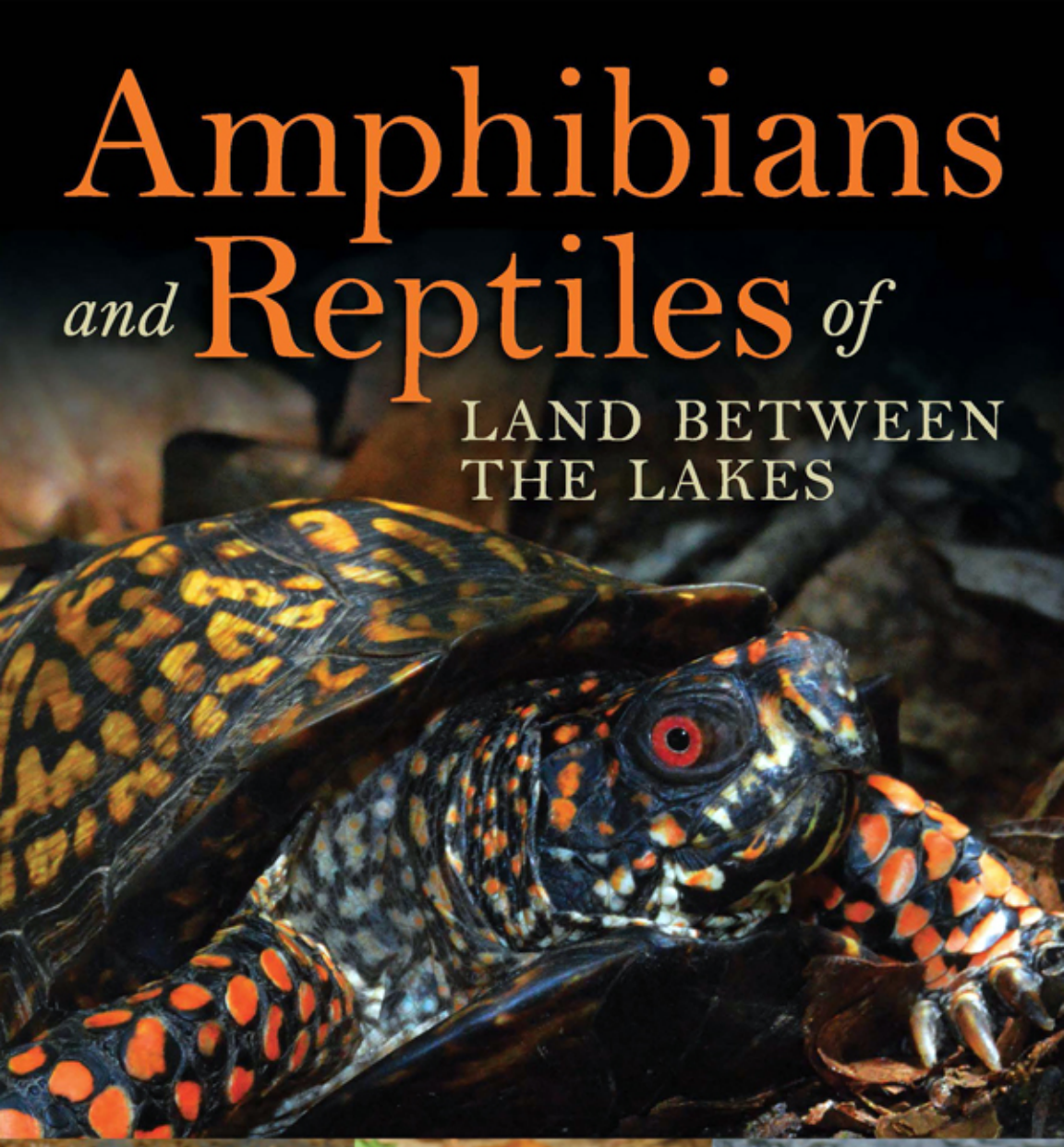
Amphibians and Reptiles of Land Between the Lakes



DAVID H. SNYDER, A. FLOYD SCOTT,
EDMUND J. ZIMMERER, AND DAVID F. FRYMIRE

Amphibians and Reptiles of Land Between the Lakes

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Amphibians *and* Reptiles *of* LAND BETWEEN THE LAKES

David H. Snyder, A. Floyd Scott,
Edmund J. Zimmerer, and David F. Frymire

UNIVERSITY PRESS OF KENTUCKY

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Editorial and Sales Offices: The University Press of Kentucky
663 South Limestone Street, Lexington, Kentucky 40508-4008
www.kentuckypress.com

Cataloging-in-Publication data is available from the Library of Congress.

ISBN 978-0-8131-6767-1 (pbk : acid-free paper)
ISBN 978-0-8131-6841-8 (pdf)
ISBN 978-0-8131-6842-5 (epub)

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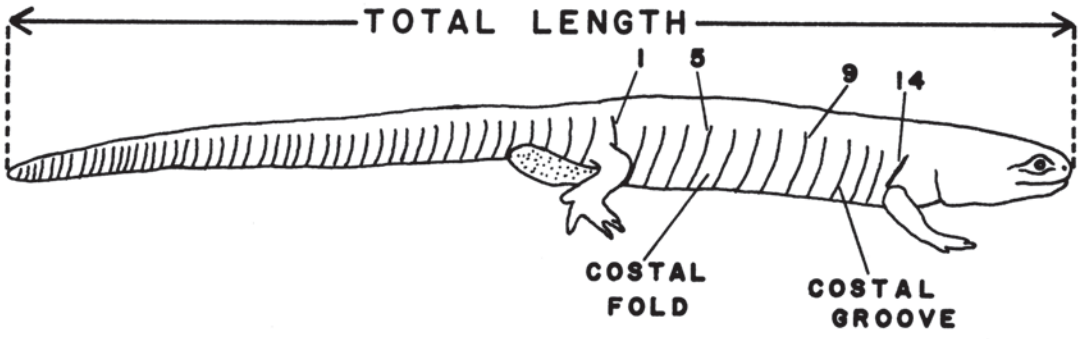

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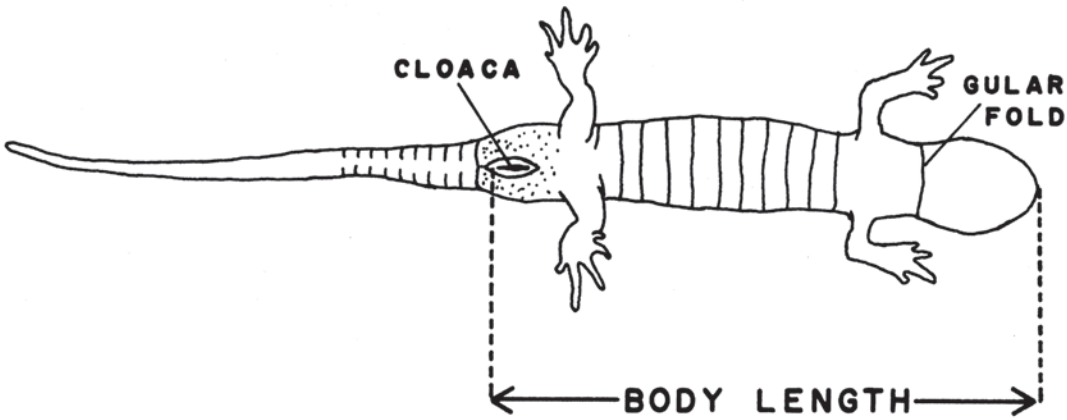

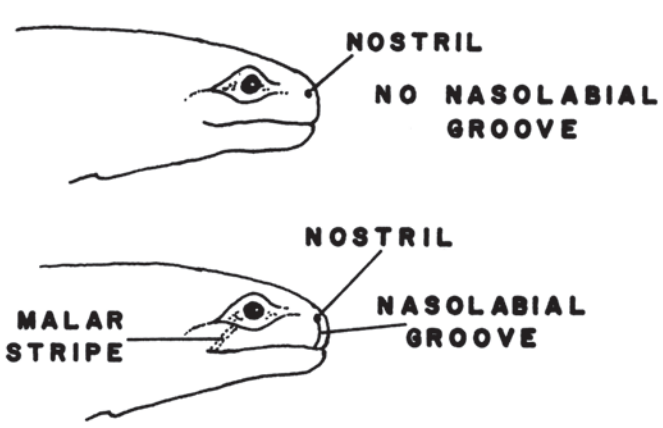

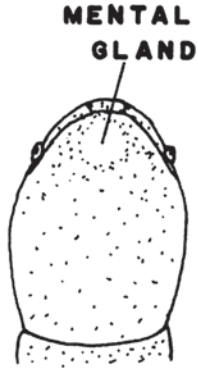

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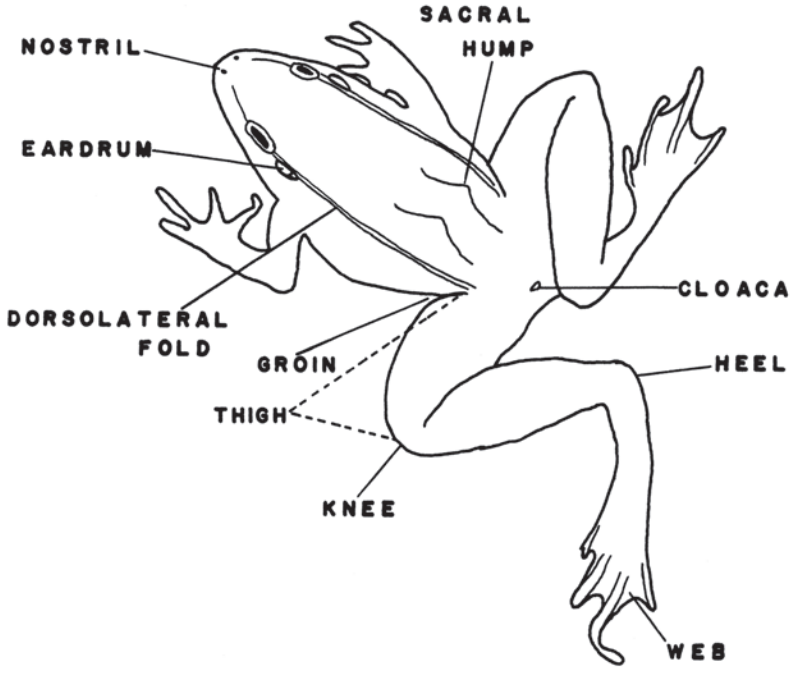
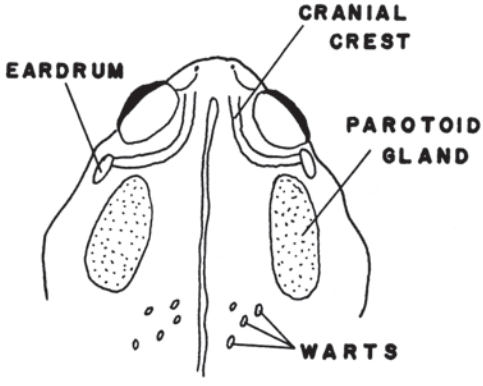


FEATURES OF A FROG



TOAD HEAD

FROG AND TOAD FEET

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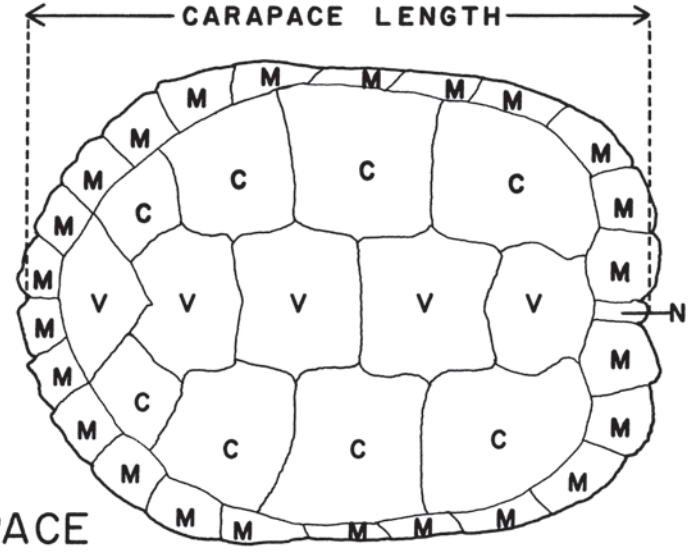
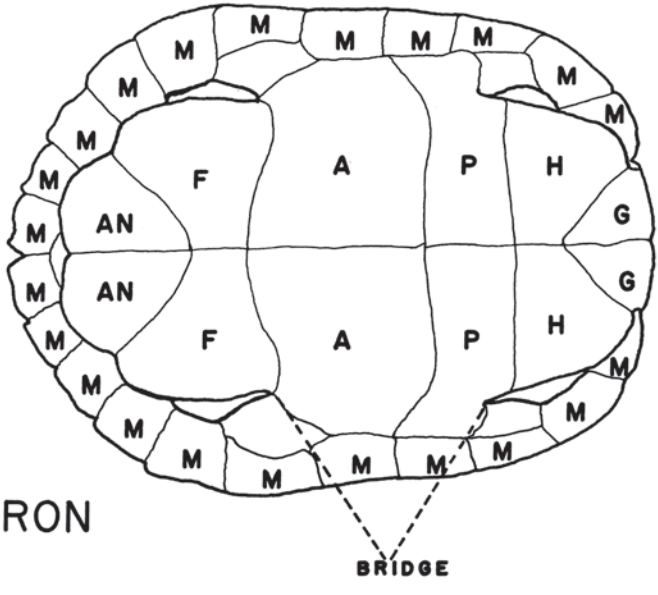


CARAPACE

SCUTES

A= ABDOMINAL
AN= ANAL
C= COSTAL
F= FEMORAL
G= GULAR
H= HUMERAL
M= MARGINAL
N= NUCHAL
P= PECTORAL
V= VERTEBRAL



PLASTRON

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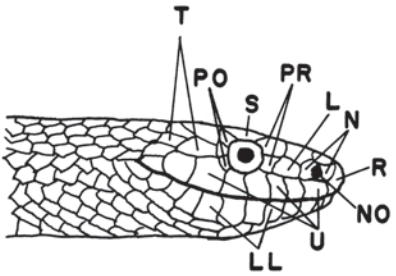
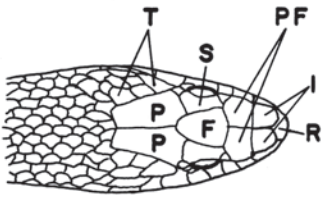
FEATURES OF A SNAKE'S HEAD
(NONVENOMOUS)



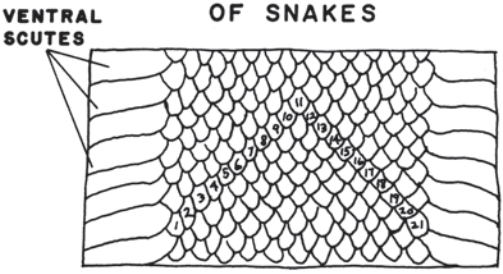


F=FRONTAL
I=INTERNASAL
L=LOREAL
LL=LOWER LABIAL
N=NASAL

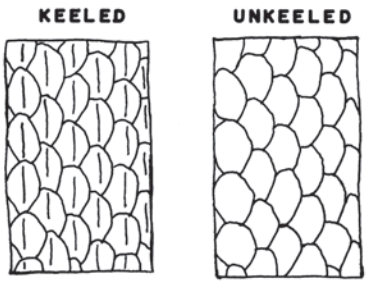
NO=NOSTRIL
P=PARIETAL
PO=POSTOCULAR
PF=PREFRONTAL

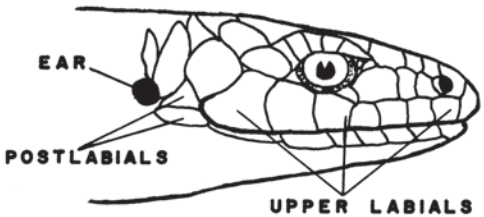
PR=PREOCULAR
R=ROSTRAL
S=SUPRAOCULAR
T=TEMPORAL
U=UPPER LABIAL

COUNTING SCALE ROWS OF SNAKES

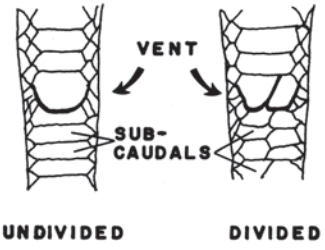


SCALE TEXTURE





SKINK HEAD



ANAL PLATES

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Preface

Fifty years ago when I was an undergraduate biology major at Austin Peay State College, I signed up for a course labeled "Field Zoology" being taught by David Hilton Snyder, a young and energetic biology professor who specialized in vertebrates but whose knowledge ran the gamut of living things. In that course, I was introduced to the wide array of fishes, amphibians, reptiles, birds, and mammals in Tennessee and Kentucky. Although the fishes, birds, and mammals were captivating, it was the secretive and reclusive amphibians and reptiles (collectively referred to as herpetofauna, or herps for short) that most fascinated me. During the summer of 1965, following my senior year and preceding my first year as a master's student at Austin Peay, Professor Snyder offered me the opportunity to work with him on a project funded by the Tennessee Valley Authority to conduct an inventory of the herpetofauna of the newly established Land Between the Lakes National Recreation Area (LBL), occupying the space straddling the Tennessee–Kentucky border between Kentucky Lake (impounded Tennessee River) and Lake Barkley (impounded Cumberland River). Over the next two years, Professor Snyder, his family, and a crew including me and several other students crisscrossed LBL and its adjacent waters in search of its herpetofauna, gathering data on the variety of species, their distributions, and their habitat preferences. We meticulously recorded all of this information in notebooks, ledgers, and catalogs, and it was to serve eventually as the knowledge base for a book on LBL's amphibians and reptiles. In 1967, I left Tennessee for my first teaching job at the University of South Alabama in Mobile, and in 1968 David Snyder moved to South Bend, Indiana, to work on a Ph.D. in zoology at Notre Dame University. In 1971, he was granted a doctorate and returned to Austin Peay to resume his teaching duties and other obligations, which included completion of the LBL herpetofauna book. In 1972, his book *Amphibians and Reptiles of Land Between the Lakes* was published by the Tennessee Valley Authority, and until it went out of print, it was the main source of information on these fascinating creatures in the LBL region.

The current edition is based on Dr. Snyder's 1972 book but includes new species accounts, factual updates, and corrections of minor errors. The

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layout follows that of the earlier publication: an updated introduction is followed by separate sections on each major group (amphibians first), with general information preceding the individual species accounts. Subheadings have been added to the species accounts to help readers more easily find the information of most interest to them. The species accounts are followed by keys to species, a list of marginally occurring forms, acknowledgments, an appendix, a glossary, a list of suggested references, illustration credits, and an index to species—all of which have been updated. All but one of the photographs in the 1972 book have been replaced by digital images taken by the authors and others.

My collaborators and I hope that anyone interested in the animal life of LBL will find this work of value as they explore its forests, fields, ponds, lakes, and adjacent reservoirs. Reptiles and amphibians, though often maligned, are an integral part of the web of life, serving as both predator and prey as energy passes through whatever ecosystem they are a part of. Knowing more about them and their roles in nature will likely lead to an increase in the respect and appreciation they deserve.

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Professor Emeritus
Department of Biology and Center for Field Biology
Austin Peay State University, Clarksville, Tennessee

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Introduction

Land Between the Lakes (LBL) is a 170,000-acre, mostly wooded peninsula between Kentucky Lake (Tennessee River) and Lake Barkley (Cumberland River) managed by the U.S. Forest Service as an outdoor recreation and environmental education area (see figure 1). Developed and managed by the Tennessee Valley Authority (TVA) from 1963 to 1998, when control was passed on to the Forest Service, it continues to serve as a model for how an area of limited natural resources can be developed into an outstanding public-recreation area. Surrounded on three sides by water, the 300 miles of shoreline extend across Trigg and Lyon counties in western Kentucky and Stewart County in western Tennessee. Camping, fishing, hunting, boating, hiking, and nature study are among the major activities that attract millions of visitors to this area.

The flora and fauna of LBL are rich and varied. Within this scenic area, more than 80 percent of which is forested, there are many diverse habitats, each supporting a particular community of plants and animals. Among the most mysterious and misunderstood of all the animal types that live there are the amphibians and reptiles. This guide has been prepared for the visitor to LBL as an aid in identifying and becoming acquainted with the amphibians and reptiles of the area. It can also serve as a broader guide to the herpetofauna of adjacent areas of western Kentucky and Tennessee.

The species of amphibians and reptiles described and illustrated herein are either known to occur in LBL or are strongly suspected to occur there on the basis of their known occurrence around the area and the availability of apparently suitable habitat. (Two species—the Hellbender and the Pickerel Frog—are in the latter category.) Species whose ranges are known to extend to the approximate boundaries of LBL from only one direction have not been included, although the possibility that some of them occur within the area is good. A list of these marginally occurring forms is given on pages 83–84.

Two possible procedures can be followed to identify an animal using this book. In many instances, a simple comparison of an animal with the picture will result in identification. In using this "picture book" method, however, you should also read the account of the species you think you

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have. The species account may point out such things as variation within the species, distinguishing characteristics, similar species, and differences in the appearance of the same species at different ages.

The other way you can identify a species is by using the keys to species beginning on page 71. Although a little more effort is involved in using the keys, they simultaneously identify most specimens encountered in LBL (they will not work for some immature or atypical animals) and teach some of the terminology and structures of the various forms. A basic vocabulary must be mastered in either using the keys or reading the species accounts. The vocabulary is brief and as nontechnical as possible. Any term with which you are unfamiliar is probably defined in the glossary or illustrated in the drawings on pages 93–97 and viii–xi or both.

The common and scientific names used for species are in accord with those presented in *Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico* (edited by B. I. Crother), which was published in 2012 by the Society for the Study of Amphibians and Reptiles as Herpetological Circular 39. For recently changed taxa, current genus names are followed by previous names, and alternative common names are also listed for many species. Family names of amphibians are those used by AmphibiaWeb (http://amphibiaweb.org/) as of 30 June 2015. Family names of reptiles are those used by the Reptile Database (http://www.reptile-database.org) as of 30 June 2015. The names used are generally accepted among herpetologists but also reflect several recently suggested changes in classification. The animals are treated at the species level rather than the subspecies or race level in view of the number of intergrading forms that occur in the area and the general audience to which this book is addressed.

Scientific names are often useful in determining whether two species are closely related or not. The scientific name of an animal consists of two words: the first word is the generic name and is always capitalized; the second word is the trivial name or species epithet and is never capitalized. If two species (kinds) of animals have the same first word in their scientific names (i.e., are of the same genus), this indicates they are rather closely related. For example, the Long-tailed Salamander, *Eurycea longicauda,* is more closely related to the Cave Salamander, *Eurycea lucifuga,* than either is to the Spotted Dusky Salamander, *Desmognathus conanti.* The scientific names will also be useful in seeking information in other books or online because they vary less than do the common names.

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A general discussion of amphibians (including salamanders as well as frogs and toads) and reptiles (including turtles, lizards, and snakes) precedes the species accounts for each group. This organization has allowed us to avoid the necessity of repeating many statements in the species accounts.

Value and Conservation of Amphibians and Reptiles

LBL is an area in which nature is to be studied and enjoyed and in which interested persons may have an opportunity to become acquainted with forms of wildlife that are not common or are inaccessible in more disturbed regions. All the plants and animals of the area interact with one another and with the nonliving factors of soil and climate to produce an ecological whole that is truly greater than the sum of its parts. In a few instances, humans can see some of the ways in which these things affect one another. In many more instances, they cannot. Herein lies the real value of the amphibians and reptiles of LBL—as part of the ecological whole. In terms of dollars and cents, they are of little importance, although a few, such as the American Bullfrog and some turtles, may affect the financial fortunes of humans to a small degree. The spirit of LBL is not basically one of economic considerations but rather of natural considerations, and in that spirit all forms of plant and animal life are protected from destruction and undue disturbance by humans. (Only in some areas and at certain seasons are a few species specifically exempted from this protection.)

Probably no group of animals or plants is more maligned and mistreated than amphibians and reptiles, especially snakes. In reality, some potentially dangerous forms deserve respect, not vilification, because they are a fascinating lot, and the more one learns about them, the more fascinating and less fearsome they become.

The possibility of being bitten by a venomous snake in LBL of course exists, but snakebite is not a serious problem in the area. The best "cure" for snakebite is to avoid being bitten. Pit vipers (the category to which all the venomous snakes of LBL belong) are primarily nocturnal. During daylight, they typically seek seclusion beneath objects such as logs, stones, or other debris, or they may simply coil up in a well-shaded spot. You can therefore minimize your exposure to venomous snakes by watching where you step and reach, using a tool to turn over debris that may shelter snakes,

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and using a lantern to illuminate trails that must be traveled during darkness. Our pit vipers are not normally aggressive animals, and although they tend to hold their ground when encountered, they are perfectly willing to live and let live when it comes to humans. Most bites result from handling or teasing these snakes, and to do either is to tempt fate.

If bitten by a venomous snake (you'll know if it's venomous because of the very immediate and sharp pain, followed within several minutes by the appearance of swelling), you should keep as calm and inactive as is possible while you get to a hospital. There is today little agreement among medical personnel as to what constitutes the best field treatment of a pit viper bite. For this reason and the fact that, regardless of where you may be in LBL, you are never more than an hour or so from a hospital, no specific medical treatment is suggested here.

Description of the Resource

The Cretaceous Tuscaloosa Gravel covers many of the hilltops and ridges of Land Between the Lakes, and Mississippian limestone formations (the Warsaw and St. Louis) surface in the valleys and at lower elevations. Deposits of hematite were worked as a source of iron near the middle of the nineteenth century, and ore pits are still evident in several parts of the area. Some of them serve as basins for ponds, which afford habitat for several species of amphibians and reptiles. Erosional dissection of LBL has been extensive in some areas, especially on the Kentucky Lake side. The relatively short distance between the two bounding lakes, averaging 6 to 8 miles, means that the drainage basins of the streams flowing out of LBL cannot be very large, which results in intermittent flow of most streams. Only a few spring-fed streams are permanent, and none of them is large. Limestone caverns are common immediately to the east of LBL, but there are no caves in the area itself.

In terms of vegetation, LBL is within the Western Mesophytic Forest Association, a transition region between more xeric (dry) areas westward and more mesic (moist) areas eastward. The area is more than 92 percent forested, but all forests are secondary. Various combinations of the nineteen species of oaks (*Quercus*) known from the area predominate, usually with scattered individuals of one or more of the nine species of hickory (*Carya*). Mesophytic forests dominated by American Beech (*Fagus*

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grandifolia), sugar maple (*Acer saccharum*), and tulip poplar (*Liriodendron tulipifera*) occur in a few sites. Evergreens include scattered red cedar (*Juniperus virginiana*) and a few native stands of Virginia and shortleaf pine (*Pinus virginiana, P. echinata*). In addition, individuals and plantations of introduced loblolly and white pine (*P. taeda, P. strobus*) are regularly seen. It is estimated that oak-forest cover types are present on 82 percent of the landscape, with mesophytic/riparian types on 7 percent and pine forests on 3 percent of the landscape.

Forests that were virgin at the time of settlement have since then been heavily impacted by removal for cropland; timbering for lumber, railroad cross-ties, fuel, and buildings; and mining, especially for charcoal for a number of iron furnaces in blast during the nineteenth century. Today, LBL forests range in age from early successional stages to before public ownership. Selective timber harvest has been commonplace under both federal entities that have managed LBL. Two areas totaling more than 8,900 acres are under management, mostly by controlled burning, to develop oak–grassland demonstration areas.

Open lands (about 8 percent of the area) include acreage devoted to row crops (corn and soybeans, with a tithe left for wildlife) and to grasslands for hay crops. Some former agricultural fields are maintained in an open condition for wildlife by mowing and by plantings for wildlife food and cover. In addition, there are open lands for bison and elk, for such recreational activities as camping, hiking, biking, equestrian and off-highway riding, and for environmental and historical interpretation.

Although the entire area has been and is currently heavily disturbed, more than 1,300 vascular plant species have been documented, including several that are of concern in either Tennessee or Kentucky or in both as well as some that the U.S. Forest Service considers sensitive species.

Areas of particular herpetological interest in LBL include the many springs and scattered, temporary ponds in both open and wooded situations as well as the areas of rock outcroppings, especially along the Kentucky Lake border. The two major lakes, their floodplains, and their subimpoundments are also rich in herpetofauna.

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Amphibians

The word *amphibian* comes from two Greek words meaning "both" and "life" and refers to how these animals' eggs are laid in water, their larval development occurs in water, and then the animals undergo a metamorphosis or "change in form" during which many of their aquatic larval structures are lost or modified as they become adapted for a terrestrial existence. Typical metamorphosis in amphibians (often called transformation) involves the loss of the larval gills, development of legs for land locomotion, loss of the caudal fins (and in some cases the entire tail), development of lungs for breathing, and changes in the skin that make it better suited for existence in air. Modifications of the mouth and digestive system to accommodate a change in diet also occur in some forms.

Amphibians are in many respects situated between the aquatic fishes and the terrestrial reptiles. Their eggs lack any effective waterproofing mechanisms and must therefore be laid either in water or in very moist, terrestrial situations. No amphibian occurring in LBL has any scales on its body or claws on its feet, as reptiles do, and their skins are much less resistant to water loss than are the skins of reptiles, thus restricting them to moist situations. Their skins are much more glandular than those of reptiles, and, in addition to keeping the skin moist, the glands may secrete substances that are either irritating or poisonous to animals that eat them.

Amphibians are ectothermic, which means that their body temperature is not maintained at a constant level, as in birds and mammals, but fluctuates with the temperature of the environment. These animals exert considerable control over their body temperature through behavioral means: by moving to or from warmer or cooler areas, regulating their exposure to the sun, and varying the amount of water that evaporates from their skin and mouth linings; this condition is basically different from that of the endothermic birds and mammals, which rely more on internal than on behavioral regulation of body temperature.

As ectotherms, amphibians are generally not active in very cold weather (although some salamanders may remain active in water beneath the ice of ponds or lakes in winter), and most hibernate in places beneath the frost line. Burrowing forms may simply go deeper underground, where freezing

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temperatures do not penetrate. Others may retire to the mud and litter on the bottoms of ponds, there absorbing sufficient oxygen through their skins to remain alive, though they may have to breathe air when active. Two major groups of amphibians occur in LBL—the salamanders (order Caudata) and the frogs and toads (order Anura). As adults, salamanders have tails, and the hind legs are not greatly modified for jumping. In frogs and toads, adults lack a tail, and the hind legs are greatly modified for jumping.

Salamanders

Sixteen species of six families of salamanders are included in this book (table 1 in the appendix). Four of the six families are represented in the LBL region by only a single species.

Both the Lesser Siren and the Mudpuppy, in separate families (Sirenidae and Proteidae, respectively), are permanent larval forms, never losing their gills or taking up a terrestrial existence, but becoming reproductively mature. This condition is known as paedomorphosis (see the glossary for special terms). Both species retain gill slits on the sides of the neck, through which water that enters the mouth may exit, as in fishes. The size of these forms' gills is correlated with the amount of oxygen in and temperature of the water in which they live. In cool, oxygen-rich waters, an individual's gills are less well developed than they are in warmer, oxygen-poor waters. The Hellbender, also permanently aquatic with a few paedomorphic traits (a single pair of gill slits and absence of eyelids), is in the family Cryptobranchidae. During metamorphosis, it loses its external gills and develops lungs, which are reduced and essentially nonfunctional. Gas exchange occurs primarily through the highly vascularized and wrinkled skin. The five species of the genus *Ambystoma* are in the family Ambystomatidae, and natives of the LBL region may refer to many of them as "ground puppies" because all burrow during the nonbreeding season and are sometimes unearthed during plowing or excavation work. Collectively they are called "mole salamanders" even though only one of them (*Ambystoma talpoideum*) has this label as its accepted common name (Mole Salamander). They all are terrestrial as adults and have lungs. They lack a nasolabial groove. In identifying salamanders, it is sometimes necessary to count the costal grooves—the vertical furrows on the ani-

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mal's sides between the front and hind legs, corresponding to the spaces between the animal's ribs.

The Eastern Newt belongs to the family Salamandridae, which is best represented in Europe and Asia but has representatives also in eastern and western North America. The adults and efts (land-dwelling juveniles) have lungs but lack distinct costal grooves.

The remaining seven salamanders of LBL are members of the large family of lungless salamanders, the Plethodontidae. As adults, these animals are typically terrestrial and lack both gills and lungs, breathing through their skin and mouth lining. All of the lungless salamanders possess a nasolabial groove as adults.

All salamanders of the LBL region practice internal fertilization of the eggs, with the single exception of the Hellbender, in which the male emits the sperm into the water over the eggs after the female has laid them. In the other species, there is no true copulation or direct transfer of sperm by the male into the female's body; rather, the male deposits the sperm in small, gelatinous-enclosed capsules called spermatophores, which the female then picks up by placing her cloaca over them. Inside the female's body, the sperm are released from their capsule and make their way to one or more blind tubules (called spermatheca) leading from the cloaca. There they are stored until needed in fertilizing the eggs.

Frogs and Toads

Fourteen species of five families of frogs and toads (collectively called anurans) are found in LBL (table 2 in the appendix). The Eastern Spadefoot (family Scaphiopodidae), Eastern American and Fowler's Toads (family Bufonidae), and Eastern Narrow-mouthed Toad (family Microhylidae) are referred to as "toads" because they are less aquatic, normally live farther from water, and often have a rougher, wartier skin than other anurans. In the case of the Eastern Narrow-mouthed Toad, one specialist may refer to it as a toad, but another calls it a frog. One of the two best-represented families, with five species, is the Hylidae or treefrogs, characterized by the expanded adhesive disk at the tips of their digits. They include the Eastern Cricket Frog, Spring Peeper, Upland Chorus Frog, Green Treefrog, and Cope's Gray Treefrog. The five remaining species belong to the family Ranidae (true frogs), which includes the familiar American Bullfrog and its

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close relatives the Pickerel Frog, Green Frog, Southern Leopard Frog, and Wood Frog.

Frogs and toads, unlike salamanders, have eardrums and can hear airborne sounds. They also typically have well-developed vocal cords, which salamanders do not have. Each of the frog and toad species in LBL has its own distinctive voice, as characteristic of that species as is the song of a specific kind of bird. During the breeding season, the males move to standing water and begin singing, apparently to attract the females (females of many species can make various vocal sounds—for example, the "mercy scream" that some emit when captured by a snake or other predator, but none normally gives the mating call). A group of singing frogs is called a "chorus" or "congress." Some species do not restrict their singing to the breeding season—for example, the Gray Treefrog, which may sing during humid weather while far from the breeding ponds.

Lesser Siren ***Siren intermedia***

Description: Figure 2. Adults of this eel-like salamander are dark above, often with scattered, tiny black dots, and lighter beneath. There is a single pair of tiny, four-toed legs located on the sides just behind the three pairs of external gills. The gills and three pairs of gill slits are present in adults as well as in larvae, and the adults have poorly developed lungs. Adults in the LBL region average about 9 inches in total length, with a maximum of 20 inches. The Amphiuma, a large aquatic salamander resembling the Siren, occurs in waters west of Kentucky Lake but has not been recorded from LBL. Compared to the Siren, the Amphiuma is larger (up to 42 inches), lacks external gills when adult, and possesses tiny forelegs and hind legs.

Distribution and Habitat: Lesser Sirens inhabit the backwaters of Barkley and Kentucky Lakes and many of the subimpoundments and floodplain ponds of LBL. They were common in Hematite Lake when it was drained in the fall of 1966. Shallow, sluggish bodies of water with an abundance of vegetation are their preferred habitat.

Natural History: Sirens are nocturnal, active foragers, eating mostly worms, crayfish, mollusks, insects, and some aquatic vegetation. Several hundred eggs are deposited in early spring in depressions in mud bottoms of quiet waters and hatch into ½-inch larvae with red facial stripes. The

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larvae grow rapidly and become adults in their first summer. Sirens in LBL are probably active all year. During droughts, they may retreat into the mud bottoms of dried-up ponds, remaining inactive there until the next rains, which may be several weeks in coming.

Hellbender ***Cryptobranchus alleganiensis***

Description: Figure 3. The Hellbender, monstrous in appearance as well as in size, is the largest amphibian (in terms of mass) of the LBL region, attaining lengths of more than 24 inches. The head, body, and toes are flattened, the tail laterally compressed. Large, loose folds of skin along the sides of the body are probably used in aeration of the blood, although the animal has functional lungs. External gills are lacking in adults, but a single gill slit occurs on each side of the neck. The eyes are tiny, and the mouth wide. The general color is gray to yellowish or greenish brown, with scattered, irregular dark markings sometimes present.

Distribution and Habitat: Although records from LBL are lacking, Hellbenders have been documented at upstream locations in both the Cumberland and Tennessee drainages. Anecdotal accounts by older fishermen describe a creature just like the Hellbender as being caught by hook and line in the portion of the Tennessee River that is now Kentucky Lake adjacent to LBL. Currently it is not known to occur in the flatlands west of Kentucky Lake in the latitude of LBL but is still found in some streams to the east. Hellbenders inhabit clear, clean, fast-flowing, well-oxygenated streams and rivers that have an abundance of large flat rocks, logs, and other cover objects. Holes in stream banks may substitute as cover where rocks and other cover are lacking.

Natural History: The Hellbender is primarily nocturnal and never leaves water, preferring deeper, swifter streams than do the Mudpuppy and Lesser Siren. Hellbenders are predators, with a diet probably similar to that of the Mudpuppy. Crayfish make up the bulk of their diet, but they also feed on small fish, salamanders, worms, insects, and other aquatic invertebrates. Mating occurs in late summer and early fall, and the several hundred eggs produced are deposited in an excavated nest under a rock. The long, twisted strands of eggs from one or several females are attended by a single male until in two to three months they hatch into larvae slightly more than an inch long.

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Conservation Status: The Hellbender carries NatureServe Conservation Status Ranks globally imperiled (G3), nationally vulnerable to apparently secure (N3N4), and subnational vulnerable (S3) in Kentucky and Tennessee. It is listed nationally by the U.S. Fish and Wildlife Service as a "Candidate" species, which means that there is sufficient information on the taxon's biological status and threats to propose it as endangered or threatened under the Endangered Species Act, but development of a proposed listing regulation for it is precluded by other higher-priority listing activities. The Convention on International Trade in Endangered Species of Wild Fauna and Flora also lists it in appendix III of its protected species. The Kentucky State Nature Preserves Commission lists the Hellbender as "endangered," and the Tennessee Wildlife Resources Agency lists it as a species "in need of management."

Mudpuppy *Necturus maculosus*

Description: Figure 4. The Mudpuppy or Waterdog, as it is locally known, is a permanently aquatic salamander averaging about 12 inches long (maximum 19 inches). The adults have three pairs of external gills, which in water are striking, maroon-colored, feathery structures, and two pairs of gill slits. Mudpuppies are slimy creatures with tiny eyes, a blunt snout, a wide mouth, four moderately developed legs, and a laterally compressed tail used in swimming. The generally dark dorsum is usually interrupted by two irregular brownish stripes running the length of the body on either side of the midline. The lighter underside may be mottled or with a clear central stripe.

Distribution and Habitat: Records of the Mudpuppy from LBL are limited to specimens from Lake Barkley in the Bards Creek and Brandon Landing areas. During daylight hours, they take cover under rocks, logs, and submerged debris.

Natural History: The Mudpuppy, when present, is easily taken on hook and line during the colder months. Although many fishermen consider them dangerous or even venomous, they are actually completely harmless. They are most active at night and on cloudy days, retreating to deeper waters during other periods. They will eat almost any animal they can capture and overpower (which does not include the fast or the strong), and they may scavenge and consume some vegetation. Mating occurs usually in autumn but may occur in spring. Egg laying occurs some six months later, when 50–150 eggs are attached singly to the underside

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of some sheltering rock or log. There they remain, attended by the female, until they hatch into 1-inch larvae four to six weeks later.

Small-mouthed Salamander ***Ambystoma texanum***

Description: Figure 5. Named for its comparatively small head and mouth, the Small-mouthed Salamander most closely resembles the Mole Salamander, from which it may be distinguished by its greater number of costal grooves (fourteen or fifteen, whereas the Mole Salamander has ten or eleven) and a proportionally smaller head. Both the Spotted Dusky Salamander and the Northern Slimy Salamander, with which the Small-mouthed might also be confused, have a nasolabial groove. Adult Small-mouthed Salamanders average about 5 inches long but may reach 7 inches. The head and mouth are truly diminutive, lending a bulldoglike appearance to the face. The dark brown or gray ground body color may be flecked with lichenlike markings, which are more numerous on the sides and venter, although some individuals are nearly uniformly dark. The Small-mouthed Salamander is known to occupy a variety of lowland and upland habitats.

Distribution and Habitat: In LBL, Small-mouthed Salamanders have been found only in or near floodplain areas adjacent to Lake Barkley. No records exist on the Kentucky Lake side of the drainage divide. Floodplain woodlands that accumulate water in late winter and early spring are where Small-mouthed Salamanders have been found in LBL.

Natural History: The Small-mouthed Salamander seems less of a burrower than its close relatives, although it has by no means abandoned the burrowing habit. Its food consists of available and manageable invertebrates. Breeding takes place in February and March, the animals utilizing a diversity of temporary, still-water habitats such as roadside ditches, flooded woodlands, and fishless ponds. The eggs may be attached singly or in small masses of five to thirty eggs to submerged twigs, leaves, or other vegetation. They hatch in two to eight weeks, and the larvae transform into adults in May or June when they are about 2 inches long.

Mole Salamander ***Ambystoma talpoideum***

Description: Figure 6. The Mole Salamander is the smallest of the lung-breathing, terrestrial salamanders of LBL, excepting the eft stage of

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the predominantly aquatic Eastern Newt. Adults average 3 to 4 inches and are stoutly built, the legs appearing undersize and the head oversize in relation to the body. The ground color is a dark gray, with scattered whitish flecks progressively more numerous on the sides and venter. It has ten or eleven costal grooves but no nasolabial groove (see description of the Small-mouthed Salamander).

Distribution and Habitat: In LBL, the Mole Salamander has been found only in a few ponds in northern Trigg and southern Lyon Counties. Upland woodland ponds that are devoid of fish are where Mole Salamanders have been found in LBL.

Natural History: This species' common name is quite descriptive of its burrowing habits. It apparently leaves its burrows only during the breeding season, normally January or February at this latitude, and moves to woodland ponds for mating and egg laying. The ten to forty eggs of each mass are only loosely adherent to one another, usually attached to leaves or other debris on the pond bottom. In ponds that regularly dry each year, larvae lose their gills after three to four months and assume a terrestrial existence before the pond's water is gone. In ponds that do not dry annually, some larvae metamorphose and become terrestrial adults during their first summer, whereas others retain their gills, remain aquatic, and mature sexually by fall. These gilled adults then breed among themselves prior to the arrival of the terrestrial adults in winter, and most transform the following spring. In permanent ponds, some sexually mature larvae may remain aquatic their entire lives.

Marbled Salamander *Ambystoma opacum*

Description: Figure 7. The Marbled Salamander is one of the most striking in appearance and unusual in habits of LBL's ambystomatid salamanders. Adults average about 4 inches in length and are a dark, slate color, marked with striking crossbands of gray (females) or white (males) across the back. The crossbands often run together at their edges, and on the tail the bands tend toward complete rings. Recent metamorphs are often black with small silvery flecks along the dorsum.

Distribution and Habitat: Found throughout LBL, this salamander utilizes drier habitats than other members of its group. It may occasionally be found beneath stones or logs on wooded hillsides or under debris along stream margins.

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Natural History: On the first fall evenings when the temperature falls below 50 degrees, usually in early October, the adults move to low-lying areas, which are likely to be flooded by later rains. There, courting takes place, the males deposit spermatophores, and the females select a cup-size depression beneath leaves or other litter in which to deposit fifty to two hundred separate eggs. The female remains with the eggs until they hatch, which occurs when the winter rains flood them. Her vigil may last up to three months in a dry season, and although the larvae may be ready to emerge from the eggs within three weeks after laying, they do not emerge until the eggs are flooded. In favorable areas, several nests may be located within a few feet or inches of one another.

Spotted Salamander ***Ambystoma maculatum***

Description: Figure 8. Adult Spotted Salamanders are deep slate black above, with two irregular rows of rounded, yellowish spots extending the length of the back (the spots atop the head are often bright orange instead of yellow, but this is not an indication of the individual's sex). The sides and venter are unspotted, the latter a lighter shade than the dorsum. Adults average about 7 inches in length.

Distribution and Habitat: The Spotted Salamander is essentially a woodland species and is distributed throughout LBL in proximity to breeding sites, which are permanent or ephemeral ponds or pools devoid of predatory fish.

Natural History: With the first warm spring rains (normally in late January or early February in LBL), Spotted Salamanders move by the hundreds to favored woodland breeding ponds. The males arrive first and engage in "dances" in which a few or several animals mill about in a few square feet of a shallow area of the pond, swimming to the surface, submerging, pushing, rubbing each other, and ultimately depositing spermatophores on submerged leaves and debris, where they dot the bottom of the pond like so many large snowflakes. The females pick up the spermatophore caps, and fertilization is internal. The eggs, attached to submerged twigs as firm, compact masses of a hundred or so eggs, hatch in four to seven weeks, depending on water temperature. The larvae metamorphose in mid- or late summer when about 2 inches long.

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Eastern Tiger Salamander ***Ambystoma tigrinum***

Description: Figure 9. Eastern Tiger Salamanders are the largest of the area's terrestrial salamanders, with adults approaching 14 inches in total length but usually averaging only 7 to 8 inches long. They are heavy bodied, with well-developed legs and protuberant eyes and no nasolabial groove. The dorsum is usually dark brown or black, with scattered yellowish blotches that are not aligned in rows. Similar blotches on the sides extend onto the light venter. In adult Spotted Salamanders, with which the Eastern Tiger is most likely to be confused, the light spots tend to be more circular in outline, arranged in two irregular rows down the back, and absent from the lower sides.

Distribution and Habitat: The Eastern Tiger Salamander is distributed throughout LBL in upland and lowland forest as well as in open fields and grasslands but is encountered far less frequently than the Spotted Salamander.

Natural History: Except during the winter breeding season when they gather at breeding ponds and pools, the adults are mostly nocturnal burrowers, although they may occasionally be seen abroad during other seasons, mostly on rainy nights. They may use the burrows of other animals such as crayfish or mammals in addition to their own. Adults eat invertebrates encountered in the soil. Larvae eat several kinds of small aquatic animals, and they may sometimes be cannibalistic. Mating occurs in shallow, often temporary, ponds. The spermatophores, deposited by the male on underwater debris, are picked up by the female's cloaca, and fertilization is internal. The clusters of 5 to 165 eggs hatch in three to six weeks, and the larvae normally metamorphose in midsummer, when 4 to 5 inches long.

Eastern Newt ***Notophthalmus viridescens***

Description: Figures 10 and 11. In addition to the sexually mature adults, the Eastern Newt has a postlarval, preadult, terrestrial stage in its development, called the eft (see figure 11), which may last from one to seven years. Typical 3- to 4-inch adults are olive green, flecked with black and some larger red spots above, and yellow with tiny black dots below. Lungs are present, although the skin may also be involved in breathing. The tail is laterally compressed for swimming. The 1½- to 3½-inch eft, commonly found in moist, wooded areas, is normally orange to orange

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brown, with scattered tiny black and fewer larger red dots, roughened skin, a rounded tail, and two longitudinal ridges atop the head.

Distribution and Habitat: Eastern Newts are found as larvae and adults in lakes, ponds, and vernal pools throughout LBL and as efts on land in the surrounding forest.

Natural History: Both adults and efts feed mostly on small invertebrates, but aquatic adults may also consume tadpoles as well as frog and salamander eggs. Breeding occurs with the first spring thaws, normally in February. During the breeding season, the males develop a high tail fin and horny growths on the inner surfaces of their hind legs, which are used in grasping the female's body just behind her front legs during amplexus. The spermatophores are picked up by the females, and the eggs are fertilized internally. The eggs, a few hundred of them, are attached singly to underwater objects and hatch in three to five weeks. The 1- to 1½-inch larvae normally transform into efts in two to five months, although the eft stage may sometimes be omitted. The brightly colored efts are toxic to avian and mammalian predators.

Spotted Dusky Salamander *Desmognathus conanti*

Description: Figure 12. Known locally as "spring-lizard," this very common salamander of LBL comes in a variety of patterns and colors. Adults range from 2½ to 5½ inches long, with the maximum size of males exceeding that of females. Mature individuals are usually some shade of gray or brown with scattered darker markings. The young and some adults have two rows of reddish-brown spots down the back, which may run together to varying degrees. All ages and phases normally have a light malar stripe extending from the eye downward and backward to the back corner of the mouth. The hind legs are much larger than the front, and the animals are surprisingly good jumpers. Their heads are peculiar in that it is the upper jaw rather than the lower that moves when the mouth is opened.

Distribution and Habitat: Spotted Dusky Salamanders, which occur throughout LBL, are creatures of very damp areas, especially margins of spring-fed streams, where they may be extremely common under the leaves and rocks. Many bass fishermen know this and collect them from such areas for use as bait (which is not allowed within LBL). They are quick, agile, slippery, and hard to hold, thus difficult to capture by hand.

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Natural History: Breeding may occur in either fall or spring. The eggs, one to three dozen of them, are deposited in a depression under a rock near a stream margin and attended by the female until they hatch several weeks later. The larvae must make their own way to the water, where they stay until metamorphosis.

Northern Zigzag Salamander ***Plethodon dorsalis***

Description: Figure 13. The common name refers to the jagged-edged, reddish-brown band that extends the length of the back in many individuals. On the tail, the edges of this band are usually more even, and in rare individuals the evenness may extend the length of the body as well. A lead-backed morph, in which the middorsal, reddish stripe is completely lacking, is about as common in LBL as the striped morph. Both morphs may be distinguished from the Spotted Dusky Salamander by the absence of a light malar stripe, a more slender body, proportionately smaller hind legs, and smaller size. Adult zigzags range from around 2½ to 4 inches in length.

Distribution and Habitat: The Northern Zigzag Salamander is probably one of the commonest vertebrate animals in LBL, but one would never know it were it not for their habit of congregating under logs and rocks in wooded areas in the early spring and fall. However, in late spring, as the hot weather of summer approaches, they retreat below ground and are rarely seen until they resurface in early fall.

Natural History: The breeding habits of Northern Zigzag Salamanders are incompletely known, but nests containing two to five eggs have been observed in cavities of cave rock in early summer. The eggs are in the intermediate stage of development and being brooded by adults. Therefore, like the related Northern Slimy Salamander, this species is an example of a terrestrial-breeding amphibian. The incubation period is thought to be about three months. Northern Zigzags, like many other amphibians, may be found in large numbers on the highways at night after heavy rains.

Northern Slimy Salamander ***Plethodon glutinosus***

Description: Figure 14. The Northern Slimy Salamander is one of the lungless salamanders, breathing by means of its skin and mouth cavity. The

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base color is black, with varying intensities of white flecking distributed over the sides and back. The white is often more concentrated laterally and in some individuals may form rather distinct light lateral bands. The venter usually has no or very little white. Nasolabial grooves are present, and adult males have a whitish, circular, mental gland under the chin and round orange or yellow glands on the belly. Adults range in size from 4½ to 8 inches long.

Distribution and Habitat: Except during periods when the Northern Zigzag Salamander is at the surface (early spring and fall), this salamander is the most likely to be encountered in the woodlands of LBL. It is commonly found in and under rotting logs, under rocks, and in old lumber piles.

Natural History: Although this species is common in LBL, its nests and eggs are rarely found. Breeding probably occurs in late summer or early fall, the dozen or so eggs being attended by the female in a crevice under a stone or in a rotting log until they hatch two to three months after being laid. Like the Northern Zigzag salamander, there is no aquatic larval stage. The animals emerge from the eggs as recognizable miniature editions of the adults. The skin secretions of Northern Slimy Salamanders are very sticky, and on one's hands they dry into a dark film that is very difficult to remove but will eventually wear off.

Red Salamander ***Pseudotriton ruber***

Description: Figure 15. Like other lungless salamanders, the Red Salamander has the nasolabial grooves typical of that group and in coloration somewhat resembles the Cave Salamander. Typical adults are coral red with scattered black dots on the back and upper sides. The venter is a lighter hue than the back and may lack the dark spots. Old individuals may be much darker in general coloration—almost purplish—but the speckled appearance is retained. They are stout-bodied animals, and this character, plus the relative shortness of the tail (less than half the animal's total length), provides the easiest means of distinguishing them from Cave Salamanders. As a last resort in determining identification, one may count the costal grooves: the Red has sixteen or seventeen, but the Cave has only thirteen to fifteen. Both species average about 5 inches long.

Distribution and Habitat: The Red Salamander is unknown in the

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northern third of LBL but has been found at several sites elsewhere in the area. Springs and spring-fed branches and adjacent areas, in either open or wooded situations, are this animal's preferred habitat. It occasionally may be found under logs in damp, forested areas or on roads at night during rains.

Natural History: In the fall or early winter, the female deposits a cluster of fifty to one hundred white eggs on the undersides of stones in springs or spring branches. The larvae, about ½-inch long at hatching, remain and feed in the spring waters until they reach a size of about 3 inches, when they transform into terrestrial adults.

Cave Salamander ***Eurycea lucifuga***

Description: Figure 16. The Cave Salamander, although a close relative of the Long-tailed Salamander, more closely resembles the Red Salamander in coloration and pattern. To distinguish it from the latter, see the description of that species. Adult Cave Salamanders are yellow to orange red, with scattered black dots on the back, sides, tail, and limbs. Young individuals tend to be even more yellowish. The head is flat, the eyes bulge, and a nasolabial groove is present. Adults are usually between 4 and 6 inches long, more than half of which is tail (except in some individuals that have lost part of their original tails and are growing new ones). The Long-tailed Salamander is very similar to the Cave Salamander in size and proportions but is seldom orange and has black pigment on the sides of the tail that tends to be arranged as vertical bars.

Distribution and Habitat: Areas of limestone caves and outcroppings are the usual habitat of the Cave Salamander. LBL, situated as it is on the western limit of the great cave region of Kentucky and Tennessee, is also at the western edge of this species' range in these states. Nearly all of the several records for this species in LBL have come from sites in the Cumberland River drainage portion (eastern half) of the area.

Natural History: Adults are terrestrial and nocturnal and on rainy nights may be abroad in considerable numbers. During the cooler months of the year, the eggs are laid in springs (which the females may ascend into their underground sources), where they are attached singly on the undersides of rocks. The larvae transform when about 2 inches long.

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Long-tailed Salamander ***Eurycea longicauda***

Description: Figure 17. This species' intact tail usually exceeds 60 percent of the total body length, which makes its name appropriate. The adults, averaging about 5 inches long, are distinctive in coloring, with a pattern of scattered black blotches (which often tend to run together to form two or three longitudinal stripes) on a yellowish ground color and vertical dark markings on the sides of the long tail. Younger individuals may look confusingly like Southern Two-lined Salamanders, but the latter lack the dark, vertical tail markings. The Long-tailed is a lungless species and has a nasolabial groove.

Distribution and Habitat: The Long-tailed Salamander occurs throughout LBL where suitable habitat exists. They can be found along clear, flowing streams, commonly beneath rocks and among debris at the stream's edge. However, in LBL there are few such streams, and the animal is commonly taken in moist wooded areas at considerable distances from water. Trash heaps, old home sites, and abandoned logging sites often harbor them. They are much less restricted to spring-fed habitats than are the Southern Two-lined Salamanders.

Natural History: On rainy nights especially, Long-tailed Salamanders emerge at dusk from their daytime retreats to feed on a wide array of small invertebrates. Breeding and egg-laying occur in late fall or winter in subsurface bodies of water, where small clusters of eggs are attached to submerged stones or other objects. The larval period usually lasts less than one year, with metamorphosis occurring the first summer following oviposition. Some larvae, however, may overwinter and metamorphose the second summer.

Southern Two-lined Salamander ***Eurycea cirrigera***

Description: Figure 18. The Southern Two-lined Salamander is a small, lungless species, adults averaging only about 3 inches long and rarely exceeding 4 inches. Their basic color is yellowish, with a dark stripe on each side running the length of the body and extending onto the tail. In the middle of the back, there is often an irregular row of black dots. The underparts are unspotted. The tail is proportionately shorter than that of the Long-tailed Salamander and lacks the vertical barring characteristic of that species. Young Spotted Dusky Salamanders, which often occur in the

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same habitats with Southern Two-lined Salamanders, may be distinguished by the light malar stripes behind their eyes and their enlarged hind legs.

Distribution and Habitat: The Southern Two-lined Salamander is found in all sections of LBL but never far from small, rocky streams or springs or seeps in wooded areas.

Natural History: In rainy weather, Southern Two-lined Salamanders may roam far from their home streams after dark. At such times, they may occur by the scores on roadways. Breeding occurs in spring, and the twenty to thirty white to pale-yellow eggs are attached singly to the underside of a submerged rock in a clear stream. The female may remain with them until they hatch. The larvae may be more than a year old when they transform into adults.

Eastern Narrow-mouthed Toad *Gastrophryne carolinensis*

Description: Figure 19. The Eastern Narrow-mouthed Toad is quite unlike any other local anuran in appearance. Its color may be gray, brown, or reddish, with darker markings superposed on the background. The underside is strongly mottled. There is no webbing on either forelegs or hind legs, and the legs are rather stubby in proportion to the body. The small, pointed head has a transverse fold of skin across its top behind the eyes that often extends down around the neck. The eardrum is inconspicuous, and there are no "warts" on the skin. The average length is about 1 inch.

Distribution and Habitat: The Eastern Narrow-mouthed Toad occurs throughout LBL, although more records exist from the southern end of the area. Because of its secretive behavior and burrowing habits, it may rarely be encountered even in areas where it is known to be fairly common. It may be found beneath debris of many kinds in open or semiopen areas.

Natural History: At night, after heavy summer rains, adults congregate in shallow ponds and flooded, grassy fields, where the males set up loud choruses by emitting short (one- to two-second) lamblike "bleets," usually with only their heads protruding above water. The sources of individual calls are very difficult to locate, even when one is standing directly above them. Each female deposits several hundred eggs as floating rafts, each raft consisting of fewer than one hundred eggs. The eggs hatch in a few days, and the larvae transform in three to ten weeks.

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Eastern Spadefoot ***Scaphiopus holbrookii***

Description: Figure 20. The Eastern Spadefoot is definitely toad-like in general appearance but is not closely related to the more common Fowler's and American Toads of the area. It may easily be distinguished from the latter two by the absence of distinct parotoid glands atop the head and the presence of an eye pupil that is vertically rather than horizontally elliptical. The ground color of this 2-inch toad is grayish brown, with curving, irregular, yellowish lines extending down the back. The tiny skin "warts" are often red tipped. The light, unspotted underparts show two pectoral glands on the breast, suggesting mammary glands in position and appearance. The bottom of each hind foot is equipped with a single, horny, blackened, sickle-shaped tubercle that is used in burrowing (Fowler's and American Toads show two such tubercles on each hind foot). Adults average about 2 inches.

Distribution and Habitat: A confirmed burrower, this toad is rarely encountered except during its explosive, short-lived breeding periods or when it is plowed up in a field. It may occur over most of LBL but has been documented at only a few sites.

Natural History: Living most of its life in underground burrows in loose soil, where it feeds on assorted invertebrates, the Eastern Spadefoot emerges to breed in shallow, temporary pools and ditches that fill after summer rains of a half-inch or more. The males emit a loud, low-pitched, nasal grunt resembling the call of a young crow. The short strings of eggs hatch in a few days, and the larvae may transform within three weeks.

Fowler's Toad ***Anaxyrus* (*Bufo*) *fowleri***

Description: Figure 21. Fowler's Toad and the congeneric American Toad are quite similar in both appearance and habits and sometimes interbreed. Most people usually cannot differentiate them and collectively call them "garden" or "hop" toads. An account of differences in their appearance is given here.

Fowler's and American Toads may be distinguished from the Eastern Spadefoot by the presence in the former two species of (1) parotoid glands and (2) a horizontally elliptical rather than vertically elliptical eye pupil. Distinguishing the Fowler's from the American is a much trickier matter but can usually be accomplished by considering the following set of

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contrasting characters (all of these characters should be taken into account before making a decision as to which species you have): (1) The parotoid glands of the Fowler's Toad are oval, whereas in the American they are kidney shaped, with the concavity toward the outside. (2) At least some of the dark spots on the back of the Fowler's Toad usually contain three, four, or more "warts" each, whereas in the American the spots contain only one or two warts each. (3) The breast of Fowler's Toad is usually unpigmented except for a single, median spot, whereas the American's breast often has extensive spotting. In adult males of both species, the throat is usually dark. (4) The upper surface of the lower hind legs (tibial portion) of Fowler's lacks any conspicuously enlarged "warts," whereas in the American these tibial warts are proportionally much larger than elsewhere on the leg (see figures 21 and 22). Color is useless in distinguishing between these two species because both show wide variation, and there is much overlap.

Distribution and Habitat: Both of LBL's toad species are found throughout the area in all major terrestrial habitats (forests, shrub lands, fallow and mowed fields, crop lands, and developed recreational areas). For data concerning their natural history, see the account of the American Toad.

American Toad ***Anaxyrus* (*Bufo*) *americanus***

Description: Figure 22. This species and Fowler's Toad are quite similar in both appearance and habits and sometimes interbreed. An account of their habits is presented here. For information concerning differences in their appearance and their distributions and habitats in LBL, see the account of Fowler's Toad. Adult American Toads average 2 to 3 inches.

Natural History: American and Fowler's Toads are less restricted to moist habitats than are most other frogs and toads. The American Toad is found farther north in North America but not as far south as Fowler's, and in LBL this preference for cooler conditions is reflected in the American's earlier breeding season, mostly in March and early April. The Fowler's commonly does not appear in the breeding pools until late April and may be found there well into June. A late American and an early Fowler's may interbreed. Although the calls of both species can be described as a trill, they are decidedly different and easily distinguished. Higher pitched and musical, the call of the American Toad is made up of a series of rapid

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whistlelike notes usually lasting at least five seconds and often up to thirty seconds. In contrast, the call of Fowler's Toad is a nasal series of lower-pitched notes lasting less than five seconds but repeated at intervals of ten or so seconds. The eggs are laid as long, double strings in a variety of shallow water habitats.

Gray Treefrog ***Hyla chrysoscelis/versicolor* complex**

Description: Figure 23. The two treefrogs in this complex are essentially identical in external morphology. *Hyla chrysoscelis* (Cope's Gray Treefrog), which is the more likely to occur in LBL, differs from *H. versicolor* in the following ways: (1) *H. chrysoscelis* has the faster trill rate of the two; (2) *H. chrysoscelis* is diploid with twenty-four chromosomes, whereas *H. versicolor* is tetraploid with forty-eight chromosomes; (3) cell size and number average larger and fewer, respectively, in *H. versicolor;* and (4) the average number of nucleoli per cell nucleus is greater in *H. versicolor.* A study of nucleoli number in specimens from across LBL revealed only *H. chrysoscelis* in the area. However, because both are known to coexist side by side in other parts of their ranges, *H. versicolor* in LBL is still a possibility.

The Gray Treefrog's basic appearance is reflected in its appropriate common name, but individuals may change color in a matter of minutes, and different individuals may range from almost black to many shades of gray and brown and even to bright green. The adults, however, always show a light spot on the upper jaw beneath the eye (the Bird-voiced Treefrog, which has not yet been collected from LBL but may occur there, also has this light spot, but it can be distinguished by the greenish rather than bright yellow or orange color of the concealed surfaces of the hind legs and by its very different voice). The back, sides, and limbs of the 1½- to 2-inch Gray Treefrog are marked with large, darker, black-edged blotches. The toe tips bear conspicuous adhesive discs used in clinging to smooth surfaces, such as leaves or bark.

Distribution and Habitat: Having earned the local name "rain frog" because of its habit of calling during the humid periods preceding summer showers, the Gray Treefrog occurs throughout LBL, where, when it is not breeding, it makes its home in the trees.

Natural History: Breeding occurs in shallow water from late spring to midsummer. The males utter their loud, vibrant, two-second trills from in

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or near the breeding pools, and each female deposits many packets of two- to three-dozen eggs on vegetation at the water's surface. The eggs hatch in a few days, and the larvae transform during their first summer.

Green Treefrog *Hyla cinerea*

Description: Figure 24. A relatively recent immigrant to LBL, the Green Treefrog is usually bright green but can vary from dark green to greenish yellow. Reaching a little more than 2 inches in length when mature, it has a white or pale-yellow strip running along each side from just beneath the eye to the vicinity of the thigh. Usually there is a spattering of small gold or white spots on the dorsum.

Distribution and Habitat: Green Treefrogs appeared first in LBL in the early 1990s near the Tennessee–Kentucky border in the backs of bays along the eastern shores of Kentucky Lake. The species has since spread across the divide into the Cumberland River drainage and wetlands bordering Lake Barkley. Preferred habitats appear to be the swampy margins of the backs of bays of the two reservoirs, cattail marshes, and floodplain ponds and sloughs. During rainy periods from May through September, individuals are often encountered on roads in upland areas after dark.

Natural History: Mating occurs from May through August, with froglets appearing about two months following egg deposition. The voice of calling males is a series of honklike notes reminiscent of the sound coming from a ringing cow bell. Arthropods make up the bulk of its diet.

Conservation Status: The Kentucky State Nature Preserves Commission lists the Green Treefrog as a species of "special concern" in Kentucky, but the species stands unlisted in Tennessee.

Spring Peeper *Pseudacris crucifer*

Description: Figure 25. The second part of this small hylid frog's scientific name refers to the presence of a dark, X-shaped cross on the back, although it is sometimes quite faint or irregular. A dark bar also runs across the top of the head, between the eyes. Adhesive toe pads are present, and the ground color is a pinkish brown or gray. Adults average about 1 inch in body length.

Distribution and Habitat: *Pseudacris crucifer* is found throughout

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LBL in moist, wooded, and brushy habitats. Breeding occurs in temporary to permanent bodies of water, often with abundant vegetation, ranging from vernal pools to small impoundments.

Natural History: The Spring Peeper begins breeding in mid- to late winter following the first relatively warm rains and continues breeding into April or May. It normally emerges from winter dormancy a few days behind its frequent companion, the Upland Chorus Frog. Although the Spring Peeper exhibits more of a preference for areas of woody vegetation than the Upland Chorus Frog, the two are often found together by the dozens or even hundreds in ponds, puddles, or old automobile tire tracks near the edges of woods or fields. Outside the breeding season, Spring Peepers are infrequently encountered but may show up around porch lights on rainy or humid nights to feed on insects. The male's voice is a high-pitched, clear, up-slurred whistle, uttered at about one-second intervals. Each gravid female attaches several hundred eggs to submerged vegetation and debris in shallow water. The eggs hatch in a few days, and the tadpoles transform into froglets in about two months.

Upland Chorus Frog ***Pseudacris feriarum***

Description: Figure 26. The Upland Chorus Frog is a gray-to-brown, 1-inch-long frog, with a light line on the upper jaw and a dark stripe extending from the snout back through the eye to the groin. Between these lateral stripes, there is typically a pattern of three irregular, often broken stripes atop the back. In some individuals, the striping is not evident; the dark markings appear instead as scattered spots. The skin is not perfectly smooth but is less warty than that of the Eastern Cricket Frog. The webbing on the hind feet is scant, and the adhesive discs at the tips of the toes are small, intermediate in size between the discs of the Spring Peeper and the discs of the Eastern Cricket Frog.

Distribution and Habitat: Like its congener the Spring Peeper, the Upland Chorus Frog occurs throughout LBL and breeds in shallow bodies of water often temporary in nature, including roadside ditches, flooded fields, and shrub swamps.

Natural History: The first relatively warm rains of midwinter arouse these animals from dormancy, and they congregate in small bodies of water by the hundreds, where they set up loud choruses, often in concert with

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Spring Peepers. Each male emits an ascending, one-second note, resembling the sound produced by dragging one's thumb across the small teeth of a plastic pocket comb. Each female attaches about a hundred eggs as an elongate, jellied mass to underwater vegetation in shallow, often temporary ponds and puddles. Outside the breeding season, Upland Chorus Frogs range widely in moist situations but are seldom encountered.

Eastern Cricket Frog ***Acris crepitans***

Description: Figure 27. Although a relative of the treefrogs, the Eastern Cricket Frog is not a climber of vegetation. Its terrestrial habits are reflected in the absence of conspicuous adhesive discs at the toe tips. Although it is about the same size as the Chorus Frog and Spring Peeper, its skin is wartier. The general color on its back varies from gray or brown to greenish black. There are scattered dark markings, with usually a triangular mark atop the head between the eyes. A green or reddish band often extends down the center of the back, but many individuals lack this stripe. The hind feet are fully webbed, and the back of the thigh has a jagged stripe extending its length.

Distribution and Habitat: The Eastern Cricket Frog is very common in LBL, usually encountered near the edge of some body of water, including puddles, ponds, lakes, and streams.

Natural History: Eastern Cricket Frogs are active both day and night and are good jumpers for their size. When disturbed, they characteristically jump into the water, turn around, and swim back to shore a few feet away. They are late breeders, the season extending from late spring through midsummer. Their voice suggests two chert pebbles being tapped together rapidly, often becoming faster toward the end of each series of notes. A couple hundred eggs are deposited in shallow water, and either fall to the bottom or become attached to submerged vegetation.

Southern Leopard Frog ***Lithobates* (*Rana*) *sphenocephalus***

Description: Figures 28 and 29. This species is one of the four true frogs (family Ranidae), along with the American Bullfrog, Green Frog, and Wood Frog, that have been documented in LBL. At around 3 to 4 inches total length, the Southern Leopard Frog varies from green to gold to

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brown on its back, with a scattering of rounded dark spots, but the venter is creamy white and unmarked. A dorsolateral fold of light-colored skin is present on each side, extending from just behind the eye to the hind limbs. Like all of the other true frogs in the area, each front foot has four toes, and each hind foot five.

Distribution and Habitat: Like its relatives, the Southern Leopard Frog is found in a wide variety of aquatic to semiaquatic habitats throughout LBL, often in large numbers. It frequents the margins and backwaters of Barkley and Kentucky Lakes, streams, springs, ponds, and puddles. In areas of dense vegetation, it commonly ranges far from water in quest of food.

Natural History: Southern Leopard Frogs feed mostly on terrestrial invertebrates. They are wary and very good jumpers and when encountered at a pond may seek refuge in the bank vegetation rather than in the water. In LBL, they are late-winter and spring breeders, the 4- to 5-inch masses of a few to several thousand eggs sometimes appearing as early as late February. The male has paired vocal pouches, one on either side of the body above the armpits, and a chuckling, croaking voice that resembles closely the sound produced when an inflated balloon is rubbed with the fingers.

Pickerel Frog ***Lithobates* (*Rana*) *palustris***

Description: Figure 30. The Pickerel Frog resembles the Leopard Frog but is typically smaller (2 to 3 inches), is basically a light brown or tan instead of green, has quadrangular rather than rounded dorsal spots (the spots arranged in two more or less distinct rows), and shows bright yellow or orange on the hidden surfaces of the hind legs. The dorsolateral fold is prominent and extends to the groin.

Distribution and Habitat: This species has not yet been reported from LBL and may not occur there. It has been included because of its presence to the north and east of the area and because seemingly suitable habitats, although restricted, do exist in the area.

Natural History: In other parts of its range, the Pickerel Frog is a denizen of cool, clear waters, rarely occurring around lakes or ponds. Although there are several springs and seepage areas in LBL, for some reason they apparently do not harbor this species. The Pickerel Frog is fond of dense,

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streamside vegetation and eats mostly terrestrial invertebrates. Breeding occurs in the spring, the 3- to 4-inch masses of one thousand to three thousand brass-colored eggs being deposited in standing or gently flowing waters and usually becoming attached to underwater sticks or tufts of grass. The males may sing underwater while clasping females. Their voice is an unquavering, snorelike sound of one to two seconds duration.

Green Frog ***Lithobates* (*Rana*) *clamitans***

Description: Figure 31. In appearance, the Green Frog resembles what one imagines the offspring of a cross between an American Bullfrog and a Southern Leopard Frog might look like. The predominating general dorsal coloration of this 3-inch species is, like that of the American Bullfrog, olive green or brown. Dark markings, not edged in white, are variously present and distributed on the upper parts of this frog, and the underside is white with black, wormlike markings extending onto it from the sides in many individuals. Probably the best identification character is the dorsolateral fold, which extends only to the sacral hump midway down the back, not to the groin, as in the Leopard and Wood Frogs. The American Bullfrog has no such fold. Adult males have a large eardrum and are yellow under the throat.

Distribution and Habitat: Before the filling of Barkley Lake, the Green Frog was common along some streams flowing into what was then the Cumberland River. Since the fall of 1965, however, when Barkley Dam was closed and its feeder streams inundated by the waters of Lake Barkley, this species has become more abundant in the numerous small ponds (wildlife watering holes) scattered across the area.

Natural History: Breeding may occur anytime during the late spring or summer. The voice has been likened to the sound produced by the bass string of a banjo, repeated rapidly one to three times. The few thousand eggs are deposited in surface masses, which are smaller than those deposited by the American Bullfrog. Adults eat mostly terrestrial invertebrates.

American Bullfrog ***Lithobates* (*Rana*) *catesbeianus***

Description: Figure 32. As a true frog, the American Bullfrog lacks a warty skin and parotoid glands, and the hind toes are extensively webbed.

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Adults average 4 to 5 inches in length from snout to vent, although individuals may occasionally exceed 7 inches. Its predominant color is olive green or brown, with scattered dark blotchings, especially on the hind legs. The underparts are whitish, becoming yellowish under the adult males' throat. The American Bullfrog may be distinguished from its close relatives, the Leopard, Green, and Wood Frogs, by the absence of a dorsolateral fold, although there is a skin fold along the top of and down behind the eardrum. In adult males, the diameter of the eardrum is about twice that of the eye; in adult females, the eardrum and eye are about the same size in diameter.

Distribution and Habitat: Excepting Fowler's Toad, the American Bullfrog is the frog most often encountered in LBL. It is common, is not very choosy about its habitat, and wanders widely during rainy weather. Almost any permanent body of water may serve as home for the American Bullfrog, from Kentucky Lake to an old cistern.

Natural History: American Bullfrogs are voracious feeders, eating essentially any animal they can seize and ingest. Items reported in their diet include arthropods, fish, salamanders, other frogs, snakes, small mammals, and even birds. They breed in late spring and summer. The male's voice is a low, resonant, loud *jug-o'-rum* or *rrum.* Each female deposits up to twenty thousand eggs as a single, floating mass, which is sometimes more than a foot across. The larvae, which may reach 6 inches in length, live a winter or even two winters before transforming.

Wood Frog ***Lithobates* (*Rana*) *sylvaticus***

Description: Figure 33. The Wood Frog resembles the Green Frog but is on average smaller (2 to 3 inches), and like the Green Frog it has little or no pattern over most of its body. One constant distinguishing character, however, is the presence of a dark patch that extends backward from the eye to just past the tympanic membrane. The Wood Frog also differs from the Green Frog in the background color, which can range from pink to gold to various shades of brown. The dorsolateral fold is prominent and extends to the groin.

Distribution and Habitat: This species has been documented from LBL only recently and by only one specimen. It is, however, found in several nearby counties in both Kentucky and Tennessee and may be ex-

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panding its range into LBL. The Wood Frog is usually encountered in or near moist wooded areas and is a winter (January to March) breeder in temporary woodland ponds, road ruts, and roadside ditches.

Natural History: The Wood Frog is an "explosive breeder," with all mating taking place over just a few days in early spring, usually in ephemeral pools. Its call is a hoarse clacking sound that has been compared to the quacking of a duck. The egg masses, each with several hundred eggs, are often deposited in communal clusters.

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Reptiles

The word *reptile* comes from a Latin word meaning "to creep," an obvious allusion to many of these animals' normal method of locomotion. Reptiles exhibit a wider array of adaptations for terrestrial life than amphibians. Their ancient ancestors were the first vertebrates on earth to develop an amniotic or "land" egg that can be laid in relatively dry situations. This was accomplished by the development of a shell and membranes that allow respiratory gases to pass but prevent fatal desiccation. When reptiles hatch, they are relatively more mature than most animals, having undergone the equivalent of a larval stage while still in the egg. To allow this greater development within the egg, a much larger yolk is supplied to serve as food during development, and so reptiles lay proportionately much larger eggs than do amphibians.

Besides the land egg, the most important advance of the reptiles was the development of a waterproof skin, which allows them to inhabit drier habitats than many amphibians can tolerate. They are covered with horny (keratinized) scales that amphibians lack. These scales may be enlarged and flattened, as on the shells of turtles or the bellies of snakes, in which case they are called "scutes." The toes of those reptiles that have feet are supplied with claws, which are lacking in almost all amphibians.

Reptiles, like amphibians, are ectothermic, and most forms hibernate (brumate) during the winter. The aquatic turtles may bury themselves in the mud and debris at the bottoms of ponds and lakes, or some may remain active under the ice. Terrestrial reptiles may hibernate in burrows below the frost line, or they may bury themselves in decaying vegetation such as rotting logs, sawdust and manure piles, and accumulations of dead leaves in wooded areas. Snakes have a special preference for crevices and retreats in rocky, wooded hillsides, preferably with a southern exposure.

Fertilization of the reptilian egg is always internal. The lizards and snakes of LBL have copulatory structures in the base of the tail of the males called hemipenes (see glossary), which are functionally comparable to the true penis of turtles and mammals. Because of the hemipenes, the tail of male reptiles is usually larger, especially at its base, and often longer than that of females.

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Three major groups of reptiles occur in LBL: turtles, lizards, and snakes. The turtles (order Terstudines) are unmistakably distinct. Many who study these animals now consider them "basal archosaurs," which means they may be more closely related to dinosaurs and birds and therefore not technically reptiles. For this edition, however, we follow the more traditional taxonomy and group them with the reptiles. The lizards and the snakes (order Squamata) are closely related to each other and are the only reptiles besides turtles found in LBL.

Turtles

Thirteen species of turtles, representing four families, are known from LBL and adjacent waters (table 3 in the appendix). There are two species each in the families Chelydridae (snapping turtles), Kinosternidae (mud and musk turtles), and Trionychidae (softshells); the remaining seven species are members of the family Emydidae (emydid turtles).

The turtle lineage has ancient origins and has probably been around for at least ninety million years. Turtles are the only vertebrates that have the shoulder and hip girdles located inside the rib cage.

Their basic defense is their shell, which consists of an inner series of bony plates and (except in the softshell forms found in the area) an outer layer of horny, flattened scales called scutes. The upper part of a turtle's shell is the carapace, the lower part the plastron. These two parts are usually connected by the bridges at their margins between the front and hind legs. The scutes covering the shell are arranged in basically the same pattern in most turtles, but the slight variations are sometimes useful in identifying some species. Turtles lack teeth but have sharp-edged, powerful jaws or beaks, which serve the purposes of crushing, cutting, and shredding food items.

Lizards

Six kinds of lizards in three families have been documented in LBL (table 4 in the appendix). One, the Eastern Fence Lizard, is a member of the family Phrynosomatidae (phrynosomatids); one, the Six-lined Racerunner, belongs to the family Teiidae (whiptails); the rest are skinks in the family Scincidae.

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Lizards and snakes are closely related and belong to the same order (Squamata) of reptiles. Differences between the two groups are recognized by placing them in separate suborders: Sauria (lizards) and Ophidia (snakes).

Lizards differ most obviously from snakes in their possession of legs, but this difference is not constant. The glass lizards, or joint snakes as they are sometimes called, lack any indication of legs and move in snakelike fashion. They differ from the true snakes, however, in having two characters that snakes lack—moveable eyelids and external ear openings—and their upper and lower jaws are rigidly fused, whereas snakes' jaws are connected by expansible ligaments. The tails of many lizards, including all forms in LBL, are modified so they are easily detached and thus serve as a distraction to a potential predator while the rest of the animal escapes. A lizard that loses its tail will grow a new one that is stubbier than its original and supported internally by a solid cartilaginous rod rather than by discrete bony vertebrae.

Snakes

Snakes are the best-represented group of reptiles in LBL (table 5 in the appendix), totaling twenty-six species. Ten are in the family Colubridae (colubrids), nine in the family Natricidae (harmless live-bearing snakes), four in the family Viperidae (pit vipers), and three in the family Dipsadidae (rear-fanged snakes). Although members of the Dipsadidae have a mildly toxic venom, only the pit vipers are considered harmful to humans. Pit vipers in LBL can best be distinguished from the other snakes in the area by their color patterns. However, other features also distinguish them. First, all pit vipers have a facial pit. Second, their eyes have a vertically elliptical pupil, which is visible at least in daylight (the light from a flashlight is usually not bright enough to cause the pupil to constrict to its elliptical shape). Third, the subcaudals are in a single row to or nearly to the tip of the tail on pit vipers but are in a double row on the nonvenomous snakes. Only experienced individuals should examine a snake for this trait, however.

The pit vipers of LBL produce venom in a pair of modified salivary glands in the upper jaw. These glands are connected to a pair of hinged fangs at the front of the upper jaw. The fangs, periodically replaced, are laid back against the roof of the mouth when the snake is not using them; were

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they not, they would penetrate the lower jaw when the mouth is closed because of their great length. The fangs are hollow, and the venom ducts enter these hollows at the upper base of the teeth. The venom, forced from the venom glands by the contraction of special muscles, exits from the front of the fangs near their tips. Pit viper venom is a clear, yellowish liquid that attacks the tissues at the site of the bite and is carried by the blood to other parts of the body. The pain from a venomous snakebite is acute and immediate, and although the chances of recovery from even the bite of a large Timber Rattlesnake are good, a bite is nevertheless a traumatic experience. The snakebite problem is discussed more fully in the introduction on pages 3–4.

Nearly all snakes are exclusively carnivorous. They can swallow objects much larger than the diameter of their own bodies by virtue of the elastic ligaments that connect their upper and lower jaws. The skin is also quite stretchable, and a snake that has recently swallowed a sizable prey item shows it. Some snakes lay eggs; others give birth to live young. In LBL, there are as many egg-laying species as live-bearers (thirteen each). In other groups of animals, live-bearers typically produce fewer young than egg layers in the same group, but this is not true for the snakes.

Snapping Turtle *Chelydra serpentina*

Description: Figure 34. Snapping Turtles, with their large, flattened heads, small plastrons, and long tails, are easily recognized. This species, which reaches a length of 15 inches and weighs up to 30 pounds in LBL, is best distinguished from its larger relative, the Alligator Snapping Turtle, by the absence of three or four small scales (supramarginals) between the costal and marginal scutes in the region of the bridge between the upper and lower shells. Also, the top of the Alligator Snapping Turtle's head is covered with distinct, large plates.

Distribution and Habitat: Snapping Turtles are large aquatic turtles. They are primarily bottom dwelling and relatively poor swimmers. They are found throughout LBL wherever there is permanent water.

Natural History: The Snapping Turtle is a valuable animal, not only as food for humans but also as a scavenger of dead or sick animals. It does consume some game and pan fish, but usually these individuals are dead or sick before the turtle finds them. Snappers, like predators generally, have

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what is called a "sanitation effect" on prey populations, much as a farmer has on a herd of cattle when he removes ill or undesirable animals. In addition, snappers may eat large amounts of vegetation. Although vicious when encountered out of water, which it rarely leaves except to move to a new pond or to lay eggs, the Snapping Turtle tries only to escape from humans when it is in the water; even when it is stepped on, it typically merely retracts its head. Females typically lay twenty to forty round, white eggs, each 1 inch in diameter, in damp soil in June (sometimes far from water), and the young hatch in August or September.

Alligator Snapping Turtle ***Macrochelys temminckii***

Description: Figure 35. This gargantuan turtle is the most massive reptile occurring in LBL and the largest freshwater turtle in North America. There are authentic records of individuals weighing more than 200 pounds and measuring more than 5 feet (the carapace length of such a monster would probably be 24 to 30 inches). In captivity at the Philadelphia Zoo, an Alligator Snapping Turtle lived to the age of seventy. In general appearance and proportions, this species resembles the Snapping Turtle but may be distinguished from it by the presence of a strongly hooked beak, shieldlike plates atop the head, and the presence of an extra row of three or four scutes (supramarginals) on the carapace between the marginals and the costals.

Distribution and Habitat: The Alligator Snapping Turtle is primarily a species of southern lakes and rivers. Several large individuals (up to 105 pounds) have been caught in the bays of Kentucky Lake bordering the Tennessee portion of LBL. None has been found in areas of Lake Barkley adjacent to LBL, although one was caught a few miles upstream near Dover, Tennessee.

Natural History: A sluggish animal that would rather walk on the bottom of a lake than swim, the Alligator Snapping Turtle leaves water only to lay eggs and spends much of its time on or partly buried in the mud under downed trees and submerged logs. Its diet comprises an astounding array of food items, including crayfish, freshwater mussels, snails, fish, amphibians, turtles (even its own species), snakes, mammals, birds, wild fruits, and acorns. On the floor of its mouth, there is a movable, wormlike appendage that may be engorged with blood and used as lure to attract fish

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within range of the powerful, beaked jaws. In early summer, a clutch of ten to forty spherical, white eggs 1½ inches in diameter are buried up to 14 inches deep in moist soil.

Conservation Status: The Kentucky State Nature Preserves Commission lists the Alligator Snapping Turtle as "endangered" in Kentucky, and the Tennessee Wildlife Resources Agency lists it as a species "in need of management" in Tennessee.

Eastern Mud Turtle ***Kinosternon subrubrum***

Description: Figure 36. Averaging slightly smaller than the Eastern Musk Turtle, the Eastern Mud Turtle lacks the light stripes on the sides of the head and neck. The carapace is olive brown, with no markings. The plastron is larger than in the Eastern Musk Turtle and has two hinges, sometimes inconspicuous, one in front of and one behind the bridge. The pectoral scutes of the plastron—that is, the scutes just in front of the anterior hinge—are triangular (rather than squarish, as in the Eastern Musk Turtle). The experienced observer can usually distinguish these two species by the relative height of the carapace; in the Mud Turtle, it is more flattened centrally, as though it has been stepped on. Young Snapping Turtles have prominent knobs on the back when small and much longer tails.

Distribution and Habitat: Occurrence records for the Eastern Mud Turtle in LBL number less than ten, many fewer than the more common Eastern Musk Turtle, which it resembles in appearance and habits. It is known from one upland pond and a few shallow coves of both Kentucky and Barkley Lakes. Consistent with its name, this species seems to prefer mud bottoms.

Natural History: The breeding habits and foods of the Eastern Mud Turtle and Eastern Musk Turtle are similar, but the Mud Turtle is more disposed to wandering over land, especially late in the evening or during rainy periods. Unlike its cousin the Eastern Musk Turtle, which bites tenaciously to defend itself, the Eastern Mud Turtle almost never bites. Both species feed on a variety of small aquatic invertebrates and plants and produce a clutch of up to five brittle-shelled eggs that are deposited in shallow cavities they dig with their hind limbs. Mud Turtles, in contrast to Musk Turtles, commonly move onto land to aestivate and hibernate.

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Eastern Musk Turtle ***Sternotherus odoratus***

Description: Figure 37. The Eastern Musk Turtle, also known as the Stinkpot, is often mistaken for a small Snapping Turtle or a Mud Turtle. See the previous species account for the best ways to tell all three apart. The Eastern Musk Turtle is common in ponds and backwaters throughout LBL. The adult's average carapace length is about 4 inches. The young may show a low median keel on the carapace, but there are no lateral keels. They are generally dark horn colored on top, often covered with extensive growths of algae, and light or yellowish on the bottom. The head usually shows two light stripes on each side. The pair of glands along the sides of the body, in the skin that connects the carapace and plastron, is responsible for producing the unpleasant odor for which the species is named. The plastron is smaller than in the similar Eastern Mud Turtle and has a single hinge, in front of the bridge; the Eastern Mud Turtle has a second hinge across the plastron at the back of the bridge. These two forms are also distinguished, however, by the shape of the pectoral scutes: in the Eastern Musk Turtle they are squarish, whereas in the Mud Turtle they are triangular.

Distribution and Habitat: The Eastern Musk Turtle is abundant in shallow back bays and coves throughout LBL. It often colonizes small interior ponds as well.

Natural History: The Eastern Musk Turtle is an opportunistic feeder and does much scavenging. In the spring, it lays about a half-dozen eggs in shallow pits on shore, often around rotting logs.

Eastern Box Turtle ***Terrapene carolina***

Description: Figures 38 and 39. The Eastern Box Turtle is the most terrestrial and frequently encountered turtle in LBL. No other turtle of the area can completely withdraw its neck, head, feet, and tail into the shell, where they are protected by almost perfect closure of the hinged plastron (some fat or egg-laden individuals cannot quite get both ends in all at once). Color is variable, but normally the carapace has a dark background with yellow, olive, or orange distributed over it. Males, which may be especially bright around the head and neck, differ from females by having a central depression in the plastron and red eyes rather than the usually yellow or brown eyes of females.

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Distribution and Habitat: This ubiquitous turtle is at home in almost all terrestrial habitats of LBL and may occasionally be found swimming or even walking along the bottom of a shallow pool.

Natural History: Young Eastern Box Turtles are rarely encountered, possibly because they prefer habitats that are more restricted (e.g., leaf litter and rodent burrows) than those of the adults and because of their small and cryptic appearance (see figure 39). Adults eat both plant and animal foods, including insects, worms, berries, garden vegetables, and even poisonous mushrooms. The poisonous mushrooms apparently do not affect the turtles but may cause illness or even death in humans who eat turtles that have recently dined on these fungi. Mating occurs in the spring on emergence from hibernation and perhaps also in the fall. One mating may render a female capable of laying fertile eggs (clutch size ranging from three to eight) for several years. These turtles are long-lived animals, with a normal life span estimated at from forty to fifty years. When they are young (less than ten years or so), their age may be determined by counting the growth rings on the dorsal scutes.

Painted Turtle *Chrysemys picta*

Description: Figure 40. The Painted Turtle is a colorful animal, with bright patterns of red, black, and yellow on the marginal scutes and the skin of the legs and neck. The 4- to 6-inch adults have no hint of knobs or tubercles on the back, and the rear margin of the carapace is smoothly rounded, not jagged as in other basking turtles of the area. A narrow, reddish stripe extends the length of the carapace in the midline. The toenails of the front feet on adult males are much elongated for use in courtship, as is the case in many other turtles of LBL.

Distribution and Habitat: The Painted Turtle is known from fewer than ten localities in LBL and thus is considered uncommon. It prefers quiet, shallow waters with abundant vegetation, a mud bottom, and basking sites. The water's temperature and turbidity seem to matter little—the species is known from both clear, spring-fed streams and warm, muddy ponds.

Natural History: Adult Painted Turtles are mostly vegetarians, consuming large amounts of duckweed and algae, but they also consume

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some aquatic invertebrates. In juveniles, the balance of the diet is reversed, aquatic invertebrates being consumed more than vegetation. The nests, dug by the females with their hind feet, are usually close to water, and each contains up to ten elongate, ¾-by-1⅛-inch eggs.

Conservation Status: LBL lies on the border between the ranges of the Painted Turtle and the Southern Painted Turtle. The Kentucky State Nature Preserves Commission lists the Southern Painted Turtle (*Chrysemys dorsalis*) as "threatened" in Kentucky.

Pond Slider *Trachemys scripta*

Description: Figure 41. Pond Sliders can be easily identified by the presence of a large, bright-red, broad streak on each side of the head behind the eye, visible when the neck is extended (hence the subspecies common name "Red-eared Slider"). In rare instances, this streak is yellow, or it is absent in old males (such males tend to be very dark all over). When these turtles are hatchlings, the head, carapace, and leg background color is a bright green. This color darkens with age to a drab olive green, and most Pond Sliders will lose, at least to some degree, their dorsal pattern of light, irregular lines. There are usually fine, longitudinal ridges on the carapace, which are also present on the River Cooter. Adults average 5 to 9 inches in carapace length.

Distribution and Habitat: This species is very common in the quiet waters of the bays bordering LBL and the larger, permanent impoundments therein. Often at dusk the heads of as many as a score of individuals may be seen projecting above the water's surface in both shallow and deep parts of the lake. Other species of turtles in LBL also have this habit of lying at the water's surface with only their heads protruding from the water. They are avid sun bathers and often crowd favorite logs until there is literally no room left.

Natural History: Pond Sliders are omnivorous in food habits. Females may lay more than one clutch in a season—each clutch containing four to twenty 1-by-1¾-inch eggs—in jug-shaped holes near the water. If the nest is being dug in hard-packed soil, the female may release liquid from her bladder to soften it. Females are sometimes encountered digging their nests in full daylight in gravel roadbeds. Late clutches may overwinter and hatch the following spring.

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River Cooter ***Pseudemys concinna***

Description: Figures 42 and 43. The River Cooter is the largest of the basking, hard-shelled turtles of LBL, sometimes attaining a carapace length of 14 inches. It resembles the Pond Slider more than any other species but lacks the red patch on the side of the head. A good field mark when it is visible is the presence of a C-shaped light mark on the second costal scute, with the open side of the C facing backward. Old individuals, however, tend to lose the pattern of light lines on the carapace that is so evident in younger individuals. (An obscure pattern can often be made more visible by wetting the shell or holding the specimen under water.) As with the Pond Slider, the young tend to show a brighter green background color on their carapace (see figure 43). In many, but certainly not all, individuals, the edge of the carapace is constricted or "pinched in" just before the hind legs. Except in hatchlings, there are no knobs on the vertebral scutes. Fine, longitudinal furrows and ridges are evident on the carapace upon close examination, as in the Pond Slider.

Distribution and Habitat: The River Cooter is considered uncommon in LBL because it has been found in fewer than five localities, all backwater areas of Kentucky and Barkley Lakes.

Natural History: This species is a wary animal, difficult to approach but docile, with even large captives not attempting to bite. Its foods include a variety of plants (algae and aquatic vasculars) and animals (crayfish, insects, small fish, and tadpoles). River Cooters are active from April through October. But unseasonably warm winter days will entice adult males to surface and bask. Large, 1-by-1½-inch, hard-shelled eggs (up to twenty-three per clutch) are laid in soil, near water, in June. Hatchlings appear usually in September but may overwinter in the nest and not emerge until the following spring. Their light-green shells are vibrantly marked with a mosaic of nonconcentric designs.

Southern Map Turtle ***Graptemys ouachitensis***

Description: Figures 44 and 45. The Southern Map Turtle is the more abundant of LBL's two species of "sawbacks," a name used by local fishermen that refers to the prominent knobs on the second and third vertebral scutes. Adults range from 4 to 10 inches in carapace length, and any specimen longer than 6 inches is almost certainly a female. The smaller males

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have very long toenails on their forefeet and have larger bases to their tails. In both sexes, the hind margin of the carapace is jagged, and the plastron is large and unhinged. The dorsal ground color is olive brown, with light, irregular, curving lines distributed over the back. The plastron is relatively unmarked in adults but may have prominent "ink blot" markings along the seams of the scutes in smaller specimens. The head is distinctive, with two quadrangular yellow spots on top, one behind each eye. There is usually an oval yellow spot on the upper jaw, beneath each eye, and often a similar pair of spots on the lower jaw. In the Southern Map Turtle, one to many neck stripes always reach the orbit. This species was once considered a subspecies of the closely related False Map Turtles (*G. pseudogeographica* ssp.), which include the Northern False Map Turtle (*G. p. pseudogeographica*) and the Mississippi Map Turtle (*G. p. kohnii*). In *G. p. pseudogeographica,* the yellow neck spots atop the head are greatly reduced. In *G. p. kohnii,* the neck stripes do not reach the orbit of the eye (see hatchling picture, figure 45). Individuals showing all of the phenotypic characteristics given here do appear in Kentucky Lake, and it is therefore unclear at this point whether we are in fact dealing with multiple related species in this area or just natural variation within a single taxa.

Distribution and Habitat: In LBL, the Southern Map Turtle is a common inhabitant of both Kentucky and Barkley Lakes, where it can be found along the main channels and in coves and bays. It often basks in large groups on logs over water but is quite wary and slides into the water at the slightest disturbance.

Natural History: Adult Southern Map Turtles are omnivorous, feeding on a variety of plants and invertebrates. Mating occurs in April (and possibly again in fall), and the white, elongate eggs (up to three clutches of two to twenty eggs each) are laid from May into July. Hatchlings emerge from the nest some two and a half months later.

False Map Turtle — *Graptemys pseudogeographica*

Description: Figure 46. The second of LBL's "sawbacks" is the False Map Turtle. The subspecies in LBL is the Mississippi Map Turtle (*G. p. kohnii*). The False Map Turtle is very similar in size, appearance, and behavior to the closely related Southern Map Turtle but far less abundant. It differs from the Southern Map Turtle by having a yellow-orange crescent

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(sometimes broken) behind each eye instead of a large spot. It also lacks the conspicuous pair of yellow spots on each side of the head (one on the upper jaw beneath the eye, the other directly below that one and on the lower jaw). When the postorbital crescent is well developed and unbroken, no lines reaching the eye can be observed. The white iris of the eye has no horizontal line through the dark pupil.

Distribution and Habitat: False Map Turtles are found in both Kentucky and Barkley Lakes but in fewer numbers than the Southern Map Turtle.

Natural History: Like the Southern Map, the False Map Turtle is an omnivore that feeds on a variety of plants and arthropods but also (especially in the case of mature females) on clams and snails. The two species' basking and reproductive behaviors are essentially the same.

Northern Map Turtle *Graptemys geographica*

Description: Figure 47. The Northern Map Turtle is a somewhat larger relative of the two previous "sawbacks." The sexes differ markedly in size, as is often the case among turtles, the males normally being 4 to 6 inches in carapace length, the females 7 to 11 inches. In contrast to the other two species of *Graptemys* in LBL, no prominent knobs are present on the second and third vertebral scutes of the Northern Map Turtle, and the two yellow spots atop the head behind the eyes tend to be elongated lengthwise rather than quadrangular or crescent shaped. Also, no light spots are found below the eye on the upper and lower jaws. The carapace is olive drab with a system of irregular light lines on it, suggesting roads or contour lines on a map and providing the basis of the common name. Adults' plastron is plain yellow. Young Northern Map Turtles usually have a system of narrow, dark lines along the edges of the plastral scutes, but this dark pigment is much less extensive than in young Southern Map and False Map Turtles.

Distribution and Habitat: The Northern Map Turtle occurs in both Barkley and Kentucky Lakes, but in low numbers. Spring-fed coves and back bays with clear water seem to be this species' preferred habitat.

Natural History: The Northern Map Turtle feeds largely on clams, snails, and other hard-shelled invertebrates, which it crushes between the powerful jaws of its flattened head. Mating occurs in spring and probably again in fall; nesting takes place from May into July; and hatchlings emerge in August and September. An average clutch includes about ten

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ellipsoidal, soft-shelled eggs, which are deposited in pits excavated in soft soil or sand. Hatchlings resulting from late clutches may overwinter in the nest and emerge the next spring.

Midland Smooth Softshell ***Apalone* (*Trionyx*) *mutica***

Description: Figure 48. Of the two species of softshells or "pancake" turtles in LBL, the Midland Smooth Softshell is the less common. Being a softshell, it lacks the horny, flattened scutes that cover the shells of all our other turtles, although the bones that are embedded in the carapace and plastron are discernible in outline. Flexible, leathery extensions of the carapace extend far beyond the edges of the embedded bony plates. The lack of three features distinguish this species from the Spiny Softshell. First, it has no spines or projections along the front edge of the carapace, as are present in all but the smallest Spiny Softshells. Second, it lacks a strong pattern of dark markings on the feet, although a faint pattern may be visible. Finally, the Midland Smooth Softshell has no longitudinal ridges projecting from the median septum into each nostril. These turtles' carapace may reach up to 14 inches in length, and females are on average about twice as long as males. These turtles have long necks and are excellent swimmers.

Distribution and Habitat: The Midland Smooth Softshell inhabits rivers, lakes, and their larger tributaries. In LBL and surrounding areas, it is far less common than the Spiny Softshell.

Natural History: The softshells are LBL's most aquatic and agile turtles. They are fond of lake areas with loose mud or sand bottoms, in which they bury themselves by lying flat on the bottom and rapidly and alternately lifting each side of the flattened carapace. This movement raises a cloud of mud or sand, which then settles on the turtle and may completely conceal it, except for its long neck and pointed head. They often bury themselves this way in water shallow enough for them to breathe air by extending their long necks, although they may go for long periods of time without breathing by using their mouth and cloacal linings as respiratory surfaces. Unlike its larger cousin, the Spiny Softshell, which will defend itself tenaciously, the Midland Smooth Softshell in our experience does not bite. However, both species will scratch if handled. Both of LBL's softshells are highly and quite indiscriminately carnivorous in their food habits and are active feeders. They leave the water only to bask on mud or sand bars

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and to lay eggs, producing two clutches of them each year. Nesting may occur from late May to August, but June and July see the most egg-laying activity. The nests are dug in areas of sand or fine gravel, usually close to water, but sometimes as far as 100 yards inland. The spherical eggs, which number around fifteen per clutch, are white and brittle and average around $1^{1}/_{10}$ inches in diameter. Hatching usually occurs in late summer or early fall after an incubation period of about two and a half months.

Conservation Status: The Kentucky State Preserves Commission lists the Midland Smooth Softshell Turtle as a species of "special concern" in Kentucky.

Spiny Softshell — *Apalone* (*Trionyx*) *spinifera*

Description: Figures 49 and 50. This thoroughly aquatic turtle is rather common in the waters of Barkley and Kentucky Lakes, although special efforts must be made to collect it. In appearance, the Spiny Softshell closely resembles the Midland Smooth Softshell. For features that can be used to distinguish between the two species, see the description of the Midland Smooth Softshell. The Spiny Softshell is one of the largest turtles in LBL. Females can measure 17 inches, with a neck capable of extending more than a foot. Males are much smaller in both length and mass.

Distribution and Habitat: As with the Midland Smooth Softshell, the Spiny Softshell is a species of streams and rivers; however, in LBL and surrounding areas it is far more common than the Midland.

Natural History: In habits, this species closely resembles the Midland Smooth Softshell. The stealthy Spiny Softshell often ambushes its prey from a concealed hiding place. Prey consists of small fish, crayfish, insects, and other invertebrates. These turtles are exceptionally agile and fast on both land and water. They are often the last turtles to emerge from the lake bottom in the spring and the first to descend again in the fall, usually in late October. They are powerful turtles, armed with lashing jaws and formidable claws, and should be handled with caution.

Eastern Fence Lizard — *Sceloporus undulatus*

Description: Figures 51 and 52. The Eastern Fence Lizard is the most conspicuous lizard of LBL. Adults average 4 to 7 inches in total length, more

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than half of which is tail. Females are gray on top, with a series of wavy, dark crossbands on the back. The males tend to be browner, with the dorsal bands less distinct. The bellies of adult males have lateral, blue or greenish-blue patches, edged with black (see figure 52). Similar-colored patches occur under the throat. A row of femoral pores is conspicuous on the underside of each thigh in adult males but less conspicuous in females and subadults. The scales are quite spiny, imparting a very rough texture to the skin.

Distribution and Habitat: The Fence Lizard is a species most often seen in dry, open, wooded areas. It is common in the LBL wherever such habitat exists.

Natural History: Fence Lizards are often observed basking in the sun, usually on the side of a tree but also on other suitable substrate, including fence rails or the sides of buildings. Each male claims and defends a small area, called a territory, from other males. All ages and sexes are agile and good climbers and when pursued often ascend the opposite side of a tree. As in many lizards, the Fence Lizard's tail detaches easily, and a potential predator often must be content with just the tail. The lizard grows a new one. Food items include spiders and assorted insects. Mating occurs in April, and the females deposit their clutches of three to sixteen ⅜-by-⅝-inch, oval, soft-shelled eggs in cavities in or under rotting logs or stumps in early summer. The 1- to 2-inch young emerge in late summer and mature in their second year.

Six-lined Racerunner *Aspidoscelis* (*Cnemidophorus*) *sexlineatus*

Description: Figure 53. Also known as the "whiptail" because of its long tail, the Racerunner is aptly named. One often catches only a brief glimpse of these lizards before they disappear into the vegetation. The pattern of the six longitudinal stripes on a brownish ground color suggests the two largest skinks of LBL, but the resemblance goes little further. Whereas in skinks the scales are smooth and extend around the entire body in even rows, the Racerunner's dorsal scales are tiny and granular, not shiny, and those on the belly are enlarged and quadrangular and arranged in eight distinct rows. The scales of the tail are also enlarged and are arranged in distinct circular bands. The adults have a 2- to 3-inch-long body and a tail about twice that length. Adult males often have dim dorsal stripes and appear washed with blue or green on the underparts.

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Distribution and Habitat: The Six-lined Racerunner was once common throughout LBL in scattered colonies in areas of dry loose soils and lots of sun (open forest canopy). The amount of such habitat has been in decline, however, with a resulting decline in the number of sightings of this species.

Natural History: The Six-lined Racerunner is fast and alert and extremely difficult to catch by hand. Some related forms in the western United States have been clocked at speeds of 18 miles per hour. In the exposed, loose-soiled areas where they occur, they retreat to burrows, either of their own digging or appropriated from other animals, when threatened or during unfavorable (i.e., not sunny) weather. Soft-bodied arthropods and snails are their main prey. Mating takes place in April a few weeks after emergence from hibernation. Eggs, numbering one to six per clutch, are laid in June and July in loose soil or sawdust and then abandoned. Hatchlings, which emerge from eggs in August, are 3 or 4 inches long and have light-blue tails.

Little Brown Skink *Scincella lateralis*

Description: Figure 54. Also called the Ground Skink, this lizard is found throughout LBL. Adults average less than 4 inches in total length. The back and sides are a rich brown, flecked with black. There is a conspicuous dark stripe extending down each side from behind the eye onto the tail. There are no light stripes, as in young Common Five-lined and Broad-headed Skinks. The eye, as in other lizards, is closed by raising the lower eyelid, which in this species has a clear "window" in it through which the animal may see. The tail detaches easily, and these lizards may eat their own tails occasionally. It would be possible to misidentify this animal as a Southern Two-lined Salamander, but close examination will reveal the smooth scales covering the body and the claws on the toe tips, both characters lacking in salamanders.

Distribution and Habitat: The Little Brown Skink may be the most widespread lizard in LBL. However, because of its small size and secretive habits, it is often overlooked.

Natural History: The Little Brown Skink is at home almost anywhere on the forest floor, and it is often heard rather than seen as it scurries among fallen leaves. It eats mostly insects and spiders. It lays one to five eggs in cavities of rotting logs or in humus in late spring or early summer. They are white, have a thin but tough shell, and measure about $^{3}/_{16}$ by $^{5}/_{16}$

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inch. Hatching of the 1¾-inch young occurs several weeks later, in August and September.

Common Five-lined Skink *Plestiodon* (*Eumeces*) *fasciatus*

Description: Figures 55 and 56. Four of the six lizards of LBL are smooth-scaled skinks. The Common Five-lined, Southeastern Five-lined, and Broad-headed Skinks are quite similar and must be examined in hand to distinguish the species, except in the case of adult males. (See accounts of the Southeastern Five-lined Skink and Broad-headed Skink for details.) Young Common Five-lined Skinks are black, with five longitudinal, light stripes on the body and a bright-blue tail (see figure 56). The bright tails of the young belie their relationship to the adults, and they are sometimes erroneously thought to be a different species—the so-called "blue-tailed lizard" or "scorpion"—and to have a venomous bite. (They can and often do bite when captured but achieve only a firm pinch that does not break one's skin.) The adults average 5 to 7 inches in total length (more than half of which is an easily detachable tail), and their tails are not blue. As they age, males tend to lose the stripes and develop orange pigment on the head.

Distribution and Habitat: Common Five-lined Skinks are found throughout LBL. They prefer moist habitats in or near woods, often under things.

Natural History: Common Five-lined Skinks are primarily a ground-living species. They will climb trees but seldom more than a few inches, and when pursued they are likely to retreat beneath a log or stone. They often bask in the sun but appear very nervous about it, continually moving around. Prey items include mainly small insects and spiders. Mating occurs in the early spring, and oviposition occurs in June and July. Clutches of two to eighteen whitish eggs, measuring about 5/16 by ½ inch, are guarded by the female in a cavity in a rotting log, in a sawdust pile, or under a board or stone. Hatchlings, about 2 inches long, appear from mid-July through August.

Southeastern Five-lined Skink *Plestiodon* (*Eumeces*) *inexpectatus*

Description: Figure 57. The Southeastern Five-lined Skink is almost identical in appearance and behavior to the Common Five-lined Skink.

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In fact, for many years we were not aware that they were in reality two species. Like the Common Five-lined Skink, its young are black, with five longitudinal, light stripes on the body and a bright-blue tail. The best way to distinguish this species from the similar Common Five-lined Skink and the Broad-headed Skink is to closely examine the scales under the tail. In the Southeastern Five-lined Skink, the scales under the tail are all nearly the same size. In the other two species, the scales in the middle row are enlarged.

Distribution and Habitat: The Southeastern Five-lined Skink is rare in LBL, with no recent records of it. It favors open and disturbed areas, including road cuts, gravel pits, and utility line clearings.

Natural History: This species' overall behavior is similar to that of the Common Five-lined Skink; however, over much of its range it shows a tendency to tolerate dryer and perhaps warmer temperatures.

Conservation Status: The Kentucky State Nature Preserves Commission lists the Southeastern Five-lined Skink as a species of "special concern" in Kentucky.

Broad-headed Skink *Plestiodon* (*Eumeces*) *laticeps*

Description: Figure 58. Broad-headed Skinks grow to a larger size than either of the two Five-lined species. Adults can reach nearly 12 inches in total length. Any skink in LBL measuring more than 3½ inches in body length will probably be this species. The juveniles and females look like juvenile and female Common Five-lined Skinks, but adult male Broad-headed Skinks, with their larger size, absence of striping, and swollen, orange heads, are distinctive (although larger males of both Five-lined species show these characters to some degree as well). Some natives of the area refer to the adult males as "glade bitches." They can inflict a painful but not dangerous bite.

The best character for distinguishing young and female Broad-headed Skinks from young and female Common Five-lined Skinks is the structure of the postlabial scales, which are located on the upper jaw just in front of the ear opening. Common Five-lined Skinks normally have one or two large postlabials; Broad-headed Skinks normally have none or one or two very small ones. A less-reliable character is the number of upper labials—seven in the Common Five-lined and eight in the Broad-headed.

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(Individuals with seven on one side and eight on the other are occasionally found.)

Distribution and Habitat: The Broad-headed Skink is much less common in LBL than its look-alike, the Common Five-lined Skink. Nevertheless, it probably exists in scattered colonies throughout most of the area's forest.

Natural History: The Broad-headed Skink's habits as well as its looks are similar to those of the Five-lined Skink, though it is much more prone to climbing, especially dead or standing hollow trees. It sometimes takes up residence in attics of houses, where it will feed on wasps, bees, and spiders. See the accounts of the Common and Southeastern Five-lined Skinks because their habits are very similar. Broad-headed Skinks lay up to fifteen oval, thin-shelled eggs in early summer. The mother will brood the eggs until they hatch, usually in August. The dark and brightly striped hatchlings will often stay with the mother a day or so before going off on their own.

Plain-bellied Watersnake ***Nerodia* (*Natrix*) *erythrogaster***

Description: Figures 59 and 60. The common name suggests the best character for distinguishing this species from the other two species of watersnakes in LBL. A heavy body, pugnacious nature, strongly keeled scales, divided anal plate, absence of a facial pit, and habitat will identify a watersnake as one of this species. The belly ranges in color from yellow to orange to almost red, with dark pigment encroaching on the sides of the scutes and sometimes extending across the back edge of each scute as a narrow line, but there are no spots or blotches on the belly. On top, the animal is gray to greenish olive; young individuals have a pattern of bold blotches (see figure 60). In mature specimens, the juvenile pattern is sometimes discernible, especially just after the snake has shed or if its skin is wet. A series of light, dark-bordered crossbars down the back is the most usually evident pattern retained. Adults may exceed 4 feet in length but average 2 to 3 feet.

Distribution and Habitat: Especially common in the Barkley Lake drainage, this species is less restricted in habitat than the Diamond-backed Watersnake but is not as wide ranging as the Northern Watersnake. It prefers the shallow margins of bays, small interior ponds, and lakes throughout LBL.

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Natural History: The diet of the Plain-bellied Watersnake is similar to that of the other semiaquatic snakes of LBL. Fishes, tadpoles, frogs, small turtles, and crayfish are commonly taken. It is LBL's most terrestrial watersnake. Relying on its quickness and agility, the Plain-bellied Watersnake can move with surprising speed. If cornered, it will flatten its body and strike wildly while musking its adversary. Watersnakes may move considerable distances inland in the fall in search of hibernation sites. Several species of snakes frequently may hibernate in the same favorable location, such as an area of broken, rocky outcrops. Mating occurs in spring, with up to thirty live-born young per female appearing in late summer. Newborn individuals average 10 inches and have alternating dark blotches on a tan background (see figure 60).

Diamond-backed Watersnake ***Nerodia* (*Natrix*) *rhombifer***

Description: Figure 61. The Diamond-backed Watersnake is the largest of LBL's watersnakes. Adults may grow to as long as 5 feet, and this very heavy-bodied snake is one of the most impressive in the area. Like all watersnakes, this species has strongly keeled scales and a divided anal plate. The dorsal color is basically brown or tan, with a chainlike pattern of dark markings formed by diagonal lines connecting a middorsal row of dark spots with alternating lateral rows of spots. The belly is yellowish, with diffuse, darker half-moons at the front of each scute.

Distribution and Habitat: The Diamond-backed Watersnake prefers the sloughs and warm, sluggish backwaters of Kentucky and Barkley Lakes. It is the least-common watersnake in LBL.

Natural History: When cornered, these snakes may coil, flatten their bodies, and strike viciously. A bite by one of these snakes or by any other large, nonvenomous snake in LBL may result in profuse bleeding, but there is little pain and, except for the risk of infection that accompanies any break in the skin, no danger from envenomation. Adults, especially pregnant females, are fond of basking in the sun on exposed trees or rocks near water. Their feeding, however, is done mostly at night, and although they eat mainly fishes, they may consume almost any cold-blooded vertebrate they encounter and can overpower. Drying pools with trapped fishes attract these snakes as well as other predators, sometimes in large numbers. Twenty live young,

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each measuring 11 inches, are on average born to each gravid female Diamond-backed in late summer.

Common Watersnake ***Nerodia* (*Natrix*) *sipedon***

Description: Figures 62 and 63. Local people may or may not be able to distinguish the Common Watersnake, known locally as the "water moccasin" (as are other watersnakes of the area), from the venomous Cottonmouth. The Common Watersnake is heavy bodied, with strongly keeled scales and a divided anal plate. The dorsal pattern (often obscure in large or dry individuals) is a series of crossbands on the forepart of the body that breaks up into alternating, unconnected side and dorsal spots farther back. The background color may range from copper to brown to gray. Those with the copper background color are often misidentified as the venomous Copperhead. The belly has a strong but variable pattern of half-moons and blotches extending to the tip of the tail. A medium to large snake, the Common Watersnake averages about 30 inches but occasionally may reach 40 inches or more.

Distribution and Habitat: Of the three species of watersnakes occurring in LBL, the Common Watersnake is, as its name indicates, the most common. It is found in all types of aquatic habitats, from lake margins to small streams or ponds.

Natural History: This snake, although timid and retiring, will nevertheless defend itself vigorously when cornered. Individuals may bite viciously when handled and emit a noxious odor from glands located near the anus (as will the other watersnakes). It eats mostly fishes, frogs, and salamanders, and it may play an important role in preventing overpopulation of fish ponds. During the hot summer months, it is largely nocturnal. Mating occurs in April, and one to three dozen 9-inch young are born alive to each gravid female the following August or September.

Queensnake ***Regina septemvittata***

Description: Figure 64. The Queensnake is a small- to moderate-size snake, rarely more than 24 inches in length. It has a brown to dark-olive dorsal ground color and a narrow light stripe running the length of the body on the lower part of each side. The venter is yellow (often darker

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posteriorly), with two gray or brown stripes on either side of the midline and two brown stripes on its outer edge.

Distribution and Habitat: The Queensnake is known from only one record (July 1991) in the extreme southeastern part of the area, so it is no doubt the rarest snake of LBL. This record involved a gravid female (30 inches total length) that was found dead on a gravel road near Lake Barkley. Dissection revealed fourteen ready-for-birth young that averaged 8.5 inches total length. Several recent accounts have also documented this species just to the north of LBL in and around the community of Grand Rivers. To the east of LBL, where the Queensnake is more likely to be encountered, it frequents small- to medium-size, rocky-bottomed streams with an ample supply of flat rocks and shoreline debris, which it uses for cover when disturbed. It is occasionally encountered on limbs overhanging the water.

Natural History: The Queensnake is active mainly during the daytime and feeds almost exclusively on crayfish that have recently molted. Several adults and juveniles may hide under the same rock, usually within just a few feet from water. Queensnakes are not inclined to bite, but if handled they will musk, twist, and roll in an attempt to free themselves. Mating occurs in spring, and about a dozen young, measuring around 10 inches, are born alive to each gravid female in late summer.

Dekay's Brownsnake *Storeria dekayi*

Description: Figure 65. This small relative of the watersnakes shares with them the characteristics of keeled dorsal scales and a divided anal plate. Dorsally, it may be any of several shades of brown to light gray, with a broad light stripe extending down the middle of the back, commonly interrupted by narrow, dark, often incomplete crossbands. Some individuals, however, show almost no dorsal pattern. The underparts are clear yellowish to pinkish, often with small dots on the sides of the scutes. Adults range between 10 and 15 inches long, with females consistently attaining a larger size than males. A dark, vertical bar on the side of the head behind the eye is a good identifying character. There are seventeen scale rows at midbody—the similar Red-bellied Snake has fifteen.

Distribution and Habitat: Dekay's Brownsnakes are widespread in LBL, often found beneath stones, logs, and bark in the forest or under de-

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bris at old homesites. Field- and forest-edge habitat is most favored. They exhibit a preference for moist areas, although they may wander far from standing water.

Natural History: This secretive, inoffensive little snake is often overlooked, even in areas where it may be fairly common. It does not bite but may flatten its body and emit a disagreeable odor from anal glands when handled. The diet consists mostly of slugs and snails, with earthworms, insect larvae, and very small frogs rounding out the fare. The young are about 4 inches long when born in midsummer and have a yellow band around the neck, which disappears with age. Aggregations of several to hundreds of individuals are sometimes found, usually in loose soil.

Red-bellied Snake ***Storeria occipitomaculata***

Description: Figure 66. Red-bellied Snakes are small snakes that average less than 12 inches long and are quite variable in appearance. Typical individuals are brown or gray on top, with two, often indistinct, narrow, dark lines running the length of the body on each side. The belly is a bright red to orange (occasionally yellowish) centrally, with dark pigment on the lateral edges of the scutes continuous with that of the sides. On the neck, just behind the head, there are typically three light spots, one on the center top and one on either side. The scales are strongly keeled and in fifteen rows at midbody. The anal plate is divided.

Distribution and Habitat: Although Red-bellied Snakes probably occur in all parts of LBL, most records of the species are from south of U.S. Highway 68/80. Even in that area, though, they are seen far less often than the Dekay's Brownsnake. They are usually found under logs, stones, or bark in moist, wooded situations or as they cross roads at night.

Natural History: Red-bellied Snakes feed on insects, slugs, and earthworms captured on or in the ground. When handled, they do not attempt to bite but defecate and exude a mildly offensive odor from anal glands, a practice common to many species of snakes when disturbed. Like its relative, the Dekay's Brownsnake, this species has the unusual behavior of curling the upper labials to reveal the gums and teeth when threatened. The Red-bellied Snake is a live-bearer and gives birth to from one to twenty 3½-inch young during July and August.

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Eastern Ribbonsnake ***Thamnophis sauritus***

Description: Figure 67. In appearance, the Eastern Ribbonsnake is a slender edition of the Common Gartersnake. It is best distinguished from that species by the position of the lateral stripes, which involve the third and fourth scale rows in the Ribbonsnake and the second and third scale rows in the Common Gartersnake. There is a third light stripe down the middle of the back, which in the Ribbonsnake often has an orange tinge. The belly is white or cream and unmarked. There are no vertical dark markings on the white upper labials, as there are in the Gartersnake. Adults average about 2 feet in total length, more than one-quarter of which is tail. They are very slender animals, resembling the Rough Greensnake in body proportions. The scales are keeled, and the anal plate is undivided. Female Ribbonsnakes and Common Gartersnakes are considerably larger than males.

Distribution and Habitat: In LBL, the Eastern Ribbonsnake has been found only on the Lake Barkley side of the central drainage divide. Stream margins and the edges of lakes and ponds are this species' typical habitat.

Natural History: Ribbonsnakes are semiaquatic, feeding on small vertebrates such as salamanders and small frogs that they can catch in or near shallow water. When pursued, they often enter the water but usually swim along the surface rather than diving like watersnakes. Ribbonsnakes are most often observed near aquatic habitats during rainy nights. They are quick, agile, and alert, and when picked up they will sometimes open their mouths threateningly but seldom bite. Five to twenty 8- to 9-inch young are born alive to each gravid female in July to September.

Common Gartersnake ***Thamnophis sirtalis***

Description: Figure 68. Similar to the Eastern Ribbonsnake, the Common Gartersnake is heavier bodied and has lateral light stripes involving the second and third instead of the third and fourth scale rows. Dark, vertical marks on the upper labials are also a good character in distinguishing this species from the Eastern Ribbonsnake, which lacks them. The Common Gartersnake's middorsal stripe is rarely orange tinged, as it may be on the Eastern Ribbonsnake. The darker area on either side of the middorsal stripe is often checkered in appearance. Much variation exists in

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this species' pattern and background colors. The scales are strongly keeled, the anal plate undivided. Adults average around 2 feet long and rarely exceed 3 feet.

Distribution and Habitat: One of the best-known and widespread snakes in LBL, the Common Gartersnake is not very choosy about its habitat, although it seems to avoid dense, mature woodlands.

Natural History: Not so restricted to vicinities of water as the Eastern Ribbonsnake, Common Gartersnakes seek earthworms and small, cold-blooded vertebrates in many types of habitat. They are one of the earliest snakes to become active in the spring, normally emerging from hibernation in March and remaining active into October. When cornered, they often flatten their bodies, making themselves look larger than they really are. If handled, they emit a smelly excretion from anal glands. Mating takes place shortly after emergence from hibernation, and from less than ten to as many as one hundred 7-inch young are born alive to each gravid female from July through September.

Smooth Earthsnake *Virginia valeriae*

Description: Figure 69. The Smooth Earthsnake is one of six species of small, drab-colored snakes in LBL that are most commonly taken from under debris in a variety of habitats. With a little effort, however, they are not difficult to distinguish. This species averages 8 to 9 inches in total length, is plain reddish to grayish brown on top, with a cream-colored, unspotted belly. The anal plate is divided, and the scales are weakly keeled, except for the lower rows in some individuals. A faint, light line down the middle of the back is sometimes evident. There are seventeen scale rows at midbody. Females are considerably larger than males.

Distribution and Habitat: The Smooth Earthsnake is a common but seldom encountered species in LBL. It is largely nocturnal and dwells on and in the forest floor, where it may be found among leaves and under rocks, logs, and other debris. It prefers areas with moist soil, where field and forest mix. During their nighttime journeys, Smooth Earthsnakes may fall into ditches or pits from which they cannot escape. They may burrow extensively, especially during dry weather.

Natural History: Smooth Earthsnakes are completely inoffensive to humans. They feed on earthworms and soft-bodied insects. Mating takes

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place in the spring, and up to a dozen 4-inch young are born alive to each gravid female in August.

Eastern Hog-nosed Snake ***Heterodon platirhinos***

Description: Figures 70–72. The Eastern Hog-nosed Snake comes in a variety of color patterns. Some individuals are almost solid black or dark brown on top when adult, but adults of a second form retain the juveniles' strongly patterned appearance. The ground color on top in patterned individuals may be brown, gray, yellowish, or reddish. The rostral scale at the tip of the snout is upturned, and this characteristic serves as the basis for the common name. The scales are keeled, the anal plate divided. Adults average 2 feet in length but may exceed 3 feet.

Distribution and Habitat: This species is found over most of LBL, often in areas of sandy or loose soil,

Natural History: The Eastern Hog-nosed Snake is known locally as the "spreadhead" and "spreadin' adder" or "puff adder," all allusions to its habit of flattening its head and the forepart of its body, rearing like a cobra, hissing, and making false strikes when at bay. Although very convincing, this behavior is all bluff, and even when it strikes, it frequently "forgets" to open its mouth. If this ruse fails to discourage an intruder, a disturbed Hog-nosed will often go into rolling, writhing convulsions—as if in its last death throes—open its mouth, let its tongue loll out, and roll over on its back (see figure 72). If picked up at this stage, it is completely limp, but if placed back down on its belly, it immediately rolls over onto its back again. Eastern Hog-nosed Snakes feed primarily on toads. They produce a mildly toxic saliva, which they use in immobilizing their prey, and possess a pair of enlarged rear teeth, used to "deflate" toads. The female lays about two dozen elongate eggs in June, which hatch into 7-inch young in July or August.

Ring-necked Snake ***Diadophis punctatus***

Description: Figure 73. No other snake in LBL has the combination of a yellow belly, a dark, unmarked back, smooth scales, and a yellow or orange collar. The only species with which the Ring-necked is likely to be confused is the Red-bellied Snake, and that species has keeled scales (look

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closely) and three light spots on the neck just behind the head rather than a collar. The Ring-necked Snake's belly usually has some dark spots on it, in either a single or double row down the center, but this character is quite variable. The collar is in some instances interrupted middorsally. Adults average 12 inches long and rarely exceed 18 inches. The anal plate is divided.

Distribution and Habitat: The Ring-necked Snake is common throughout LBL. Debris-laden, wooded hillsides are its preferred habitat. Beneath stones, logs, and bark slabs and around abandoned home sites are good places to look for it. They are most often seen in spring or late winter, soon after emerging from hibernation and while the surface soil is still moist, but with the advent of drier and hotter weather they retreat to moist places.

Natural History: Ring-necked Snakes eat almost any animal of appropriate size that they may encounter in their wanderings on the forest floor, including salamanders, lizards, snakes, and worms. In late spring, several females may lay their eggs in the same nest in rotting wood or beneath large stones. The elongate eggs measure about ¼ by 1 inch and hatch in August.

Common Wormsnake *Carphophis amoenus*

Description: Figure 74. The common name is appropriate on three counts: these snakes look like worms, burrow like worms, and eat worms. Adults average 8 to 10 inches in total length and seldom exceed 12 inches. Due to the small size of the conical head and the bluntness of the tail, the animal appears somewhat two-headed. The tail, although blunt, is furnished with a sharp, pricklike scale at its tip, which the snake may press into one's hand when the snake is held, although it can do no harm. Adults are brown on top and pinkish on bottom, with the pink extending onto the first or second lateral scale rows. There are thirteen rows of satiny iridescent and very smooth scales. The anal plate is divided.

Distribution and Habitat: Common Wormsnakes occur throughout LBL in wooded areas where there are earthworms, which means moist soil. In the spring and early summer, they may be fairly common under debris in appropriate areas, but as summer progresses and the soil dries, they retreat to deeper burrows.

Natural History: Common Wormsnakes may wander around the

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forest floor, but only at night. They will often follow the slime trails of earthworms as they move overland and can occasionally be observed crossing roads. The eggs, up to half a dozen per clutch, are laid in depressions under logs or rocks in early summer. They are elongate, with rather delicate shells. Hatchlings, which appear in August and September, average about 4 inches long.

North American Racer ***Coluber constrictor***

Description: Figures 75 and 76. The North American Racer, known by many as the "Black Racer," is a sleek animal, and the shiny, unkeeled scales have a satiny luster. Adults average 3 to 5 feet long. The dorsal color is blue black, and the underside is a lighter, unmarked blue gray. The anal plate is divided. The hatchlings and young are patterned with a row of brownish blotches down the middle of the back against a light background and have heavy spotting on the sides and underparts (see figure 76). In overall appearance, they may look very little like the adults.

Distribution and Habitat: The North American Racer is more likely to be encountered in LBL than probably any other snake. It frequents a variety of habitats, especially open woodlands and grassy areas, and in early summer it may be observed swimming in open lakes.

Natural History: Racers are active, alert snakes and when encountered usually try to escape, but they will actively defend themselves if they cannot. They crawl with their heads well above the ground, apparently to get a better view. They are commonly believed to chase people, but it is difficult to imagine what they would do with a human if they caught one. If they do approach an intruder, it is likely in defense of their territory. They are indiscriminate feeders, eating insects, mice, frogs, birds, and other snakes, including Copperheads. The food is not constricted but may be pinned down with a body loop and is swallowed alive. The female deposits up to two dozen ¾-by-1-inch, rough-shelled eggs in decaying vegetation in June and July, which hatch in August or September into young that average about 9 inches.

Rough Greensnake ***Opheodrys aestivus***

Description: Figure 77. This distinctive snake is known locally as the "vine snake," which is an appropriate name in view of both its resemblance

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to a vine stem and its habit of climbing among vines and other vegetation in search of food. Adults average 2 to 3 feet in length, about one-third of which is tail. The green, unmarked, elongated body is well adapted to movement and concealment among tree branches. The dorsal scales are keeled, hence the name "Rough Greensnake," and the anal plate is divided. The mouth cavity in live specimens is purplish, and when captured the snakes will sometimes open their mouths as if to bite, but they seldom do. It is probably the only snake in LBL that even approaches acceptance in the minds of many people as a harmless and beneficial member of our wildlife.

Distribution and Habitat: Although the Rough Greensnake is known from sites throughout the length of LBL, most of the records are from the Lake Barkley side of the drainage divide. It may at times be semiaquatic and is most often encountered in brushy situations near water.

Natural History: This species' diet consists almost entirely of spiders and insects, especially caterpillars. Retiring and quick, Rough Greensnakes are easily overlooked. They are often killed on roadways, after which their carcasses turn from green to pale blue, a change that often results in a misidentification. Mating occurs in the spring, and each gravid female deposits two to eleven eggs in depressions beneath rocks, logs, or other debris in June or July. The white, hard-shelled eggs are very elongate, about 7/16 by 1⅛ inches, and hatch into 7-inch young a couple of months after being deposited.

Gray Ratsnake ***Pantherophis* (*Elaphe*) *spiloides***

Description: Figures 78 and 79. "Chicken snake" is the name applied locally to this species, although darker individuals may be called simply "black snakes." Young specimens are gray with about thirty dark blotches down the center of the back and alternating rows of dark spots on the sides (see figure 79). Adults in LBL lose this pattern to varying degrees, some being almost completely black but with white on the skin between the scales. The scales are only weakly keeled (those on the lower sides sometimes indiscernibly so), and the anal plate is divided. Adults average 4 to 6 feet in length, and 7-foot specimens have been reported.

Distribution and Habitat: The Gray Ratsnake occurs throughout LBL and is fairly common in a variety of habitats, usually near woods or

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brush. The name "chicken snake" apparently was conferred because of the animal's habit of establishing residence around barns and chicken houses, where it feeds on rats and mice and sometimes on eggs and baby chicks.

Natural History: Gray Ratsnakes are excellent climbers, and their movements are slow and deliberate, even on the ground. Small mammals are their staple food, but they will eat baby birds and eggs and sometimes climb high into trees in quest of them, where they may be discovered and mobbed by Blue Jays. One to two dozen 1-by-2-inch adhesive eggs are laid in July among decaying organic matter of rotting stumps, compost heaps, and sawdust piles. This species will sometimes utilize communal nesting sites, often in a large hollow stump. Hatchlings are 11 to 12 inches long and appear in September.

Pinesnake ***Pituophis melanoleucus***

Description: Figure 80. If you see a large black-and-whitish snake with keeled scales and an undivided anal plate in LBL, it is sure to be this species. The ground color is often quite yellowish, and the black dorsal blotches are browner toward the tail. Adults average 4 to 6 feet in length and are moderately heavy bodied. It seems improbable that this species would be misidentified as a rattlesnake, but one of us (DHS) once saw in a local newspaper a picture of a large specimen that was so identified. Natives refer to this species as the "bull snake" or "goose snake," the latter name alluding to its habit of hissing loudly at intruders as it coils and rears menacingly. The Pinesnake will bite but is not as vicious as many snake species.

Distribution and Habitat: Pinesnakes are found in the south and central sections of LBL. Over most of its range, it is restricted to areas of dry, loose soil. In LBL, it prefers open areas associated with oak–hickory forest.

Natural History: As might be inferred from the relatively small, unexpanded head and pointed snout, the Pinesnake is a burrower. One of the most economically valuable reptiles because of its diet of small rodents, it deserves complete protection. Pinesnakes are frequently victims of automobiles on highways, and some uninformed drivers even go out of their way to hit them. Females lay a cluster of around a dozen 1¼-by-2¼-inch, adherent eggs in loose soil in mid-July. Hatchlings average about 16 inches long.

Conservation Status: The Tennessee Wildlife Resources Agency con-

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siders populations of *Pituophis melanoleucus* "threatened" in Tennessee, and the Tennessee Department of Environment and Conservation, Division of Natural Areas, gives it a ranking of "subnational vulnerable" (S3). The Kentucky State Nature Preserves Commission lists it as "threatened" in Kentucky.

Yellow-bellied Kingsnake ***Lampropeltis calligaster***

Description: Figures 81 and 82. The Yellow-bellied or Prairie Kingsnake is sometimes misidentified as a Copperhead, though in pattern and other characteristics it is distinctly different. Like other members of the kingsnake group that occur in LBL (i.e., Red Milksnake and Eastern Black Kingsnake), it has smooth scales, an undivided anal plate, and an unexpanded head. Adults average about 3 feet long and are patterned middorsally with a row of forty to sixty olive-green, brown, or reddish black-edged blotches, which alternate with rows of smaller blotches on the sides. In some individuals, the pattern is obscure, and faint, broad, longitudinal stripes may be perceptible. The venter is yellowish with darker, squarish blotches, which are often more numerous toward the sides.

Distribution and Habitat: Although not common, the Yellow-bellied Kingsnake occurs throughout the length of LBL, usually in open or semi-open habitats. Much like the Pinesnake, this species has declined over the past several decades because its formerly open habitat has decreased significantly.

Natural History: The Yellow-bellied Kingsnake is often found wandering about in daylight (particularly in the spring and fall) as it actively seeks the small mammals that constitute most of its diet. It eats other small vertebrates (including snakes) and some insects. Large food items are constricted, but the smaller ones are simply swallowed. About a dozen smooth, white, ¾-by-2-inch, adherent eggs are laid in moist soil in June or July and hatch in August or September. Hatchlings average 10 to 12 inches in length.

Eastern Black Kingsnake ***Lampropeltis nigra***

Description: Figure 83. The Eastern Black Kingsnake is the largest and most abundant of the kingsnakes in LBL, averaging more than 3 feet

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long when mature. This handsome snake is predominantly black on top, often with yellowish flecks. In some individuals, there is a series of numerous, very thin, light, yellowish lines across the top of the back. In juveniles, this banded pattern is commonly distinct. All other large, black snakes of LBL have divided anal plates, whereas the kingsnakes' anal plates are undivided. The scales are smooth. The venter shows a distinct black-and-white, checkered pattern.

Distribution and Habitat: The Eastern Black Kingsnake can be found most anywhere in LBL; however, it prefers sites near ponds, streams, swamps, or other bodies of water.

Natural History: The Eastern Black Kingsnake feeds on a variety of vertebrates, including small mammals, lizards and snakes (and their eggs), and, less frequently, amphibians and birds (and their eggs). Prey are normally killed by constriction before being ingested but may be swallowed alive if small and inactive. (Specimens being held often coil around one's arm and squeeze with surprising force.) Their diet includes many species of snakes, including venomous ones. Kingsnakes apparently have at least partial immunity to pit viper venom. They may bite when first captured and are prone to chewing on one's finger rather than striking and then quickly recoiling, as most snakes do. The female lays about a dozen strongly adherent, ¾-by-1½-inch eggs in June or July, which hatch into 10-inch young in August or September.

Red Milksnake *Lampropeltis triangulum*

Description: Figure 84. The Red Milksnake averages about 2 feet in length. It has a body adorned with bright-red, black-edged dorsal blotches (on average twenty-eight) on a white or yellowish ground color, coupled with a venter boldly patterned with squarish, black marks. The Red Milksnake has a comparatively small head, smooth scales, and an undivided anal plate. Two other snakes that resemble the Red Milksnake in LBL are the Scarlet Kingsnake and the Scarletsnake. The Scarlet Kingsnake is in general smaller and has blotches that usually extend to the midline of the belly to form complete or nearly complete rings and that are fewer in number (on average eighteen). The Scarletsnake differs in several characters, but the most obvious is the creamy white (with no black) belly.

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Distribution and Habitat: The Red Milksnake is extremely secretive, spending much of its time burrowing in leaf litter and loose soil or under fallen logs or other substrates. It is often observed in edge habitat between forest and field. It occurs throughout the area in moderate numbers.

Natural History: The myth that Milksnakes will suck milk from cows in the pasture or barn is no longer widely believed but, along with the hoop snake myth, is probably as widely known as any story about snakes. The Red Milksnake feeds mostly on small rodents, birds, and reptiles and is sometimes found around barns and farm buildings where these animals abound and where there may incidentally be cows. When first captured, Milksnakes may coil, vibrate their tails rapidly, and even strike. They are most likely to be encountered in the spring or early summer, especially at night on paved roads following a heavy rain. They are occasionally found in moist situations in or under a variety of vegetative cover objects (e.g., the bark of standing dead trees, rotting logs, or old lumber piles). The female lays about six to ten white, elongate eggs in decaying vegetation in June, which hatch into 9-inch young.

Scarlet Kingsnake *Lampropeltis elapsoides*

Description: Figure 85. At first glance, the Scarlet Kingsnake, with an average adult size of less than 16 inches, seems like just a smaller version of its close relative, the Red Milksnake. Unlike the Red Milksnake, however, its body can be completely ringed (in many specimens) with a series of broad, black-bordered red bands on a yellow or white background. As mentioned in the previous species account, the number of bands on the Scarlet Kingsnake is less than the number on the Red Milksnake. Although these two species were once thought to interbreed in other parts of the country where their ranges overlap, evidence is accumulating that interbreeding may be minimal at best (as it appears to be in LBL) and that these two snakes are in fact two distinct species.

Distribution and Habitat: The Scarlet Kingsnake has a much more limited distribution than the Red Milksnake in LBL and is found mostly in the northeastern portion in established oak–hickory forests.

Natural History: The Scarlet Kingsnake feeds primarily on small lizards and lizard eggs. Like both the Red Milksnake and the Scarletsnake, the Scarlet Kingsnake is a burrower, often found inside or just under de-

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composed logs. The female lays an average of four elongate, adhesive eggs, 1 inch in diameter, in June, which hatch into 5- to 6½-inch replicas of the adult.

Conservation Status: The Kentucky State Nature Preserves Commission lists the Scarlet Kingsnake as a "species of special concern" (S) in Kentucky.

Scarletsnake *Cemophora coccinea*

Description: Figure 86. The Scarletsnake is one of the most pleasant reptiles in LBL. Like the Red Milksnake and the Scarlet Kingsnake, the Scarletsnake has a conspicuous red, black, and yellowish-white dorsal pattern. The Scarletsnake may, however, be distinguished by its immaculate creamy-white belly in contrast to the patterned bellies of the other two species. There are usually nineteen rows of smooth scales at midbody, and the anal plate is undivided. Adults average about 18 inches long but may exceed 2 feet. The burrowing habits are reflected in the animal's head form (which is not expansive), its small eyes, and its pointed, projecting, conical snout.

Distribution and Habitat: This species occurs in widespread areas of LBL, but its burrowing habits and perhaps its actual rarity ensure that it is seldom seen. Most specimens we have taken or have knowledge of from LBL have been captured from blacktop roads at night.

Natural History: Less is known about the life history of this snake than of possibly any other amphibian or reptile in the area. The Scarletsnake is strongly nocturnal and may forage well into the early morning. It is a docile animal and pleasant to handle. Moist areas of loose soil are seemingly preferred. Food items include invertebrates, reptile eggs, and a variety of small vertebrates, the latter of which are killed by constriction before being eaten. The female lays two to nine eggs, each about 1⅜ inches long, in moist situations in June and early July. Hatchlings average just less than 6 inches and are replicas of the adults.

Southeastern Crowned Snake *Tantilla coronata*

Description: Figure 87. If you take a small, shiny, rich-brown snake with a black cap atop the head and a black collar around the top and

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sides of the neck in LBL, it is the Southeastern Crowned Snake. Crowned Snakes have the slender bodies, small heads, and smooth scales that typify burrowing snakes. The anal plate is divided, and there are fifteen scale rows at midbody. Adults average about 9 inches in length and rarely exceed 12 inches. The belly is whitish and unmarked.

Distribution and Habitat: Southeastern Crowned Snakes have been recorded over all but the extreme southern area of LBL, with most records involving single individuals on roads after dark. Like many burrowing animals, Crowned Snakes may be more numerous in certain areas than collection records would indicate. When not on roads at night, the species is most commonly encountered beneath logs, stumps, and rocks on wooded hillsides or ridges. These snakes generally seem to occur in drier situations than the other small, secretive snakes of the area.

Natural History: The Southeastern Crowned Snake is the smallest snake found in LBL. It is strongly nocturnal. Both males and females may be found in the spring under rocks, with males more likely to be found on roads during summer. Southeastern Crowned Snakes feed primarily on centipedes and insect larvae they encounter underground. There is evidence that they may produce a mild venom for use in immobilizing their prey, but they do not nor can they bite humans. There are no hollow fangs but rather small, grooved teeth toward the back of the mouth. In early summer, the female lays two or three small, white, elongate eggs in depressions or cavities in moist situations, such as around stumps and under logs and stones. Hatchlings appear in September and measure a little more than 4 inches.

Copperhead *Agkistrodon contortrix*

Description: Figure 88. Copperheads are called "highland moccasins" by some natives, and they are closely related to the Cottonmouth. Adult Copperheads average 2 to 3 feet in length but are not as heavy bodied as the Cottonmouth. The Copperhead is beautifully camouflaged among the brown leaves of the forest floor. The dark, hourglass crossbands on a rich brown or even pinkish background are distinctive, although toward the front of the animal the two halves of the hourglass sometimes fail to meet. The young (as with the related Cottonmouth) often have a yellow to greenish tail. The heat-sensitive facial pit, present on all the venomous

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snakes of LBL, is used in detecting infrared radiation emitted by warm-blooded prey, thus aiding in capturing such prey in the dark.

Distribution and Habitat: The most common venomous snake in LBL, the Copperhead is widespread over wooded and brushy parts of the area, and it not infrequently wanders into open areas, especially if attracted by an abundant food supply or by moisture during dry weather.

Natural History: The Copperhead is not a deadly species, although its bite is very painful and conceivably could be fatal to a small child. As evidence of the potency of its venom, dogs, which are commonly bitten by these snakes, almost always recover with no treatment. Yet a bite by any venomous snake should be considered a serious medical emergency. Copperheads eat a variety of prey, including arthropods, amphibians, reptiles, birds, and small mammals. Mating occurs in spring or fall, and the female gives birth to up to a dozen 7-inch live young in late summer. The young are equipped with a fully operational envenomation apparatus, but, contrary to a popular myth, their venom is no more toxic than that of a fully mature adult.

Cottonmouth *Agkistrodon piscivorus*

Description: Figures 89 and 90. The Cottonmouth, also known as the "cottonmouth moccasin" or simply the "water moccasin," is a very heavy-bodied snake. A 3-foot specimen may be as big around as a man's wrist. The head has a very angular profile, especially where its top joins the side of the face in front of the eyes. Adults average 2 to 3 feet long but may approach 4 feet. Young Cottonmouths are boldly patterned with broad, dark, irregular crossbands on a brown or olive background, with a bright yellow-tipped tail (see figure 90). At this age, they look confusingly like Copperheads and are best distinguished by the broad, dark stripe extending down the side of the head at eye level. (Young Copperheads may show a narrow dark line here.) The yellow-tipped tail may serve as a lure for insects, frogs, salamanders, and small mammals in both these species, so Cottonmouths lie coiled with the wriggling tail tip in front of their heads.

Distribution and Habitat: The Cottonmouth is found in the coves and backwaters of Barkley and Kentucky Lakes, but usually in small numbers in LBL.

Natural History: The Cottonmouth, like nearly all snakes, is severely

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persecuted by humans and is probably on the decline in LBL. When threatened, it will hold its mouth open, revealing the white interior—hence the name. Cottonmouths love the water (under which they can bite perfectly well) and are never found far from it, except when moving to and from hibernation sites in the spring and fall. Cottonmouths swim gracefully on top of the water with their heads held well out of the water. Watersnakes do not swim in this manner. The nocturnal Cottonmouth has a varied diet consisting of fish, salamanders, lizards, snakes, small mammals, and birds. The female gives birth to on average eight live young in late summer, typically on a forested hillside and sometimes at a distance from the water. The newborn average 8 inches.

Pygmy Rattlesnake ***Sistrurus miliarius***

Description: Figures 91 and 92. The Pygmy Rattlesnake or "ground rattler" has typical pit viper characteristics: a heat-sensitive facial pit, a vertical pupil, a single row of subcaudals, salivary glands modified for the production of venom, and a pair of hollow, erectile fangs at the front of the upper jaw. Adults reach a maximum length of about 2 feet. The middle of the top of the head between the eyes is covered with large, flattened scales, whereas the Timber Rattlesnake has numerous, tiny scales in that area. The general color and pattern are suggestive of a young Hog-nosed Snake, but of course the latter lacks a rattle and facial pit. The body of the Pygmy Rattlesnake is heavy, the tail short. A distinct decrease in circumference is often evident at the end of the body and beginning of the tail. The rattle is very small, even proportionally, and the sound it makes suggests the buzzing of an insect and has little carrying power.

Distribution and Habitat: The "ground rattler" occurs mainly in the southern half of LBL, on the Kentucky Lake side of the drainage divide. Although rarely seen, it prefers field edges in association with mixed upland and deciduous and coniferous forests.

Natural History: The Pygmy Rattlesnake is active from April through October. Most encounters are with individuals found crossing gravel and paved roads on hot summer nights. Like other rattlesnakes, the Pygmy does not always rattle before striking and may bite from an uncoiled position. Its venom is potent, but there is probably not enough of it to be fatal to a human in good health. Frogs, lizards, snakes, and small mammals

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are known prey. After it mates in spring, around six young are born alive in August or September. These tiny replicas of the adults measure only 6 inches and have tails tipped in yellow (see figure 92).

Conservation Status: The Kentucky State Nature Preserves Commission and the Tennessee Wildlife Resources Agency list the Pygmy Rattlesnake as "threatened" in Kentucky and Tennessee, respectively.

Timber Rattlesnake *Crotalus horridus*

Description: Figure 93. One of the truly impressive experiences in the outdoors is a first encounter with this magnificent animal. If snakes as a group are maligned and loathed, this one in particular epitomizes evil and danger in many people's minds. In reality, the Timber Rattlesnake is a fascinating creature and, though potentially dangerous, is not aggressive. Except for the Pygmy Rattlesnake (which reaches a maximum length of about 2 feet and is covered with large, flattened scales on the top of its head between the eyes), there is no snake in LBL with which this species is likely to be confused. Natives refer to it as the "diamond-backed rattler," but the true Diamond-backed Rattlesnake does not occur here. Adults average 3 to 4½ feet long but may exceed 5 feet. Its population is widespread in brushy and wooded regions of the area, but it is nowhere common. In hot weather, it may move into moist, low-lying areas. The facial pit and vertical pupil mark this species as a pit viper, a group containing all four of the venomous species of snakes found in LBL. The rattle may consist of as many as a dozen segments, one segment being added each time the skin is shed. Terminal segments are also frequently lost through breakage, rendering the number of rattle segments unreflective of an individual's age.

Distribution and Habitat: Timber Rattlesnakes can be found throughout LBL, although not in great numbers. They are most often seen crossing roads at any time of the day when temperatures are warm. They in general utilize oak–hickory forests with moderate to heavy canopy in LBL.

Natural History: Timber Rattlesnakes feed mostly on small mammals. They hibernate in rotting stumps, mammal burrows, and rocky outcrops. They are active from April through October. Females reach maturity in their fifth year and produce young every other year. Up to twenty young are born alive in late summer or fall. The young average 11 inches and are adorned with a single button.

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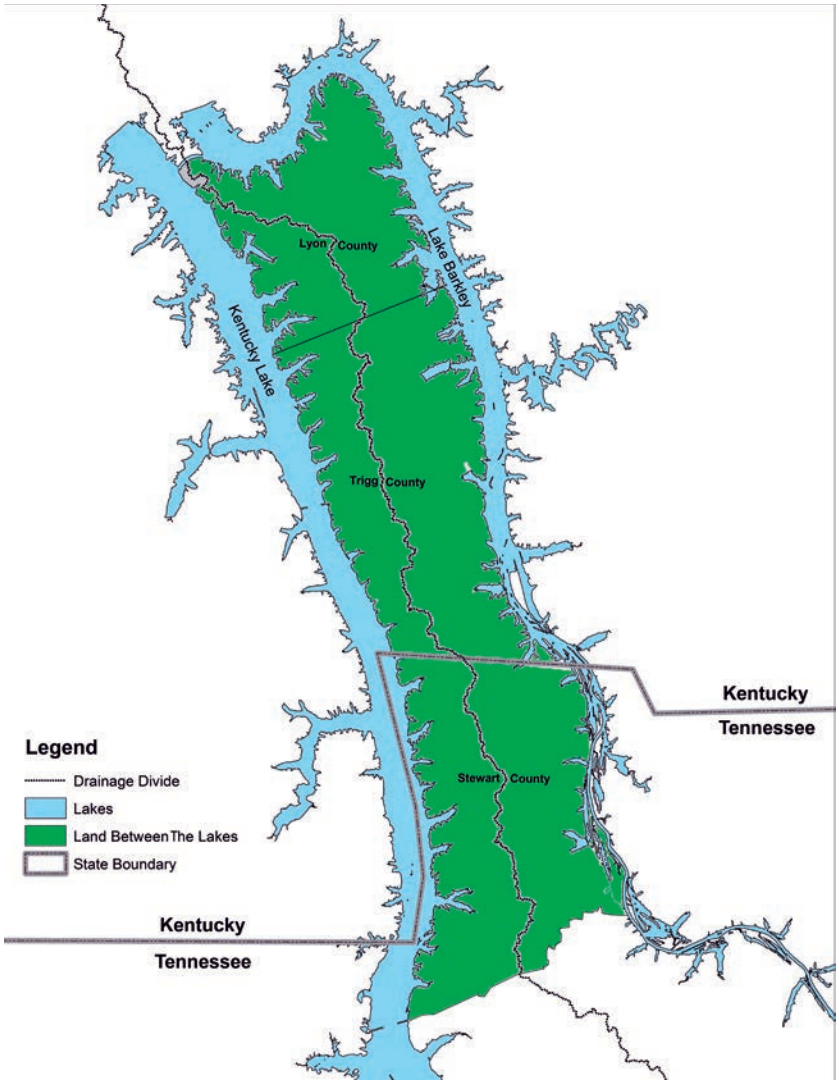

1. Land Between the Lakes

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2. Lesser Siren, Graves County, Ky.

3. Hellbender, Bath County, Ky.

4. Mudpuppy, Powell County, Ky.

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5. Small-mouthed Salamander, Hopkins County, Ky.

6. Mole Salamander, Graves County, Ky.

7. Marbled Salamander, Edmonson County, Ky.

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8. Spotted Salamander, Trigg County, Ky.

9. Eastern Tiger Salamander, Hopkins Co., Ky.

10. Eastern Newt, Stewart County, Tenn.

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11. Eastern Newt (red eft stage), Trigg County, Ky.

12. Spotted Dusky Salamander, Graves County, Ky.

13. Northern Zigzag Salamander, Stewart County, Tenn.

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14. Northern Slimy Salamander, Calloway County, Ky.

15. Red Salamander, Trigg County, Ky.

16. Cave Salamander, Hardin County, Ky.

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17. Long-tailed Salamander, Calloway County, Ky.

18. Southern Two-lined Salamander, Hardin County, Ky.

19. Eastern Narrow-mouthed Toad (mating), Trigg County, Ky.

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20. Eastern Spadefoot, Hardin County, Ky.

21. Fowler's Toad, Caldwell County, Ky.

22. American Toad, Trigg County, Ky.

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23. Gray Treefrog, Graves County, Ky.

24. Green Treefrog, Trigg County, Ky.

25. Spring Peeper, Graves County, Ky.

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26. Upland Chorus Frog, McCracken County, Ky.

27. Eastern Cricket Frog, Henderson County, Ky.

28. Southern Leopard Frog (typical color), Graves County, Ky.

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29. Southern Leopard Frog (alternative color), Calloway County, Ky.

30. Pickerel Frog, Hardin County, Ky.

31. Green Frog, Calloway County, Ky.

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32. American Bullfrog, Calloway County, Ky.

33. Wood Frog, Stewart County, Tenn.

34. Snapping Turtle, Harrison County, Ky.

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35. Alligator Snapping Turtle, Houston County, Tenn.

36. Eastern Mud Turtle, Graves County, Ky.

37. Eastern Musk Turtle, Graves County, Ky.

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38. Eastern Box Turtle, Harrison County, Ky.

39. Eastern Box Turtle (hatchling), Harrison County, Ky.

40. Painted Turtle, Graves County, Ky.

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41. Pond Slider, Calloway County, Ky.

42. River Cooter, Marshall County, Ky.

43. River Cooter (hatchling), Calloway County, Ky.

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44. Southern Map Turtle, Calloway County, Ky.

45. False (Mississippi) Map Turtle phenotype (hatchling), Marshall County, Ky.

46. False Map Turtle, Marshall County, Ky.

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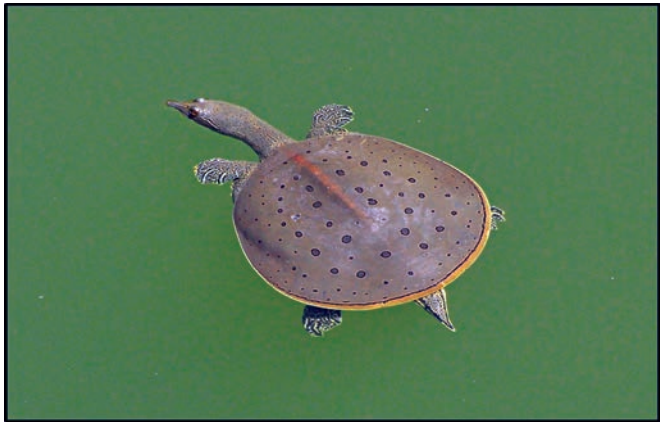
47. Northern Map Turtle, Harrison County, Ky.

48. Midland Smooth Softshell, Marshall County, Ky.



49. Spiny Softshell, Harrison County, Ky.

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50. Spiny Softshell (adult female), Calloway County, Ky.

51. Eastern Fence Lizard, Graves County, Ky.

52. Eastern Fence Lizard (ventral view, male), Trigg County, Ky.

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53. Six-lined Racerunner, Calloway County, Ky.

54. Little Brown Skink, Calloway County, Ky.

55. Common Five-lined Skink (female with eggs), Trigg County, Ky.

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56. Common Five-lined Skink (juvenile), Hardin County, Ky.

57. Southeastern Five-lined Skink, McCreary County, Ky.

58. Broad-headed Skink, Graves County, Ky.

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59. Plain-bellied Watersnake, Union County, Ill.

60. Plain-bellied Watersnake (juvenile), Trigg County, Ky.

61. Diamond-backed Watersnake, Fulton County, Ky.

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62. Common Watersnake (female with young), Graves County, Ky.

63. Common Watersnake (dark-color phase), Calloway County, Ky.

64. Queensnake, Harrison County, Ky.

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65. Dekay's Brownsnake, Calloway County, Ky.

66. Red-bellied Snake (brown and gray phases), Calloway County, Ky.

67. Eastern Ribbonsnake, Marshall County, Ky.

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68. Common Gartersnake, Harrison County, Ky.

69. Smooth Earthsnake, Graves Co., Ky.

70. Eastern Hog-nosed Snake (melanistic phase), Lyon County, Ky.

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71. Eastern Hog-nosed Snake (patterned phase), Calloway County, Ky.

72. Eastern Hog-nosed Snake (feigning death), Trigg County, Ky.

73. Ring-necked Snake, Wolfe County, Ky.

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74. Common Wormsnake, Powell County, Ky.

75. North American Racer, Powell County, Ky.

76. North American Racer (juvenile), Edmonson County, Ky.

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77. Rough Greensnake, Hopkins County, Ky.

78. Gray Ratsnake, Trigg County, Ky.

79. Gray Ratsnake (juvenile), Graves County, Ky.

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80. Pinesnake, Calloway County, Ky.

81. Yellow-bellied Kingsnake, Trigg County, Ky.

82. Yellow-bellied Kingsnake (juvenile), Hardin County, Ky.

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83. Eastern Black Kingsnake, Calloway County, Ky.

84. Red Milksnake, Trigg County, Ky.

85. Scarlet Kingsnake, Trigg County, Ky.

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86. Scarletsnake, Lyon County, Ky.

87. Southeastern Crowned Snake, Calloway County, Ky.

88. Copperhead, Montgomery County, Tenn.

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89. Cottonmouth, Graves County, Ky.

90. Cottonmouth (juvenile), Hickman County, Ky.

91. Pygmy Rattlesnake, Trigg County, Ky.

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92. Pygmy Rattlesnake (newborn), Calloway County, Ky.

93. Timber Rattlesnake, Lyon County, Ky.

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Keys to Typical Adult Amphibians and Reptiles of Land Between the Lakes

These keys have been written to aid in the identification of the adult amphibians and reptiles occurring in LBL and included in this book.

The keys are artificial in the sense that they are not designed to indicate relationships of the various animals to one another. Those characters most conveniently determinable and yet yielding accurate identifications have been used.

Immature and atypical forms may not be identifiable with these keys. Their inclusion would have added considerably to the keys' length and complexity. The colors of dead or preserved animals may fade and be quite different from the colors of live animals; as a consequence, dead animals also may not be identifiable with these keys. Any unfamiliar terms you encounter in the keys are probably defined in the glossary and/or illustrated on pages 93–97 and viii–xi.

The use of these keys involves the making of a series of choices from couplets of choices presented. To use the keys, read the two choices of the first couplet (number 1) in the appropriate key and decide which of the two choices best fits the specimen. Then go to the couplet indicated by the number following your choice and read the two choices at that couplet and again decide which best fits your specimen. Continue in this manner, making a choice and going to the couplet indicated, until you come to a couplet that is followed by the name of an animal instead of a number. This name identifies the species at hand.

Key to the Major Groups

1. No scales on body; no claws on toes . . . . . Amphibians, 2
   Body covered with scales (sometimes present as flattened, horny scutes), or claws present on toes, or both . . . . . Reptiles, 3

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2. Tail present . . . . . Salamanders
Key to species on pages 72–74
Tail absent . . . . . Frogs and toads
Key to species on pages 74–75

3. Body encased in a horny or leathery shell; teeth present . . . . . Turtles
Key to species on pages 76–77
Body not encased in a horny or leathery shell; teeth absent 4

4. Legs present . . . . . Lizards
Key to species on pages 77–78
Legs absent . . . . . Snakes
Key to species on pages 78–81

Key to the Salamanders

1. Hind legs absent . . . . . Lesser Siren
Hind legs present 2

2. External gills present . . . . . Mudpuppy
External gills absent 3

3. Single gill slit on each side of neck . . . . . Hellbender
No gill slit on side of neck 4

4. Without a nasolabial groove 5
With a nasolabial groove 10

5. Two distinct longitudinal ridges atop head . . . . . Eastern Newt
No longitudinal ridges atop head 6

6. With conspicuous yellow or orange markings on body 7
Without conspicuous yellow or orange markings on body, although white markings or flecks may be present 8

7. Yellow or orange markings present as two irregular rows down sides

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of back, not extending onto lower sides of venter . . . . . Spotted Salamander
Yellow markings present on sides and venter as well as on back . . . . . Eastern Tiger Salamander

8. Series of bold white or light-gray crossbands on the back, often connected laterally to produce a chainlike pattern . . . . . Marbled Salamander
No series of bold white or light-gray crossbands on the back 9

9. Ten or eleven costal grooves . . . . . Mole Salamander
Fourteen or fifteen costal grooves . . . . . Small-mouthed Salamander

10. With a light malar stripe; hind legs much larger than forelegs . . . . . Spotted Dusky Salamander
No light malar stripe; hind legs slightly but not much larger than forelegs 11

11. Body mostly black, sometimes with scattered white flecks 12
Body not mostly black 13

12. Distinct white spots scattered over body, sometimes densely on the sides . . . . . Northern Slimy Salamander
Body without distinct white spots . . . . . Lead-backed phase of Northern Zigzag Salamander

13. General coloration orange to orange red or purplish brown, with scattered black dots on dorsum 14
General coloration not orange to orange red or purplish brown, with scattered black dots on dorsum 15

14. Sixteen or seventeen costal grooves; body stout; tail less than half the total length . . . . . .Red Salamander
Thirteen to fifteen costal grooves; body slender; tail more than half the total length . . . . . Cave Salamander

15. A broad, reddish-brown, jagged-edged stripe extending down the

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midback from behind the head onto the tail . . . . . Red-backed phase of Northern Zigzag Salamander
No broad, reddish-brown, jagged-edged stripe extending down the midback from behind the head onto the tail 16

16. Black pigment on sides of tail arranged in irregular but distinct vertical bars; maximum length 7 inches . . . . . Long-tailed Salamander
Black pigment on sides of tail not arranged in distinct vertical bars; maximum length 4 inches . . . . . Southern Two-lined Salamander

Key to the Frogs and Toads

1. Paratoid glands present; pupil of eye horizontally elliptical 2
Paratoid glands absent; pupil of eye not horizontally elliptical 3

2. Paratoid glands kidney shaped, concave on lateral margin; only one or two warts in each dark spot on the back; enlarged warts on upper surface of thigh . . . . . American Toad
Paratoid glands oval, not concave on lateral margin; three, four, or more warts in each dark spot on the back; no enlarged warts on upper surface of thigh . . . . . Fowler's Toad

3. Head small and pointed, transverse fold of skin across the back of the head, behind the eyes; maximum length 1½ inches; body plump, legs short . . . . . Eastern Narrow-mouthed Toad
Head not small and pointed, no transverse fold of skin across the back of the head, behind the eyes; longer than 1½ inches; body not plump, legs not short 4

4. Pupil of eye vertically elliptical . . . . . Eastern Spadefoot
Pupil of eye round 5

5. Conspicuous adhesive discs at tips of the toes 6
Without conspicuous adhesive discs at tips of the toes 9

6. Dorsum green with a few scattered, small, golden spots; a sharply defined white lateral stripe running from just beneath eye to vicinity of

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groin . . . . . Green Treefrog
Dorsum green but without sharply defined white lateral stripe 7

7. A light spot on upper jaw below eye . . . . . Gray Treefrog
No light spot on upper jaw below eye, although light line may be present there 8

8. A dark, irregular, X-shaped mark on the back; no light line along upper lip . . . . . Spring Peeper
Dark markings on back appear as longitudinal stripes or rows of dots or scattered dots, but no X-shaped figure; light line along upper lip . . . . . Upland Chorus Frog

9. Without a dorsolateral fold 10
With a dorsolateral fold 12

10. Toes of hind foot not or only scantily webbed . . . . . Upland Chorus Frog
Toes of hind foot extensively webbed 11

11. Body length less than 1½ inches; skin faintly warty; dark triangular spot atop head between eyes . . . . . Eastern Cricket Frog
Body length up to 7 inches; skin smooth; no dark triangular spot atop head between eyes . . . . . American Bullfrog

12. Dorsolateral fold extending posteriorly only to the sacral hump 13
Dorsolateral fold extending posteriorly to the groin 14

13. Dark mask on each side of head extending through the eyes from snout to posterior edge of the tympanum . . . . . Wood Frog
Sides of head without dark masks . . . . . Green Frog

14. Concealed surfaces of hind legs conspicuously yellowish or orange; dorsal spots quadrangular in two irregular longitudinal rows . . . . . Pickerel Frog
Concealed surfaces of hind legs not conspicuously yellowish or orange; dorsal spots rounded and not in two rows . . . . . Southern Leopard Frog

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Key to the Turtles

1. Carapace not covered with scutes; margin of carapace soft and flexible 2
   Carapace covered with scutes; margin of carapace not soft and flexible 3

2. Spines along front margin of carapace; longitudinal ridge projecting into each nasal passage from median partition dividing the left and right nostrils . . . . . Spiny Softshell
   No spines along front margin of carapace; no longitudinal ridge projecting into each nasal passage from median partition dividing the left and right nostrils . . . . . Midland Smooth Softshell

3. Plastron with eleven or fewer scutes 4
   Plastron with twelve or more scutes 7

4. Supramarginals present . . . . . Alligator Snapping Turtle
   Supramarginals absent 5

5. Plastron with nine scutes . . . . . Snapping Turtle
   Plastron with eleven scutes 6

6. Plastron with two hinges; pectoral scutes triangular, meeting only narrowly at midline . . . . . Eastern Mud Turtle
   Plastron with one hinge; pectoral scutes squarish, meeting broadly at midline . . . . . Eastern Musk Turtle

7. Plastron hinged . . . . . Eastern Box Turtle
   Plastron not hinged 8

8. Marginals marked with red. . . . . Painted Turtle
   Marginals not marked with red 9

9. Carapace with fine, longitudinal ridges and furrows; vertebral scutes not knobbed 10
   Carapace without fine, longitudinal ridges and furrows; vertebral scutes often knobbed 11

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10. Usually a conspicuous red mark on each side of head behind eye; no C-shaped light mark on second costal scute; sides of carapace not "pinched in" before hind legs . . . . . Pond Slider
Without a conspicuous red mark on side of head behind eye; C-shaped light mark on second costal scute usually evident; sides of carapace often "pinched in" before hind legs . . . . . River Cooter

11. Second and third vertebral scutes lacking prominent knobs, except in very young individuals; yellow mark atop head behind eye round or longitudinally elongate and separated from eye by short vertical or horizontal lines . . . . . Northern Map Turtle
Second and third vertebral scutes with prominent knobs; yellow mark atop head behind each eye other shape than round or longitudinally elongate and not separated from eye by any lines 12

12. Mark behind eye a broad squarish to transversely rectangular yellow blotch; yellow spots below eye and on posterior part of lower jaw large (greater than diameter of iris) . . . . . Southern Map Turtle
Mark behind eye a crescent or broken crescent; yellow spots below eye and on posterior part of lower jaw, if present, are small (less than diameter of iris) . . . . . False Map Turtle

Key to the Lizards

1. Scales on upper body granular . . . . . Six-lined Racerunner
Scales on upper body not granular 2

2. Scales on upper body strongly keeled . . . . . Eastern Fence Lizard
Scales on upper body smooth 3

3. Maximum body length 1¾ inches; without five light, longitudinal stripes on dorsum . . . . . Little Brown Skink
Maximum body length to 5 inches; often with five light, longitudinal stripes on dorsum 4

4. Median row of subcaudal scales distinctly wider than adjacent rows 5

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Median row of subcaudal scales not distinctly wider than adjacent rows . . . . . Southeastern Five-lined Skink

5. Enlarged postlabials present, separating last upper labial from ear opening; typically seven (sometimes eight) upper labials on each side . . . . . Five-lined Skink
   No enlarged postlabials; last upper labial adjoining ear opening or separated by only one or two tiny scales; eight upper labials on each side . . . . . Broad-headed Skink

Key to the Snakes

1. Facial pit present; venomous 2
   Facial pit absent; nonvenomous 5

2. With a rattle at tip of the tail 3
   Without a rattle at tip of the tail 4

3. Top of the head with nine platelike scales evident; maximum length 2 feet . . . . . Pygmy Rattlesnake
   Top of the head covered by a mixture of large and small scales; up to 5 feet total length . . . . . Timber Rattlesnake

4. Head a coppery-red color; much copper color on body also; a pattern of hourglass-shaped crossbands on a lighter background; suborbitals (row of small scales between eye and upper labials) present . . . . . Copperhead
   Head a dark brown or black, not coppery red; body dark in general color, often with broad, dark crossbands evident; suborbitals absent (lower margin of eye in contact with upper labials) . . . . . Cottonmouth

5. Anal plate undivided 6
   Anal plate divided. 14

6. Dorsal scales keeled 7
   Dorsal scales not keeled 9

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7. Dorsal scales at midbody in seventeen to nineteen rows 8
Dorsal scales at midbody in twenty-seven to twenty-nine rows . . . . . Pinesnake

8. Lateral stripes confined to scale rows 2 and 3, not involving row 4 . . . . . Common Gartersnake
Lateral stripes confined to scale rows 3 and 4, not involving row 2 . . . . . Eastern Ribbonsnake

9. Venter light in color, immaculate . . . . . Scarletsnake
Venter with conspicuous dark markings evident 10

10. With a series of red or reddish-brown blotches extending down the back 11
Without a row of red or reddish-brown blotches extending down the back 13

11. With red, black, and light crossbands on dorsum 12
Without red, black, and light crossbands on dorsum. . . . . Yellow-bellied Kingsnake

12. Dorsal red, black, and light crossbands extend onto venter . . . . . Scarlet Kingsnake
Dorsal red, black, and light crossbands do not extend onto venter . . . . . Red Milksnake

13. Dorsum black, speckled with small, yellowish to white spots, some arranged in faint crossbands on back . . . . . Eastern Black Kingsnake
Dorsum not speckled 14

14. Dorsum essentially solid black . . . . . Eastern Black Kingsnake
Dorsum not solid black . . . . . Yellow-bellied Kingsnake

15. Dorsal scales keeled, at least on the uppermost scale rows at midbody (examine carefully, preferably with hand lens if uncertain) . . . 16
Dorsal scales not keeled anywhere along the length of the body . . . 25

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16. Rostral scale upturned and keeled on top . . . . . Eastern Hog-nosed Snake
Rostral scale normal, not upturned or keeled above 17

17. Dorsal scales in nineteen or more rows 18
Dorsal scales in seventeen or fewer rows 22

18. Dorsal scales strongly keeled; two or three postoculars, but if only two, then dorsal scales in fewer than twenty-four rows 19
Dorsal scales, at least those on the middle of the back, weakly keeled; lateral rows of scales often smooth; two postoculars; dorsal scales in more than twenty-four rows . . . . . Gray Ratsnake

19. Dorsal scales in nineteen rows at midbody; venter yellow or off white with two brown paramedian stripes . . . . . Queensnake
Dorsal scales in more than nineteen rows at midbody; venter pattern not yellow or off white or with two brown paramedian stripes 20

20. Usually eleven or more lower labials; dorsal pattern consisting of a series of dark markings on the midback connected by oblique bars to an alternating row of similar dark markings on the side; overall effect is a chainlike pattern, with the lighter patches on the midback being more or less diamond shaped . . . . . Diamond-backed Watersnake
Usually ten lower labials; dorsal pattern not consisting of a series of dark markings on the midback connected by oblique bars to an alternating row of similar dark markings on the side; no chainlike pattern; no diamond-shaped lighter patches on the midback 21

21. Venter plain yellow or orange, without dark spots or blotches . . . . . Plain-bellied Watersnake
Venter with dark spots or blotches evident . . . . Common Watersnake

22. Dorsum bright green; body long and slender . . . . . Rough Greensnake
Dorsum some shade of brown, gray or black, not green 23

23. Preocular absent; loreal present (if the scale touching the front of the eye is longer than it is high, then it is a loreal; if higher than long, then it is a preocular) . . . . . Smooth Earthsnake

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Preocular present; loreal absent (scale touching the front of the eye is higher than long) 24

24. Dorsal scales in seventeen rows; dark, downward-projecting streak on side of head behind the eye; venter white, yellowish, or light pink . . . . . Dekay's Brownsnake
Dorsal scales in fifteen rows; no dark, downward-projecting streak on side of head behind the eye; venter bright red or orange red, usually darker posteriorly . . . . . Red-bellied Snake

25. Dorsal scales in thirteen rows . . . . . Common Wormsnake
Dorsal scales in fifteen or more rows 26

26. Dorsal scales in fifteen rows 27
Dorsal scales in seventeen rows 28

27. Loreal present (see couplet 23); yellow ring around neck; venter bright yellow, often with black dots . . . . . Ring-necked Snake
Loreal absent; brown collar on nape, behind black-crowned head; venter not bright yellow . . . . . Southeastern Crowned Snake

28. Six upper labials; total length less than 12 inches . . . . . Smooth Earthsnake
Seven upper labials; total length up to 5 feet . . . . . North American Racer

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Forms of Marginal Occurrence in Land Between the Lakes

The seventy-five species of amphibians and reptiles discussed in this book have either been collected from LBL or, in two instances (Hellbender and Pickerel Frog), have not been collected from the area but almost certainly occur there. Further collecting will undoubtedly add to the list of forms known to occur, and the list given here includes twelve species that, on the basis of their known ranges and habitat requirements, might be looked for in LBL. The numbers in the right-hand column (1, 2, and 3) are estimates of the probability that each form does in fact occur in LBL. The numbers may be interpreted as: 1 = a good possibility of occurrence in LBL, 2 = a moderate possibility of occurrence, and 3 = a remote possibility of occurrence. In the event you should find an amphibian or reptile that is not one of the seventy-five species described in this book, this list will help you in deciding which species to check first in one of the more comprehensive works listed in "Suggested References."

Amphibians

Salamanders

Amphiuma	*Amphiuma means*	2
Four-toed Salamander	*Hemidactylium scutatum*	2
Mud Salamander	*Pseudotriton montanus*	2

Frogs

Bird-voiced Treefrog	*Hyla avivoca*	1
Barking Treefrog	*Hyla gratiosa*	2
Crawfish Frog	*Lithobates* (*Rana*) *areolatus*	2

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Reptiles

Lizards

Green Anole	*Anolis carolinensis*	3
Slender Glass Lizard	*Ophisaurus attenuatus*	1
Coal Skink	*Plestiodon* (*Eumeces*) *anthracinus*	2

Snakes

Western Ribbonsnake	*Thamnophis proximus*	3
Red-bellied Mudsnake	*Farancia abacura*	2
Red Cornsnake	*Pantherophis* (*Elaphe*) *guttatus*	2

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Acknowledgments

The original version of this book, authored by David H. Snyder and published in 1972, was made possible by a grant from the Tennessee Valley Authority (TVA), the federal agency in charge of developing and overseeing the Land Between the Lakes National Recreation Area (LBL) after its establishment in 1963. In addition to funds provided in the grant, the TVA also assisted by making available many of LBL's facilities through cooperation and assistance extended by members of its staff. Raymond Nall, staff biologist of LBL at the time, was of special assistance in securing specimens from the area. Many students of Austin Peay State University—including Fred Alsop, Connie Eatherly, Kay and Don Harker, Joe Pardue, Joe Schibig, Floyd Scott, Billy Sexton, and Marie Slate—also contributed significantly to the fieldwork and other aspects of the project leading up to the book. Sheila Owens helped keep the records and typed several drafts of the manuscript. Kraig Adler of Cornell University provided comments on the manuscript, and Joseph T. Collins of the Museum of Natural History, University of Kansas, supplied information on distribution records of the area's herpetofauna. David Snyder's family also helped tremendously in the fieldwork, and his father critically read the manuscript.

Interest in the amphibians and reptiles of LBL following the original publication of this book in 1972 increased as area universities began using the area to acquaint students in vertebrate zoology and herpetology classes with the region's herpetofauna. Austin Peay State University in Clarksville, Tennessee, and Murray State University in Murray, Kentucky, have remained heavily involved in continued studies of LBL's herpetofauna. This expanded and updated version was made possible by combining knowledge obtained during work on the first edition with information gathered since then by researchers and students at Austin Peay and Murray State. Along the way, many individuals, institutions, and agencies contributed in one way or another to this effort. Edward W. Chester provided the description of LBL's vegetation and land cover. Students at Austin Peay who deserve special recognition for their help in gathering data on LBL's herpetofauna include Heather Bagwell, Angelo Bufalino, Greg Clement, Amy Cline, Amy Deal, Jeremy Faulk, Kevin Fitch, James Flaherty, Dan-

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iel French, Michael Fullbright, Rita Gunderson, Barry Hart, Loeb Hebel, Eric Marcum, Steve Mathys, Christina Morgan, Andy Mueller, Jeremy Nichols, Dustin Owen, Matthew Padgett, Kristin Page, Curtis Pendergrass, Savannah Price, Tammy Pryor, Charles Rozelle, Shannon Salyer, Joe Shinn, Brant Smith, Jason Smith, Eugene Stewart, Ellen Twombly, John Twombly, Marie Twombly, Tom Twombly, Laura Walker, Kellie Wallace, Mike Wallace, Larry Wheeler, Scott Williamson, Colleen White, Kristoffer Wild, and Eugene Zirkle.

We are also grateful to several students and faculty members at Murray State: Thomas Anderson, Michael Armstrong, Catherine Aubee, Evan Brown, Chris Crockett, Clinton Cunningham, Dwight Good, Mark Hatfield, John Hewlett, James Hust, Tim Johnson, Robert Knopp, Mary Mandt, Brad Pendley, Valerie Titus, Jason Waller, Howard Whiteman, and Cleo Duke Wilder. We also thank members of the Murray State Herpetology Society whom we may have inadvertently missed here. Their combined hours walking the hills of LBL during the day and "road running" at night easily number in the tens of thousands. Finally, we extend our thanks to Scott Schupe and the late Kenny Maddox, who, although not directly associated with Murray State University, were nevertheless an important part of the greater Murray "herp" community.

Several institutions provided support for work on amphibians and reptiles at LBL: the Department of Biology and Center of Excellence for Field Biology at Austin Peay State University as well as the Department of Biological Sciences, the Watershed Studies Institute, and the Hancock Biological Station at Murray State University. Permission to use LBL as a study site over the years was granted by TVA and later by the U.S. Forest Service, which assumed jurisdiction of the area in 1999. Personnel at LBL, in particular Rick Lowe, Tom Forsyth, Eric Smeckpepper, and Marcus Cope, were always cooperative and willing to assist in any way they could.

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Appendix

Table 1. Families, Genera, and Species of LBL's Salamanders (in Order of Presentation)

Family	Species	Common Name
Sirenidae	*Siren intermedia*	Lesser Siren
Cryptobranchidae	*Cryptobranchus alleganiensis*	Hellbender
Proteidae	*Necturus maculosus*	Mudpuppy
Ambystomatidae	*Ambystoma texanum*	Small-mouthed Salamander
	Ambystoma talpoideum	Mole Salamander
	Ambystoma opacum	Marbled Salamander
	Ambystoma maculatum	Spotted Salamander
	Ambystoma tigrinum	Eastern Tiger Salamander
Salamandridae	*Notophthalmus viridescens*	Eastern Newt
Plethodontidae	*Desmognathus conanti*	Spotted Dusky Salamander
	Plethodon dorsalis	Northern Zigzag Salamander
	Plethodon glutinosus	Northern Slimy Salamander
	Pseudotriton ruber	Red Salamander
	Eurycea lucifuga	Cave Salamander
	Eurycea longicauda	Long-tailed Salamander
	Eurycea cirrigera	Southern Two-lined Salamander

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Table 2. Families, Genera, and Species of LBL's Frogs and Toads (in Order of Presentation)

Family	Species	Common Name
Microhylidae	*Gastrophryne carolinensis*	Eastern Narrow-mouthed Toad
Scaphiopodidae	*Scaphiopus holbrookii*	Eastern Spadefoot
Bufonidae	*Anaxyrus* (*Bufo*) *fowleri*	Fowler's Toad
	Anaxyrus (*Bufo*) *americanus*	American Toad
Hylidae	*Hyla chrysoscelis/versicolor* complex	Gray Treefrog
	Hyla cinerea	Green Treefrog
	Pseudacris crucifer	Spring Peeper
	Pseudacris feriarum	Upland Chorus Frog
	Acris crepitans	Eastern Cricket Frog
Ranidae	*Lithobates* (*Rana*) *sphenocephalus*	Southern Leopard Frog
	Lithobates (*Rana*) *palustris*	Pickerel Frog
	Lithobates (*Rana*) *clamitans*	Green Frog
	Lithobates (*Rana*) *catesbeianus*	American Bullfrog
	Lithobates (*Rana*) *sylvaticus*	Wood Frog

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Table 3. Families, Genera, and Species of LBL's Turtles (in Order of Presentation)

Family	Species	Common Name
Chelydridae	*Chelydra serpentina*	Snapping Turtle
	Macrochelys temminckii	Alligator Snapping Turtle
Kinosternidae	*Kinosternon subrubrum*	Eastern Mud Turtle
	Sternotherus odoratus	Eastern Musk Turtle
Emydidae	*Terrapene carolina*	Eastern Box Turtle
	Chrysemys picta	Painted Turtle
	Trachemys scripta	Pond Slider
	Pseudemys concinna	River Cooter
	Graptemys ouachitensis	Southern Map Turtle
	Graptemys pseudogeographica	False Map Turtle
	Graptemys geographica	Northern Map Turtle
Trionychidae	*Apalone* (*Trionyx*) *mutica*	Midland Smooth Softshell
	Apalone (*Trionyx*) *spinifera*	Spiny Softshell

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Table 4. Families, Genera, and Species of LBL's Lizards (in Order of Presentation)

Family	Species	Common Name
Phrynosomatidae	*Sceloporus undulatus*	Eastern Fence Lizard
Teiidae	*Aspidoscelis* (*Cnemidophorus*) *sexlineatus*	Six-lined Racerunner
Scincidae	*Scincella lateralis*	Little Brown Skink
	Plestiodon (*Eumeces*) *fasciatus*	Common Five-lined Skink
	Plestiodon (*Eumeces*) *inexpectatus*	Southeastern Five-lined Skink
	Plestiodon (*Eumeces*) *laticeps*	Broad-headed Skink

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Table 5. Families, Genera, and Species of LBL's Snakes (in Order of Presentation)

Family	Species	Common Name
Natricidae	*Nerodia* (*Natrix*) *erythrogaster*	Plain-bellied Watersnake
	Nerodia (*Natrix*) *rhombifer*	Diamond-backed Watersnake
	Nerodia (*Natrix*) *sipedon*	Common Watersnake
	Regina septemvittata	Queensnake
	Storeria dekayi	Dekay's Brownsnake
	Storeria occipitomaculata	Red-bellied Snake
	Thamnophis sauritus	Eastern Ribbonsnake
	Thamnophis sirtalis	Common Gartersnake
	Virginia valeriae	Smooth Earthsnake
Dipsadidae	*Heterodon platirhinos*	Eastern Hog-nosed Snake
	Diadophis punctatus	Ring-necked Snake
	Carphophis amoenus	Common Wormsnake
Colubridae	*Coluber constrictor*	North American Racer
	Opheodrys aestivus	Rough Greensnake
	Pantherophis (*Elaphe*) *spiloides*	Gray Ratsnake
	Pituophis melanoleucus	Pinesnake
	Lampropeltis calligaster	Yellow-bellied Kingsnake
	Lampropeltis nigra	Eastern Black Kingsnake
	Lampropeltis triangulum	Red Milksnake
	Lampropeltis elapsoides	Scarlet Kingsnake
	Cemophora coccinea	Scarletsnake
	Tantilla coronata	Southeastern Crowned Snake
Viperidae	*Agkistrodon contortrix*	Copperhead
	Agkistrodon piscivorus	Cottonmouth
	Sistrurus miliarius	Pygmy Rattlesnake
	Crotalus horridus	Timber Rattlesnake

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Glossary

adherent: Sticking together.

aestivate: In reference to an animal, in particular an insect, fish, amphibian, or reptile, meaning to spend a hot or dry period in a prolonged state of torpor or dormancy.

amplexus: Amphibians' sexual embrace. The male clings to the female by wrapping either his fore or hind limbs around her body.

anal plate: The scute on a snake's belly just anterior to the cloaca. It may be either a single plate or obliquely divided into left and right portions. See the illustration on page xi.

anterior: At or toward the front.

arthropods: Invertebrate animals with a horny exoskeleton and jointed appendages; this group includes the insects, spiders, crustaceans, crayfishes, millipedes, and centipedes.

body length: The distance from the most anterior point of an animal's snout to the posterior margin of the cloacal slit. See the illustration on page viii.

bridge: The bony connection of the upper and lower parts of a turtle's shell.

brumation: A condition of torpor during extended periods of low temperature (winter dormancy); this term is used to distinguish such states of inactivity among amphibians and reptiles from hibernation, which is common among birds and mammals.

carapace: The upper part of a turtle's shell.

carapace length: The straight-line distance from the front-center edge to the back-center edge of the carapace. See the illustration on page x.

carnivorous: Meat eating.

caudal: Pertaining to the tail.

cloaca: The cavity toward the back of the animal's body that receives the products of the digestive, reproductive, and excretory systems and opens to the outside of the body via the cloacal slit (vent).

clutch: A batch of eggs deposited by one female at one time.

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congener: An organism belonging to the same taxonomic genus as another organism.

costal grooves: The vertical grooves between the costal folds on the sides of salamanders. When counting the number of costal grooves, you should count one each in the axilla (armpit) and groin, even if they slant or are branched at the top. See the illustration on page viii.

dorsal: At or toward the top.

dorsolateral: Between dorsal and lateral—that is, at the juncture of the back and sides.

dorsolateral fold: A conspicuous, longitudinal, glandular fold on the back of some frogs. See the illustration on page ix.

dorsum: The top and sides of an animal.

eft: A newt, especially the Eastern Newt, *Notophthalmus viridescens,* in its immature terrestrial stage.

facial pit: A conspicuous depression on the sides of a pit viper's face. It is located midway along and slightly below an imaginary line connecting the eye with the nostril. The facial pit functions in the detection of infrared radiation emitted by warm-blooded prey and is used in locating and accurately striking at such prey in darkness.

femoral pores: Deep holes occurring in rows on the undersides of some lizards' thighs. These pores are best developed on mature males.

gill: A filamentous, blood-rich outgrowth of the side of the neck in larval amphibians, used in absorbing oxygen from the water and releasing carbon dioxide and other waste products. In frog larvae, the gills are covered by a flap of skin (the operculum) and thus are not visible externally.

gill slit: An opening in the side of the neck that allows water that enters via the mouth to exit via the slit.

gravid: Containing developed eggs or young.

groin: The area near the front of the hind limb where it joins the body. See the illustration on page ix.

gular fold: A transverse fold of skin on the underside of the throat. See the illustration on page viii.

hemipenes: A pair of copulatory organs in the base of a male lizard's or snake's tail, used in transferring sperm to the female's cloaca during mating. The hemipenes are everted (turned inside out) when in use and may have spines on their surface. They account for the fact that male lizards and snakes typically have larger tails than the females.

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immaculate: Of a solid color, with no markings.

insectivorous: Insect eating.

invertebrate: An animal without a backbone.

keeled: With a raised, median, longitudinal ridge. Many snakes' scales are strongly keeled, but some have only weak keels, in which case it is necessary to examine them closely to determine their presence. The keels are most evident on the middorsal scale rows and least prominent on the lowermost lateral rows. See the illustration on page xi.

labials: The scales bordering the mouth, on the upper and lower lips. See the illustration on page xi.

lateral: At or toward the side.

longitudinal: Running parallel to the long axis.

loreal: A scale on the side of lizards' and some snakes' faces, behind the nasals and before the preoculars. If there is a single scale between the nasal scale and the eye, it is a loreal when it is longer than high (compare *preocular*). See the illustration on page xi.

malar stripe: A pigmented line running down and back from the eye to the back corner of the mouth. See the illustration on page viii.

marginals: The protective horny plates (scutes) that run along the perimeter of the carapace of hard-shelled turtles.

median: At or toward the middle.

mental gland: A rounded, bulging area on the underside of the chin in males of certain salamanders that secretes a sex stimulant. See the illustration on page viii.

metamorphosis: The changes that occur in an amphibian as it goes from being an aquatic larva to being a terrestrial adult. The loss of external gills and development of lungs are typically the most noticeable changes. Also called *transformation*.

middorsal: At the middle of the back.

midventral: At the middle of the underside.

nasolabial groove: A depression running from the nostril to the upper lip of lungless terrestrial salamanders. It is sometimes inconspicuous and visible only under a hand lens. It possibly functions in the conduction of odors from the ground to the nostrils. See the illustration on page viii.

neoteny: Attainment of sexual maturity during morphologically larval stages due to some environmental factor (as opposed to a genetic factor).

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nucleoli: Small rounded bodies within a resting cell nucleus that contains RNA and proteins and are involved in the production of ribosomes.

omnivorous: Eating both plant and animal foods.

oviposition: The act of laying eggs.

paedomorphosis: The retention of ancestral juvenile characteristics in a descendant adult species.

parotoid glands: A pair of large, raised skin glands on the top of the head of certain toads, behind the eyes. See the illustration on page ix.

paramedian: Situated adjacent to the midline.

pectoral glands: Small, paired, wartlike glands on the breast of spadefoot toads.

plastron: The lower part of a turtle's shell. See the illustration on page x.

posterior: At or toward the back end.

postlabials: Scales on the sides of a lizard's head, behind the labials and in front of the ear opening. See the illustration on page xi.

postorbital crescent: A yellow-orange, crescent-shaped mark behind the eye of the Mississippi Map Turtle that prevents neck lines from reaching the eye.

preocular: A scale on the side of lizards' and some snakes' faces, just in front of the eye. If there is a single scale between the nasal scale and the eye, it is a preocular when it is higher than long (compare *loreal*). See the illustration on page xi.

sacral hump: The conspicuous hump near the middle of a frog's back. See the illustration on page ix.

scale rows: The longitudinal rows of scales on a snake's (or lizard's) back. They are counted obliquely forward from and including the lowermost row on one side of the animal's body, over the back and down to and including the lowermost row on the other side. See the illustration on page xi.

scute: A large, flattened scale, such as those covering the underside of snakes and the shells of turtles. See the illustration on page x.

scavenger: An animal that feeds on almost anything it can find and manage, dead or alive.

snout–vent length: The distance from the most anterior part of the snout to the anterior margin of the cloacal slit.

spermatheca: A special structure where a female salamander temporarily stores spermataphores deposited by a male before the sperm are released to fertilize the eggs inside the female's body.

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spermatophore: A gelatinous capsule of sperm deposited by male salamanders on the substrate during breeding, which is then picked up with the lips of the female's cloaca. In the female's body, the sperm are released to fertilize the eggs, either immediately or after having been stored temporarily in a special storage structure, the spermatheca.

subcaudals: The scales beneath the tail. See the illustration on page xi.

supramarginals: A row of small scales between the marginal and costal scutes of the Alligator Snapping Turtle's carapace.

terrestrial: Living on, in, or near the ground.

thigh: The upper section of a vertebrate's hind leg, attached to the body and containing the femur. See the illustration on page ix.

transformation: See *metamorphosis*.

transverse: Crosswise. At right angles to the long axis.

total length: The distance from the most anterior point on an animal's snout to the posterior tip of its tail (or hindmost point of the animal's body exclusive of the legs if the tail is lacking). See the illustration on page viii.

vent: Cloaca or cloacal opening.

venter: An animal's underside.

vertically elliptical: As in a cat's eye, a narrow slit running up and down vertically.

vocal sac: The resonating chamber of male frogs' throats. It is inflated with air during singing and may be external or internal, single or paired with another sac.

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Internet Resources

All Wild about Kentucky's Environment (AWAKE). A site with information for all audiences: students, teachers, hunters, anglers, outdoor enthusiasts, and all those who love and want to know more about Kentucky's environment. At http://www.kentuckyawake.org/.

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Illustrations, Photographs, and Photographers

The illustrations of the external morphology of salamanders, frogs, toads, turtles, lizards, and snakes (pages viii–xi) were originally printed on the front and back endpapers of David H. Snyder's 1972 edition of *Amphibians and Reptiles of Land Between the Lakes.* The map of Land Between the Lakes (figure 1) was prepared by Sarah Hazzard, geographic information system analyst for the Tennessee Aquarium Conservation Institute.

The color photographs depicting species are accompanied by common names and the names of the county and state where each animal was found. Photographers included David F. Frymire, Edmund J. Zimmerer, Richard C. Coldiron, A. Floyd Scott, David H. Snyder, and Jason Butler. When we chose photographs to include in this edition, we gave priority to quality and crispness of the image followed by location where the subject was found in relation to LBL. If the image was of good quality and represented an animal from LBL, it was selected over images of comparable quality from outside of LBL. When images were used of animals that came from outside of LBL, those from Kentucky and Tennessee counties surrounding LBL were given priority over those from more distant areas, assuming equal quality.

Photographs by David F. Frymire

Lesser Siren (fig. 2), Small-mouthed Salamander (fig. 5), Mole Salamander (fig. 6), Marbled Salamander (fig. 7), Spotted Salamander (fig. 8), Eastern Tiger Salamander (fig. 9), Spotted Dusky Salamander (fig. 12), Red Salamander (fig. 15), Cave Salamander (fig. 16), Long-tailed Salamander (fig. 17), Southern Two-lined Salamander (fig. 18), Eastern Narrow-mouthed Toad (mating) (fig. 19), Eastern Spadefoot (fig. 20), Fowler's Toad (fig. 21), Gray Treefrog (fig. 23), Green Treefrog (fig. 24), Spring Peeper (fig. 25), Upland Chorus Frog (fig. 26), Eastern Cricket Frog (fig. 27), Southern Leopard Frog (typical color) (fig. 28), Pickerel

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Frog (fig. 30), Green Frog (fig. 31), American Bullfrog (fig. 32), Eastern Mud Turtle (fig. 36), Eastern Musk Turtle (fig. 37), Painted Turtle (fig. 40), Pond Slider (fig. 41), Southern Map Turtle (fig. 44), False (Mississippi) Map Turtle phenotype (hatchling) (fig. 45), False Map Turtle (fig. 46), Northern Map Turtle (fig. 47), Midland Smooth Softshell (fig. 48), Eastern Fence Lizard (fig. 51), Six-lined Racerunner (fig. 53), Little Brown Skink (fig. 54), Common Five-lined Skink (female with eggs) (fig. 55), Common Five-lined Skink (juvenile) (fig. 56), Broad-headed Skink (fig. 58), Plain-bellied Watersnake (fig. 59), Diamond-backed Watersnake (fig. 61), Common Watersnake (female with young) (fig. 62), Common Watersnake (dark-color phase) (fig. 63), Queensnake (fig. 64), Red-bellied Snake (brown and gray phases) (fig. 66), Eastern Ribbonsnake (fig. 67), Smooth Earthsnake (fig. 69), Eastern Hog-nosed Snake (melanistic phase) (fig. 70), Eastern Hog-nosed Snake (feigning death) (fig. 72), North American Racer (juvenile) (fig. 76), Rough Greensnake (fig. 77), Gray Ratsnake (juvenile) (fig. 79), Pinesnake (fig. 80), Yellow-bellied Kingsnake (juvenile) (fig. 82), Eastern Black Kingsnake (fig. 83), Red Milksnake (fig. 84), Scarlet Kingsnake (fig. 85), Scarletsnake (fig. 86), Southeastern Crowned Snake (fig. 87), Copperhead (fig. 88), Cottonmouth (fig. 89), Pygmy Rattlesnake (fig. 91), Timber Rattlesnake (fig. 93)

Photographs by Jason Butler

Hellbender (fig. 3), Mudpuppy (fig. 4), Southeastern Five-lined Skink (fig. 57), North American Racer (fig. 75)

Photographs by David H. Snyder

Eastern Newt (fig. 10)

Photographs by Edmund J. Zimmerer

Eastern Newt (red eft stage) (fig. 11), Northern Zigzag Salamander (fig. 13), Northern Slimy Salamander (fig. 14), American Toad (fig. 22), Southern Leopard Frog (alternative color) (fig. 29), Wood Frog (fig. 33), River Cooter (fig. 42), River Cooter (hatchling) (fig. 43), Eastern Fence

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Lizard (ventral view) (fig. 52), Plain-bellied Watersnake (juvenile) (fig. 60), Dekay's Brownsnake (fig. 65), Eastern Hog-nosed Snake (patterned phase) (fig. 71), Gray Ratsnake (fig. 78), Yellow-bellied Kingsnake (fig. 81), Cottonmouth (juvenile) (fig. 90), Pygmy Rattlesnake (newborn) (fig. 92)

Photographs by Richard C. Coldiron

Snapping Turtle (fig. 34), Eastern Box Turtle (fig. 38), Eastern Box Turtle (hatchling) (fig. 39), Spiny Softshell (fig. 50), Common Gartersnake (fig. 68), Ring-necked Snake (fig. 73), Common Wormsnake (fig. 74)

Photographs by A. Floyd Scott

Alligator Snapping Turtle (fig. 35)

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