) we suggest that impact of raccoons on turtle nests should be investigated. An assessment of raccoon population size, and possibly turtle population size, would be necessary. If levels are found to be respectively abnormal (i.e. high or low) then further studies on raccoon predation of turtle nests would be recommended to determine if there is any impact. If so, then turtle nesting sites should be identified and subsequently protected.

While habitat restoration along the Pedernales River (cattle exclusion zone) on the LBJ Ranch District is already under way, we recommend a wider exclusion zone (perhaps 10 m wide) that may create a more natural vegetation corridor similar to that on the opposite bank of the Pedernales River.

Due to a paucity of federally protected areas in the biologically diverse Edwards Plateau ecoregion, consideration should be given for a greater habitat restoration effort on some areas of the property to make it more desirable to native species. Besides the Pedernales River corridor, restoration efforts should probably concentrate on parts of the park with no historic buildings or other historic values such as the junkyard, backfields at the north end of the LBJ Ranch District, pecan orchards, the longhorn pasture, and vacant lands adjacent to maintenance facilities at the Johnson City District.

A lack of proper habitat/shelter for many ground-dwelling species is among main reasons for the apparent faunal poverty of the park. Presently, logs and other woody debris are piled up and regularly burned by park maintenance staff. It may be recommended that fallen woody debris be left alone, or at least moved to where it does not conflict with esthetic goals of the park and not simply piled up in only a few points. Cutting down snags and unnecessary mowing should also be discouraged.

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APPENDIX 1. Description of fish sampling transects/stations.

1) Shallow sections (0.1-0.5 m) with rocky bottom from the Park Road 49 bridge to the lower set of riffles on Pedernales River, May 15.
2) Shallow sections (0.1-0.7 m) of Pedernales River with rocky bottom from the lower riffles to the first large water cypress, May 15.
3) Shallow and moderately deep sections (0.3-1.0 m) of Pedernales River with rocky and sandy bottom from the first cypress to the second large set of riffles, May 16.
4) Moderately deep sections (0.3-1.3 m) of Pedernales River with rocky and sandy bottoms below the first [H. A. Jordan] dam (upstream from the bridge), May 17.
5) Shallow sections (0.1-0.5 m) of Pedernales River with sandy bottom below the Johnson dam adjacent to the White House, May 17.
6) Moderately deep (0.3-0.7 m) sections of northeastern-most dugout pond (James Burns Tank) with murky and algae-blooming water and muddy bottom at LBJ Ranch, May 15.
7) Moderately deep (0.6-1.2 m) sections, with clear water but considerable algae growth, of a dugout pond (Fish Tank) adjacent to the perimeter road in the northeast section of LBJ Ranch, May 15.
8) The deep dugout pond with muddy bottom, clear water and a considerable algae growth in Johnson Settlement, May 16.
9) Shallow to deep sections (0.1-1.3 m) of Town Creek in Johnson Settlement, sandy and rocky bottom, almost no flow, May 16.

APPENDIX 2. Coordinates and elevation of coverboard stations.

Stations LBJ-1 through LBJ-12 were set out in March, 2002. Stations LBJ-13 through LBJ-20 were set out in November 2002 at the request of NPS (Brian Carey).

Coverboard Code	Latitude	Longitude	Elevation (m)
LBJ-1	N30°16.5049'	W098°24.9231'	368
LBJ-2	N30°16.5417'	W098°24.9061'	366
LBJ-3	N30°16.4821'	W098°24.8245'	364
LBJ-4	N30°16.5139'	W098°25.0838'	375
LBJ-5	N30°14.4480'	W098°36.9228'	445
LBJ-6	N30°14.4411'	W098°36.6989'	438
LBJ-7	N30°14.2772'	W098°37.0762'	438
LBJ-8	N30°15.7293'	W098°37.6441'	467
LBJ-9	N30°15.2871'	W098°37.4145'	465
LBJ-10	N30°15.6469'	W098°37.2954'	461
LBJ-11	N30°15.6962'	W098°37.1987'	456
LBL-12	N30°15.7284'	W098°37.5180'	461
LBJ-13	N30°16.5110'	W098°24.8064'	359
LBJ-14	N30°16.4632'	W098°25.0616'	371
LBJ-15	N30°16.2331'	W098°25.0533'	366
LBJ-16	N30°16.1771'	W098°24.9984'	371
LBJ-17	N30°14.2630'	W098°36.6858'	422
LBJ-18	N30°14.2378'	W098°36.9143'	427
LBJ-19	N30°14.7196'	W098°37.2019'	439
LBJ-20	N30°14.9296'	W098°37.3180'	444

APPENDIX 3. Coordinates of turtle traps.

Trap code	Latitude	Longitude
LBJ-1	N30°15.7040'	W098°37.3947'
LBJ-2	N30°15.6340'	W098°37.2627'
LBJ-3	N30°14.2867'	W098°37.1880'
LBJ-4	N30°14.2379'	W098°36.9843'
LBJ-5	N30°14.4044'	W098°36.5133'
LBJ-6	N30°15.6994'	W098°37.3880'
LBJ-7	N30°16.4961'	W098°24.7678'

APPENDIX 4. Coordinates and elevation of small-medium mammal stations (SMS).

Station code	Latitude	Longitude	Elevation (m)
SMS-1	N30°16.4957'	W098°24.8062'	360.9
SMS-2	N30°16.4821'	W098°24.8866'	371.2
SMS-3	N30°16.4469'	W098°24.9243'	366.4
SMS-4	N30°16.4773'	W098°25.0197'	370.2
SMS-5	N30°16.3202'	W098°25.0743'	367.6
SMS-6	N30°14.4491'	W098°36.4833'	424.5
SMS-7	N30°14.5978'	W098°37.2244'	455.1
SMS-8	N30°14.7639'	W098°37.2262'	440.2
SMS-9	N30°15.7094'	W098°37.3613'	448.6
SMS-10	N30°15.7281'	W098°37.4883'	451.2
SMS-11	N30°15.7502'	W098°37.6272'	457.7
SMS-12	N30°15.6926'	W098°37.7867'	473.1

APPENDIX 5. Description and location of small mammal stations (SMS).

Johnson City District (Blanco County)

1) Riverine vegetation by a draw, trees and vines;
2) Tallgrass prairie restoration site;
3) Thickets by a draw;
4) Shortgrass area with *Opuntia* cactus;
5) Grassy area along the fence of longhorn enclosure.

LBJ Ranch District (Gillespie County)

6) Along Pedernales River by water cypress;
7) Cornfield with small corn plants;
8) Cornfield with small corn plants;
9) Open grazed area with a log pile near a dugout pond;
10) Grassy junkyard with few junipers and live oaks;
11) Fenced Ash's juniper/live oak area;
12) Grassy area with live-oaks close to maintenance buildings.

APPENDIX 6. Results of small mammal trapping in Lyndon B. Johnson NHP, November 2002 (totals).

Traps: 312 trap-nights (104 trap-nights/Tomahawks and 208 trap-nights/Sherman). Pitfalls: 260 trap-nights.

Scientific Name	Common Name	Johnson City District					LBJ Ranch District							Total
		1	2	3	4	5	6	7	8	9	10	11	12	
Didelphis virginiana	Opossum	1										1		**2**
Procyon lotor	Raccoon	1												**1**
Baiomys taylori	Pygmy Mouse				2	1								**3**
Mus musculus	House Mouse									1				**1**

APPENDIX 7. Small Mammal Trapping Forms.

Date: November 24, 2002
Remarks: Overcast. Cool.
Legend: LaTo – Large Tomahawk, SmTo – Small Tomahawk, LaSh – Large Sherman, SmSh – Small Sherman, PiFa – Pit-Fall trap. * - collected.

Small Mammal Station No. (SMS)	Trap Type	Opossum	Raccoon	Pygmy Mouse	House Mouse					Comments
SMS-9	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-10	LaTo									LaTo knocked down, but bait is intact
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-11	LaTo									Ants in 2 SmSh
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-12	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									

Date: November 25, 2002
Remarks: A cold front have moved in. Cloudy, cool (+12 to +14^{o}C)
Legend: LaTo – Large Tomahawk, SmTo – Small Tomahawk, LaSh – Large Sherman, SmSh – Small Sherman, PiFa – Pit-Fall trap. * - collected.

Small Mammal Station No. (SMS)	Trap Type	Opossum	Raccoon	Pygmy Mouse	House Mouse					Comments
SMS-1	LaTo									No bait in LaTo, SmTo and 1 SmSh; ants
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-2	**LaTo**									No sardines in SmTo
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-3	**LaTo**									No bait in LaTo/SmTo Three SmSh Knocked down by deer
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-4	LaTo									Ants
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-5	**LaTo**									Ants all over the bait in all six traps
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-6	**LaTo**									
	SmTo									
	LaSh									
	SmSh									
	PiFa									

Small Mammal Station No. (SMS)	Trap Type	Opossum	Raccoon	Pygmy Mouse	House Mouse					Comments
SMS-7	**LaTo**									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-8	**LaTo**									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-9	**LaTo**									Ants on bait in all six traps
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-10	**LaTo**									Meat disappeared from LaTo (closed), SmTo closed, ants
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-11	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-12	LaTo									Bait in 1 SmSh eaten; ants
	SmTo									
	LaSh									
	SmSh									
	PiFa									

Date: November 26, 2002
Remarks: Heavy rain at night. Cool. Probably +6 to +8°C.
Legend: LaTo – Large Tomahawk, SmTo – Small Tomahawk, LaSh – Large Sherman, SmSh – Small Sherman, PiFa – Pit-Fall trap. * - collected.

Small Mammal Station No. (SMS)	Trap Type	Opossum	Raccoon	Pygmy Mouse	House Mouse					Comments
SMS-1	LaTo	1								No bait in SmTo
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-2	**LaTo**									LaTo – no bait, SmTo – missing. LaSh and 1 SmSh closed, but empty
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-3	**LaTo**									SmTo knocked down
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-4	**LaTo**									LaTo, SmTo closed, empty
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-5	**LaTo**									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-6	**LaTo**									
	SmTo									
	LaSh									
	SmSh									
	PiFa									

Small Mammal Station No. (SMS)	Trap Type	Opossum	Raccoon	Pygmy Mouse	House Mouse					Comments
SMS-7	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-8	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-9	LaTo									
	SmTo									
	LaSh				1*					
	SmSh									
	PiFa									
SMS-10	LaTo									LaTo, SmTo closed, empty
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-11	LaTo	1								
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-12	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									

Date: November 27, 2002
Remarks: Overcast, cool. +6to +8^{o}C.
Legend: LaTo – Large Tomahawk, SmTo – Small Tomahawk, LaSh – Large Sherman, SmSh – Small Sherman, PiFa – Pit-Fall trap. ***** - collected.

Small Mammal Station No. (SMS)	Trap Type	Opossum	Raccoon	Pygmy Mouse	House Mouse					Comments
SMS-1	LaTo									LaTo, SmTo, 2 SmSh closed, empty
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-2	**LaTo**									LaTo closed, empty
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-3	**LaTo**									LaTo, SmTo, LaSh closed empty
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-4	**LaTo**									Caught in the same SmSh
	SmTo									
	LaSh									
	SmSh			2						
	PiFa									
SMS-5	**LaTo**									
	SmTo									
	LaSh									
	SmSh									
	PiFa			1*						
SMS-6	**LaTo**									
	SmTo									
	LaSh									
	SmSh									
	PiFa									

Small Mammal Station No. (SMS)	Trap Type	Opossum	Raccoon	Pygmy Mouse	House Mouse					Comments
SMS-7	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-8	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-9	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-10	LaTo									SmTo closed, empty. LaTo knocked down
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-11	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-12	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									

Date: November 28, 2002
Remarks: Clear, but cool (+4 to +6^{o}C)
Legend: LaTo – Large Tomahawk, SmTo – Small Tomahawk, LaSh – Large Sherman, SmSh – Small Sherman, PiFa – Pit-Fall trap. * - collected.

Small Mammal Station No. (SMS)	Trap Type	Opossum	Raccoon	Pygmy Mouse	House Mouse					Comments
SMS-1	LaTo		1							SmTo, three SmSh closed, empty
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-2	**LaTo**									LaTo, two SmSh closed, empty
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-3	**LaTo**									Tow SmSh, LaSh closed, SmTo open, but no bait
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-4	**LaTo**									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-5	**LaTo**									LaTo closed, empty
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-6	**LaTo**									No bait in SmTo, one SmSh closed, empty
	SmTo									
	LaSh									
	SmSh									
	PiFa									

Small Mammal Station No. (SMS)	Trap Type	Opossum	Raccoon	Pygmy Mouse	House Mouse					Comments
SMS-7	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-8	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-9	LaTo									LaTo probably stepped on by cattle
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-10	LaTo									
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-11	LaTo									No bait in SmTo
	SmTo									
	LaSh									
	SmSh									
	PiFa									
SMS-12	LaTo									1 SmSh closed, empty
	SmTo									
	LaSh									
	SmSh									
	PiFa									

APPENDIX 8. Coordinates and elevation of locations surveyed with camera sets.

Camera code	Latitude	Longitude	Elevation (m)
CAM-1	N30°16.1694'	W098°25.0438'	370.2
CAM-2	N30°16.4340'	W098°24.9262'	376
CAM-3	N30°16.4834'	W098°24.8199'	356.8
CAM-4	N30°14.5156'	W098°36.7537'	429.6
CAM5	N30°14.3108'	W098°37.0125'	428.6
CAM-6	N30°15.7394'	W098°37.4948'	460.4
CAM-7	N30°15.7552'	W098°37.6718'	466.4
CAM-8	N30°16.2567'	W098°24.9421'	368.3
CAM-9	N30°15.6904'	W098°37.1959'	446.2
CAM-10	N30°15.7881'	W098°37.6366'	461.8
CAM-11	N30°14.2599'	W098°36.6786'	426.9

APPENDIX 9. Results of 2002 Camera Surveys.

Seven Trailmaster cameras with TM-550 remote sensors were set in Lyndon B. Johnson NHP in early April 2002 and four in late November-early December 2002.

Camera Code	Site	Dates	Species Recorded							Total
			Opossum	Armadillo	Gray Fox	Raccoon	Domestic cat	White-tailed Deer	Blackbuck	
CAM-1	Johnson Settlement	April 6-11, 2002	1			1				**2**
CAM-2	Johnson Settlement	April 6-11, 2002				2	1			**3**
CAM-3	Johnson Settlement	April 6-11, 2002								**0**
CAM-4	LBJ Ranch	April 6-11, 2002	1			1				**2**
CAM-5	LBJ Ranch	April 6-11, 2002	1					5	1	**7**
CAM-6	LBJ Ranch	April 6-11, 2002				1		1		**2**
CAM-7	LBJ Ranch	April 6-11, 2002								**0**
CAM-8	Johnson Settlement	Nov 27-early Dec 2002				1		1		**2**
CAM-9	LBJ Ranch	Nov 27-early Dec 2002	1			1				**2**
CAM-10	LBJ Ranch	Nov 27-early Dec 2002	1	1	1					**3**
CAM-11	LBJ Ranch	Nov 27-early Dec 2002	1							**1**
Totals			**6**	**1**	**1**	**7**	**1**	**7**	**1**	**24**

APPENDIX 10. Results of Spotlight Surveys.

Route	Length	Date	Time (00 hrs.)	Species Recorded						Total
				Opossum	Raccoon	Domestic cat	Black-tailed Jackrabbit	White-tailed Deer	Blackbuck	
Johnson Settlement	1.8 km	4-April	2125-2210				6	12		**18**
LBJ Ranch	6 km	5-April	2220-2246		1		2	1	4	**8**
LBJ Ranch	6 km	13-May	2100-2205	1	1	1		62	13	**78**
Total				**1**	**2**	**1**	**8**	**75**	**17**	**104**

APPENDIX 11. List of vertebrates recorded in Lyndon B. Johnson National Historical Park in 2002.

Legend: S – specimen, P – photo record, + - recorded, but no physical/photo records, ? – observed, nesting suspected; ** - new county records.

Fishes

Scientific Name	Common Name	Documentation Type
Campostoma anomalum	Central Stoneroller	S
Cyprinella lutrensis	Red Shiner	S
Cyprinella venusta	Black-tailed Shiner	S
Cyprinus carpio	European Carp	+
Dorosoma cepedianum	American Gizzard Shad	S
Gambusia affinis	Western Mosquitofish	S
Ictalurus punctatus	Channel Catfish	S
*Labidesthes sicculus***	Brook Silverside	S
Lepomis cyanellus	Green Sunfish	S
Lepomis gulosus	Warmouth	S
Lepomis macrochirus	Bluegill	S
Micropterus salmoides	Largemouth Bass	S
Micropterus treculii	Guadalupe Bass	S
Notropis volucellus	Mimic Shiner	S
Percina carbonaria	Texas Logperch	S
Pimephales vigilax	Bullhead Minnow	S
Pomoxis annularis	White Crappie	S
Scartomyzon congestus	Grey Redhorse	S

Amphibians

Scientific Name	Common Name	Documentation Type
Acris crepitans blanchardi	Blanchard's Cricket Frog	P
Hyla versicolor	Gray Tree Frog	S
Rana berlandieri	Rio Grande Leopard Frog	P
Rana catesbeiana	Bullfrog	P, S

Reptiles

Scientific Name	Common Name	Documentation Type
Apalone spinifera guadalupensis	Guadalupe Spiny Softshell	P
Chelydra serpentina serpentina	Common Snapping Turtle	P
Elaphe obsoleta lindheimerii	Texas Rat Snake	S

Scientific Name	Common Name	Documentation Type
Graptemys versa	Texas Map Turtle	P
Hemidactylus turcicus	Mediterranean Gecko	S
Nerodia rhombifer rhombifer	Diamondback Water Snake	+
Pseudemys texana	Texas Cooter	P
Storeria dekayi texana	Texas Brown Snake	P
Trachemys scripta elegans	Red-eared Slider	P

Birds*

* Birds were not targeted in the current study. These were observed in the course of carrying out work on other animal groups.

Scientific Name	Common Name
Actitis macularia	Spotted Sandpiper
Aphelocoma californica	Western Scrub Jay
Ardea herodias	Great Blue Heron
Bubo virginianus	Great Horned Owl
Bubulcus ibis	Cattle Egret
Butorides striatus	Green Heron
Cardinalis cardinalis	Northern Cardinal
Cathartes aura	Turkey Vulture
Ceryle halcyon	Belted Kingfisher
Chaetura pelagica	Chimney Swift
Charadrius vociferus	Killdeer
Chondestes grammacus	Lark Sparrow
Columbina inca	Inca Dove
Coragyps atratus	Black Vulture
Corvus brachyrhynchos	American Crow
Cyanocitta cristata	Blue Jay
Falco sparverius	American Kestrel
Hirundo pyrrhonota	Cliff Swallow
Hirundo rustica	Barn Swallow
Lanius ludovicianus	Loggerhead Shrike
Meleagris gallopavo	Wild Turkey
Melospiza melodia	Song Sparrow
Mimus polyglottos	Northern Mockingbird
Molothrus ater	Brown-headed Cowbird
Otus asio	Eastern Screech-Owl
Pandion haliaetus	Osprey
Parus bicolor	Tufted Titmouse
Parus carolinensis	Carolina Chickadee
Passer domesticus (exotic)	House Sparrow
Passerina ciris	Painted Bunting
Phalacrocorax auritus	Double-crested Cormorant

Scientific Name	Common Name
Picoides scalaris	Ladder-backed Woodpecker
Polyborus plancus (*Caracara cheriway*)	Crested Caracara
Sayornis phoebe	Eastern Phoebe
Sturnella sp.	Meadowlark
Sturnus vulgaris (exotic)	European Starling
Thryomanes bewickii	Bewick's Wren
Thryomanes ludovicianus	Carolina Wren
Troglodytes aedon	House Wren
Turdus migratorius	American Robin
Tyrannus forficatus	Scissor-tailed Flycatcher
Zenaida asiatica	White-winged Dove
Zenaida macroura	Mourning Dove

Mammals

Scientific Name	Common Name	Documentation Type
Antilope cervicapra	Blackbuck	P
*Baiomys taylori***	Pygmy Mouse	P, S
Bassariscus astutus	Ringtail	P
Dasypus novemcinctus	Nine-banded Armadillo	P
Didelphis virginiana	Opossum	P
Felis domesticus	Domestic Cat	P
Lasiurus borealis	Eastern Red Bat	P, S
Lepus californicus	Black-tailed Jackrabbit	+
Mephitis sp. or *Spilogale* sp.	Skunk sp.	+
Mus musculus	House Mouse	S
Myocastor coypus	Nutria	+
Myotis velifer	Cave Myotis	P
Odocoileus virginianus	White-tailed Deer	P
Procyon lotor	Raccoon	P
Sciurus niger	Fox Squirrel	P
Sylvilagus floridanus	Eastern Cottontail	+
Urocyon cinereoargenteus	Gray Fox	P

APPENDIX 12. List of vertebrates collected in Lyndon B. Johnson National Historical Park in 2002.

Legend: ASU – Angelo State University (San Angelo, Texas), WTAMU – West Texas A&M University (Canyon, Texas). Three mammal specimens at ASU have not yet been numbered pending development of a collections agreement between NPS and that institution.

Scientific Name	Common Name	Number of specimens collected by MP	Number of specimens received from NPS staff	Total	Location and number assigned
Fishes		**52**	**26**	**78**	**WTAMU**
Campostoma anomalum	Central Stoneroller	3		3	28208-210
Cyprinella lutrensis	Red Shiner	12		12	28197-200
Cyprinella venusta	Black-tailed Shiner	8		8	28201-05
Dorosoma cepedianum	American Gizzard Shad	1	9	10	28176, 28211
Gambusia affinis	Western Mosquitofish	4		4	28190-91
Ictalurus punctatus	Channel Catfish	3		3	28188-89
Labidesthes sicculus	Brook Silverside	2	7	9	28192-93, 28213
Lepomis cyanellus	Green Sunfish	1		1	28177
Lepomis gulosus	Warmouth	3		3	28181-82, 28212
Lepomis macrochirus	Bluegill	3		3	28178-80
Micropterus salmoides	Largemouth Bass	3	4	7	28185-87, 28216
Micropterus treculii	Guadalupe Bass	2		2	28183-84
Notropis volucellus	Mimic Shiner	2		2	28207
Percina carbonaria	Texas Logperch	2		2	28194-95
Pimephales vigilax	Bullhead Minnow	2		2	28206, 28214
Pomoxis annularis	White Crappie		6	6	28215
Scartomyzon congestus	Grey Redhorse	1		1	28196
Amphibians		**8**		**8**	**WTAMU**
Rana berlandieri (tadpoles)	Rio Grande Leopard Frog	6			15119-124
Rana catesbeiana (tadpoles)	Bullfrog	2			15117-18
Reptiles			**2**		**WTAMU**
Elaphe obsoleta lindheimerii	Texas Rat Snake		1		15108
Hemidactylus turcicus	Mediterranean Gecko		1		15125
Mammals		**3**		**3**	**ASU**
Baiomys tailori	Pygmy Mouse	1			Unavailable
Lasiurus borealis	Red Bat	1			Unavailable
Mus musculus	House Mouse	1			Unavailable

APPENDIX 13. Results of fish surveys conducted in Lyndon B. Johnson National Historical Park in May 2002.

Scientific Name	Common Name	LBJ Ranch District							Johnson City District		Total
		Pedernales River					Ponds				
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Campostoma anomalum	Central Stoneroller	1	7		2	2					**12**
Cyprinella lutrensis	Red Shiner	27	24	55	32	1	15				**154**
Cyprinella venusta	Black-tailed Shiner	30	68	32	14	2					**146**
Dorosoma cepedianum	American Gizzard Shad			1							**1**
Gambusia affinis	Western Mosquitofish	1				11			23	17	**52**
Ictalurus punctatus	Channel Catfish	1*	4*	2	3*						**10**
Labidesthes sicculus	Brook Silverside		1	8	1	4					**14**
Lepomis cyanellus	Green Sunfish			1		1				1	**3**
Lepomis gulosus	Warmouth						9				**9**
Lepomis macrochirus	Bluegill		1	1	2	8	47	1		15	**75**
Micropterus salmoides	Largemouth Bass	1		1	1	9		9		1	**22**
Micropterus treculii	Guadalupe Bass	6	3	2	1	12					**24**
Notropis volucellus	Mimic Shiner	21	21	1							**43**
Percina carbonaria	Texas Logperch		2	2	1	4					**9**
Pimephales vigilax	Bullhead Minnow		12			35					**47**
Scartomyzon congestus	Grey Redhorse		2								**2**
16 species		88	145	106	57	89	71	10	23	34	**623**

* - juveniles

APPENDIX 14. Text of e-mail message from Mr. Robert J. O'Kennon from September 10th, 2003.

Michael,
Yes, the fireants are certainly the reason a lot of animals are disappearing. From the time I arrived at our own ranch west of Fredricksburg in 1978 until recently, many common animals and especially herps have not only decreased but have been totally extirpated. I have seen fireants eating leathery herps' eggs many, many times usually just as the snakes, lizards and turtles are just hatching. When horned lizards encounter fireants and try to eat them, they're immediately stung to death and eaten. I've even seen young deer (fawn) being eaten alive by thousands of fireants. It's the single most serious problem in the Hill Country. I remember Lady Bird complaining about the ants way back when they first became well established. Last week at the LBJ Nat'l Grasslands in Wise Co., north of Fort Worth (where I'm doing a floristic survey) I observed fireants devouring tadpoles that had gotten into shallow water. Every pond margin is now infested with those things...I get stung every visit. there can be no question that they have made a huge impact on the herps at the Johnson Ranch and every place around there. And no one seems to know what to do, and nothing is being done.
Bob

Here is my list from the LBJ Ranch and its environs and a few from the Johnson City site. I hope the names haven't changed too much since then:

<u>Herps of LBJ Parks Gillespie/Blanco co. Texas</u>
Toads:
Bufo debilis rare
Bufo punctatus infreq
Bufo valliceps infreq
Bufo woodhouseii common
Frogs:
Acris crepitans blanchardi abundant
Hyla versicolor infreq
Pseudacris streckeri common
Gastrophryne olivacea common
Scaphiopus couchii infreq
Rana berlandieri common
Rana catesbeiana infreq
Turtles:
Graptemys versa rare two in pond across hwy 290 from Park
Pseudemys texana infreq
Trachemys scripta elegans common
Terrapene ornata rare in sandy part of ranch saw two in six years
Kinosternon flavescens common as roadkill along 290
Sternotherus odoratus rare
Trionyx spiniferus pallidus common in Pedernales at ranch house
Lizards:
Hemidactylus turcicus becoming quite common in houses in Johnson City
Cophosaurus texanus common
Crotaphytus collaris common
Crotaphytus reticulatus very rare found a pair in a rocky pasture just west of the ranch in 1988
Holrookia lacerata common
Phrynosoma cornutum was common before fire ant invasion, now very rarely seen

Sceloperus olivaceus common in almost every tree on the ranch
Sceloperus poinsettii common in granite hills just north of ranch
Sceloperus undulatus consobrinus common on rocky prairies
Urosaurus ornatus common in trees and on rocks along the Pedernales
Eumeces tetragrammus brevineatus rare in woods along Pedernales
Scincella lateralis abundant in woods throughout
Cnemidophorus gularis infreq
Cnemidophorus sexlineatus viridis common
Snakes:
Leptophlops dulcis rarely seen, probably common
Diadophus punctatus infreq
Elaphe guttata emoryi common
Elaphe obsoleta lindheimeri very common
Heterodon platyrhinos common
Heterodon nasius rare one on ranch in back pasture 1988
Hypsiglena torquata infreq
Lampropeltis never saw a kingsnake on the property, but plenty elsewhere close by in the county
Masticophis flagellum testaceus very common
Masticophis taeniatus infreq
Nerodia erythrogaster transversa common in Pedernales
Nerodia rhombifera common in Pedernales
Opheodrys aestivalis majalis common
Pituophis melanoleucus sayi common
Rhinocheilus lecontei tessellatus rare saw one on ranch in 1988
Salvadora grahamiae lineata rare saw one in 1988
Tantilla gracilis infreq Thamnophis cyrtopsis infreq
Thamnophis marcianus infreq
Thamnophis proximus rubrilineatus common in river, creeks and ponds
Thamnophis sirtalis anectens infreq saw about ten in six years, at time was new for Gillespie Co.
Micrurus fulvius tenere common, but rarely seen
Agkistrodon contortrix latinctus I saw very few, but reported by many
Agkistrodon piscivorus very rare saw one in the Pedernales at road crossing
Crotalus atrox common
Crotalus molossus rare I never saw one, but others have reported it just north of the ranch
.....
Robert J. O'Kennon
Vice Chairman
Botanical Research Institute of Texas
509 Pecan Street
Fort Worth, Texas 76102 U.S.A.

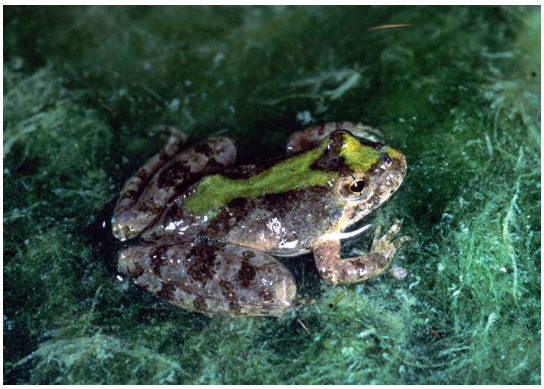
APPENDIX 15. Results of turtle trapping in Lyndon B. Johnson NHP (April-May 2002).

Trap code	Species			Survey dates
	Snapping Turtle	Red-eared Slider	Guadalupe Spiny Softshell	
LBJ-1				April 7-11, 2002
LBJ-2				April 7-11, 2002
		6		May 13, 2002
LBJ-3		1	1	April 7-11, 2002
LBJ-4				April 7-11, 2002
LBJ-5				April 7-11, 2002
LBJ-6	2			April 7-11, 2002
LBJ-7				April 7-11, 2002
Total	**2**	**7**	**1**	

APPENDIX 16. Photographic Vouchers.

Amphibians

Blanchard's Cricket Frog (*Acris crepitans blanchardi*) Green-backed form
LBJ Ranch (Gillespie County). April 2002. Photo by Michael Patrikeev



Gray Tree Frog (*Hyla versicolor*)
LBJ Ranch (Gillespie County). July 2002. Photo by Jason Lott

Rio Grande Leopard Frog (*Rana berlandieri*)
LBJ Ranch (Gillespie County). May 2002. Photo by Michael Patrikeev

Bullfrog (*Rana catesbeiana*)
Johnson Settlement (Blanco County). April 2002. Photo by Michael Patrikeev

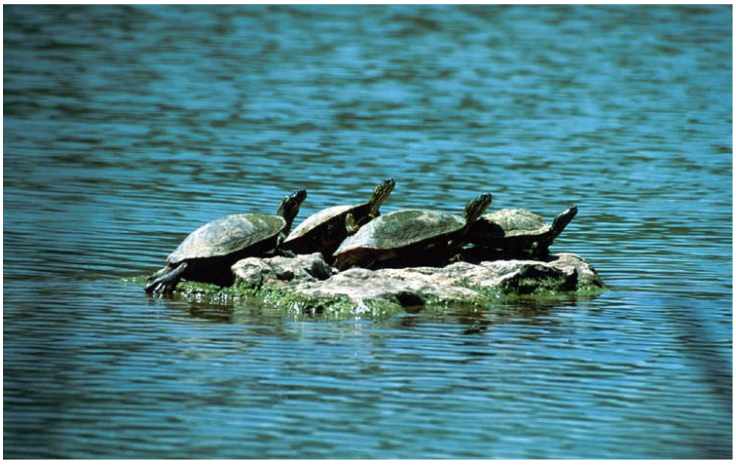
Reptiles

Common Snapping Turtle (*Chelydra serpentina serpentina*)
Johnson Settlement (Blanco County). April 2002. Photo by Michael Patrikeev

Texas Map Turtle (*Graptemys versa*)
Pedernales River at LBJ Ranch (Gillespie County). April 2002. Photo by Michael Patrikeev

Red-eared Slider (*Trachemys scripta elegans*)
Pedernales River at LBJ Ranch (Gillespie County). April 2002. Photo by Michael Patrikeev

Texas Cooter (*Pseudemys texana*) basking adults
Pedernales River at LBJ Ranch (Gillespie County). April 2002. Photo by Michael Patrikeev
Note: the rightmost turtle is a female Texas Map Turtle (*Graptemys versa*)



Texas Cooter (*Pseudemys texana*) juvenile.
Pedernales River at LBJ Ranch District (Gillespie County). July 2002. Photo by Jason Lott

Guadalupe Spiny Softshell (*Apalone spinifera guadalupensis*)
Pedernales River at LBJ Ranch (Gillespie County). April 2002. Photo by Michael Patrikeev

Mediterranean Gecko (*Hemidactylus turcicus*)
Johnson City District (Blanco County). July 2002. Photo by Jason Lott

Texas Brown Snake (*Storeria dekayi texana*)
LBJ Ranch District (Gillespie County). July 2002. Photo by Jason Lott

Mammals

Opossum (*Didelphis virginiana*
Johnson Settlement (Blanco County). November 2002. Photo by Michael Patrikeev

Racoon (*Procyon lotor*) and Opossum (*Didelphis virginiana*)
Johnson Settlement (Blanco County). March 2002.

Cave Myotis (*Myotis velifer*)
Johnson Settlement (Blanco County). August 2002. Photo by Michael Patrikeev

Eastern Red Bat (*Lasiurus borealis*) Male and female
LBJ Ranch (Gillespie County). August 2002. Photo by Michael Patrikeev

Nine-banded Armadillo (*Dasypus novemcinctus*)
LBJ Ranch District (Gillespie County). November 2002.

Eastern Cottontail (*Sylvilagus floridanus*) Johnson City District (Blanco County). May 2002. Photo by Jason Lott

Fox Squirrel (*Sciurus niger*) Johnson City District (Blanco County). July 2002. Photo by Jason Lott

Pygmy Mouse (*Baiomys taylori*)
Johnson Settlement (Blanco County). November 2002. Photo by Michael Patrikeev

Gray Fox (*Urocyon cinereoargenteus*)
LBJ Ranch District (Gillespie County). November 2002.

Ringtail (*Bassariscus astutus*) LBJ Ranch (Gillespie County). April 2003. Photo by USNPS

Trapped Raccoon (*Procyon lotor*)
Johnson Settlement (Blanco County). November 2002. Photo by Michael Patrikeev

Domestic cat (*Felis domesticus*) Johnson Settlement (Blanco County). April 2002.

White-tailed Deer (*Odocoileus virginianus*)
Johnson Settlement (Blanco County). November 2002. Photo by Michael Patrikeev

Blackbuck (*Antilope cervicapra*)
LBJ Ranch (Gillespie County). November 2002. Photo by Michael Patrikeev