This audio field guide presents the voices of 38 species of frogs and toads that occur in the Rocky Mountain and Southwestern states and provinces: Yukon, Northwest Territories, Alberta, Saskatchewan, Montana, Idaho, Wyoming, Colorado, Utah, Nevada, Arizona, and New Mexico. Most of the species have unique voices by which they can be identified.

The one hour CD (or cassette) is accompanied by a 28 page booklet with descriptions of calls, breeding season, and breeding habitats for each species, as well as information on the different types of frog calls, on learning and identifying calls, and on the use of sound by biologists.

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Part One: Reference Section

(Tape: Side A)

Compact Disc Track Number;
For each species listed, the first track is narration, the second is a recording of calls.

Part Two - Test Section

(Tape: Side B)

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CLO

Frog and Toad Calls of the Rocky Mountains

Vanishing Voices

Carlos Davidson

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USDA FOREST SERVICE
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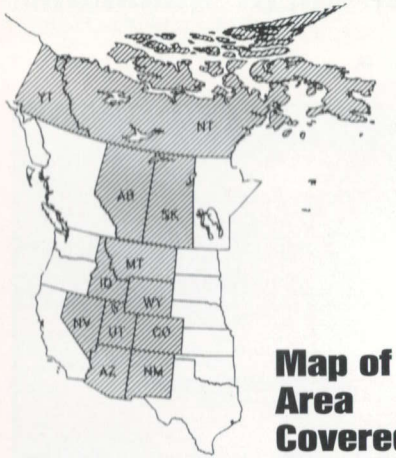


Map of Area Covered by Guide

Northern Leopard Frog *Rana pipiens*

Introduction

The voices of frogs and toads have filled the night for millions of years—since long before human voices existed. Now, many of us seldom have the pleasure of hearing their calls. For many of us life in the city means never being near a pond at night. Often we do not know what to listen for. And the voices of some frogs and toads are disappearing.

This audio field guide presents the calls of frogs and toads of the Rocky Mountains and Southwest. There are currently 40 described species of frogs and toads in the Rocky Mountain and Southwest states and provinces, an area that includes the Canadian provinces of Yukon, Northwest Territories (excluding James Bay), Alberta, and Saskatchewan, and the states of Montana, Idaho, Wyoming, Colorado, Utah, Nevada, Arizona, and New Mexico. This guide contains recordings of 38 species, most of which have a unique voice that may be used to identify them. The only Rocky Mountain or Southwestern species not included here are the Tailed Frog (*Ascaphus truei*), which may not have a voice, and the Tarahumara Frog (*Rana tarahumarae*), a generally silent species which is now extirpated (locally extinct) from the area covered by this guide.

Vanishing Voices?

The populations of some species of frogs and toads in the Rocky Mountains and Southwest appear to be declining rapidly. All known populations of Northern Leopard Frog (*Rana pipiens*) in north central Alberta vanished in the late 1970s. The Boreal Toad (*Bufo boreas boreas*) has disappeared from most of the locations where it once occurred in the southern Rocky Mountains; in Colorado only a few populations remain. The Amargosa Toad (*Bufo nelsoni*) in Nevada is at the edge of extinction with fewer than a hundred toads remaining in the wild. The situation is similar for the Wyoming Toad (*Bufo hemiophrys baxteri*), with no known reproduction in the wild since 1991. Declines have also been reported for the Mountain Yellow-legged Frog (*Rana muscosa*), Spotted Frog (*Rana pretiosa*), Lowland Leopard Frog (*Rana yavapaiensis*), and Chiricahua Leopard Frog (*Rana chiricahuensis*). At the time of this writing about a third of all native frog and toad species in the Rocky Mountains and Southwest are federally listed or are formal candidates for listing under the U. S. Endangered Species Act. At the same time, populations of other species, such as the Pacific Chorus Frog (*Pseudacris regilla*), the Rio Grande Leopard Frog (*Rana berlandieri*) and the introduced Bullfrog (*Rana catesbeiana*) appear to be stable or increasing.

Habitat destruction and alteration are likely the single most important causes of the declines. The reasons for the decline of some species even within areas that are protected from gross habitat alteration (e.g., the Boreal Toad within Rocky Mountain National Park) are unclear. Current research is exploring a number of possible causes for the declines, including competition and predation by introduced fish and other exotic species, diseases, pesticides and other introduced chemicals, increased ultraviolet radiation due to the thinning ozone layer, and climate change. For a very readable account of some of this research see *Tracking the Vanishing Frogs: An Ecological Mystery*, by Kathryn Phillips.

Types of Calls

Frogs and toads make a variety of different calls. These calls can be classified based on their function. Any classification system is a generalization, however; the specific function of a call varies from species to species, and not all species give each type of call listed here.

Advertisement call: The most commonly heard calls, advertisement calls are often produced by many individuals at a single location, creating a chorus. In Rocky Mountain and Southwest species, only adult males that are ready to breed give advertisement calls. When their sound travels over a long distance, advertisement calls serve to attract females and other males to breeding sites. At closer range, advertisement calls alert other males to the presence of a potential rival. Advertisement calls stimulate other males to respond with advertisement calls of their own or with aggressive calls. Females may select mates based on characteristics of their advertisement calls. In the past, researchers focused on the mate-attraction aspect of advertisement calls and referred to them as "mating" or "breeding" calls.

Release call: A release call stimulates a male

who is holding another frog (either male or female) to let go. Male frogs and toads are often unable to distinguish the sex of potential partners and may attempt to mate with anything that is the appropriate size, shape, and feel. Males often clasp other males and mistakenly try to mate with them. A male that gives a release call is usually quickly released. Similarly, an unreceptive female will also give a release call when she is clasped by a male. Release calls are usually accompanied by body vibrations (release vibrations) which may actually be more important than the calls in obtaining release.

Encounter or aggressive call: Males give aggressive calls during close encounters with other males. The calls are used to maintain territories and may precede physical confrontation. Aggressive calls also may be used to disrupt the advertisement calls of nearby rival males.

Alarm and distress calls: Alarm calls are given by an individual who is fleeing a potential predator. They are also known as "warning" calls; however, it is unclear whether the calls actually serve to warn other frogs. A frog or toad who has been seized by a predator will give a distress call. Alarm and distress calls are given by males and females, and by juveniles and adults.

Dry land call: Males give dry land calls outside the breeding season and away from breeding sites. These calls are also known as "rain calls." Their function is unclear.

Classification by function is only one way to look at frog calls. Another approach is to examine the information contained in calls (see Rand 1988 in the Bibliography). Frog calls may contain information about the caller's sex, species identity, individual identity, body size, physical condition, hormonal state, genetic quality, social status (such as call leader in a chorus or holder of a territory), and location (distance or direction). The meaning of a call is separate from the information it may contain and depends upon who hears it. For example, the meaning of an advertisement call is different when heard by a receptive female, a rival male, or a predator looking for a meal.

Species Names

The common and scientific names used in this guide follow those in *A Field Guide to Western Reptiles and Amphibians* (Second revised edition. Peterson Field Guide Series) by Robert C. Stebbins. The one exception is the Pacific Treefrog (*Hyla regilla*), which in this guide is called Pacific Chorus Frog (*Pseudacris regilla*). Species names are constantly changing as new research supports "splitting" a species into two or more species or determines that a species is more closely related to another than was previously thought. For example, many researchers believe the two subspecies of the Striped Chorus frog (*Pseudacris triseriata triseriata* and *Pseudacris triseriata maculata*) are sufficiently different that they represent separate species.

Choosing a correct pronunciation for scientific names is difficult. Herpetologists (scientists who study amphibians and reptiles) generally agree that classical Latin provides the "correct" pronunciation. In practice, however, Latin pronunciations are not always used. The pronunciations used here have been chosen after consultation with western herpetologists and attempt to reflect common usage.

Learning to Identify Calls

Using this guide, you can easily learn to identify frog and toad calls in the wild. The guide is arranged in two sections. Start with Part One: listen to the recordings of individual species calls and read the matching call descriptions in the reference section below. Once you have learned some of the calls, you can test your identification ability using the test sections in Part Two. Use a sound system with good-quality bass when listening to these recordings. With many headphones and car stereo speakers, the low-frequency calls of some frogs are difficult to hear.

Here are some tricks for learning calls. One is to associate a call with a familiar sound. For example, some calls sound like an infant's cry or a jackhammer. Another is to write out the sound of a call phonetically; for example, barroom for the call of the Bullfrog (*Rana catesbeiana*). The reference section below provides mnemonics or phonetics for a number of calls, but making up your own can be even more effective.

Another way to learn to identify calls is with the computer-based training program *Frog Sound Master*. This program is especially helpful for biologists and others who need to accurately identify calls. With *Frog Sound Master* software, a computer with a CD-ROM drive, and the audio compact disk version of this publication, you will be able to randomly play back calls (with or without announcements) to test the accuracy of your identifications. *Frog Sound Master* software is available from the Cornell Laboratory of Ornithology.

The recordings included in this guide are representative of each species, but the same species may sound different in the wild due to a number of factors:

Individual calls versus a chorus: For some species the sound of a full chorus is quite different from the sound of a few calling individuals.

Individual differences in calls: Not all individuals of the same species sound identical. For example, large males give calls that are lower pitched and louder than the calls of small individuals.

Geographic differences: Two populations of the same species in different locations may have slightly different calls. Usually, each species is represented here by a recording from only a single location. Some species are represented by recordings made outside the Rocky Mountains and Southwest. However, the geographic differences in calls are sufficiently small that these recordings are still representative of the calls made by Rocky Mountain and Southwestern populations.

Temperature: Temperature can affect call pitch, pulse rate (notes per second), and sometimes other aspects of a call. Cold animals will give calls with a lower pitch and slower pulse rate than warm animals. The notes for most recordings indicate the temperature at the time of recording.

Distance: Some species sound different when heard at close range than when they are far away. For example, heard up close Great Plains Toads (*Bufo cognatus*) sound like a jackhammer, but from a long distance they sound more like faint bells.

Volume: These recordings can be deceptive in that all species sound equally loud, just as the sound of an ant's footsteps and a jet plane can be the same volume in a recording. Refer to the last column in the breeding season chart below and the call descriptions in the reference section for information on call volume.

Call type: Each species may make a variety of calls, and the recordings do not include all call types for each species. This guide generally presents only the calls most often heard (usually advertisement calls). A full repertoire of calls is only presented for a single species, the Pacific Chorus Frog (*Pseudacris regilla*).

Underwater calls: For those species that primarily call underwater, the guide contains underwater recordings. These species can be heard in the air, but only faintly.

Many Rocky Mountain and Southwest species can be easily identified by their calls; others are more difficult to identify. The following information can help you identify a call:

Species range: Knowing which species occur in an area will let you narrow the possibilities when trying to identify a call. For example, the calls of the Plains and Great Basin Spadefoots (*Scaphiopus bombifrons* and *Scaphiopus intermontanus*) are very similar; however, their ranges barely overlap. Thus, range information can help you determine which species you are hearing. Many species occur in the Rocky Mountains and Southwest, but only a few are likely to occur at any one location. In most of the area covered by this guide, less than five species can be found at any single location. At a few places in southern Arizona and New Mexico you might find six or seven species. To take advantage of range information, use this guide in conjunction with a standard field guide (see Bibliography). Keep in mind that the range information is not perfect, and therefore you cannot always rule out a species because a field guide indicates it has not been reported in an area.

Time of year and breeding habitat: Once you have tentatively identified a species based on the sound of its call, check this booklet to see if the time of year and habitat you are in match the breeding season and habitat listed for the species. Time of year and breeding habitat are less definitive than range information—a single individual may be calling out of season or in an unusual habitat.

Breeding Season Chart

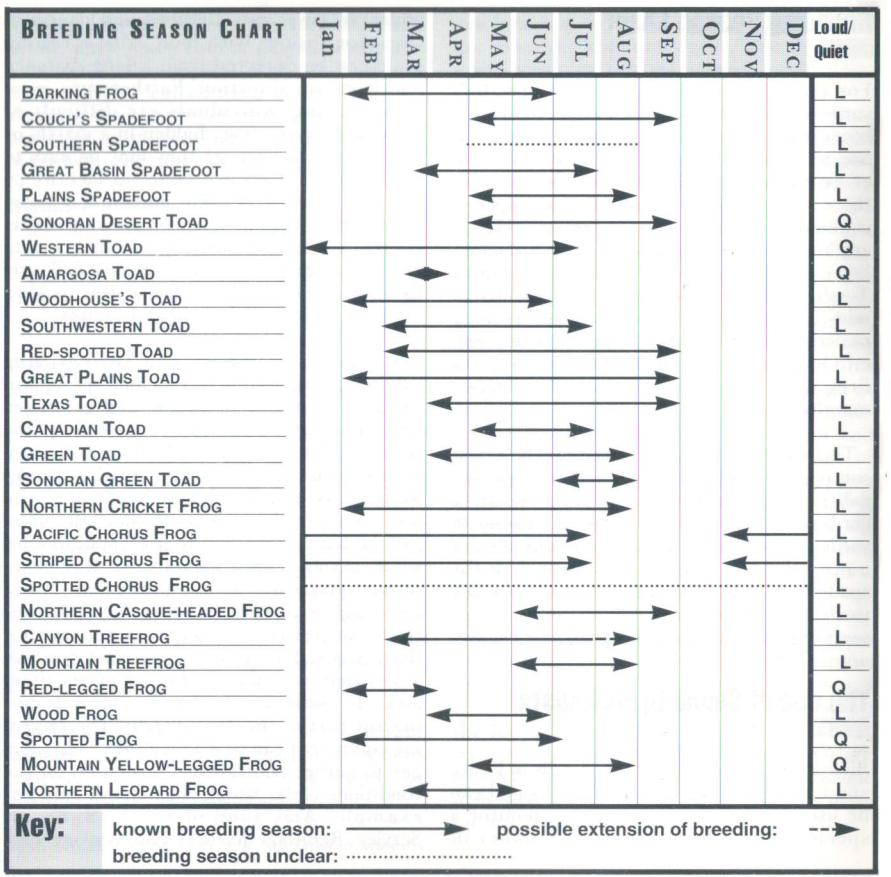
For many species the timing of breeding varies with elevation and latitude. Generally, breeding begins earliest at lower elevations and may not start until months later at higher elevations. The breeding season includes the earliest and latest dates that the species is known to breed, but the breeding period in any single location is generally much shorter. For example, the breeding season for Boreal Toads (*Bufo boreas boreas)* is from January to mid-July, but in a single location the breeding period is often only a few weeks or even shorter. Other species, such as the Pacific Chorus Frog (*Pseudacris regilla*), may call for many months.

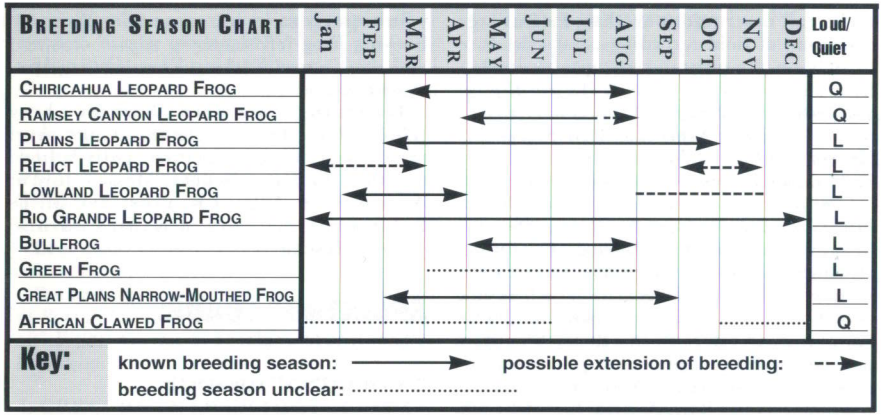
The right-hand column in the breeding season chart below indicates whether a species' call is loud (can be heard from at least 40 yards) or quiet (not likely to be heard from 40 yards). Note that 40 yards is a minimum distance—the calls of many species, such as the spadefoots, can be heard from well over 200 yards. The call descriptions in the reference section give additional information on the volume of calls.

The Use of Sound by Biologists

Biologists can use frog and toad calls to locate and identify breeding males. Thus sound can be used to survey, inventory, or monitor a species. This approach has a number of advantages over visual location and identification. For species with loud calls, a calling male can be detected from a long distance and from any direction. Furthermore, even when calling individuals are difficult or impossible to see (e.g., hidden in a marsh, or calling from a burrow) they may be easy to hear. Some species are easier to identify by call than by sight. A major limitation of audio detection is that only calling males can be detected, and in the Rocky Mountain and Southwestern states, many species call only for short periods (explosive breeders), and/or have very quiet calls, or call underwater.

In Wisconsin, Illinois, and Missouri frog calls are being used in formal monitoring programs that use point counts and volunteer observers very similar to the methods of the Breeding Bird Survey. Such monitoring programs are less feasible in the Rocky Mountains and Southwest because of the large number of explosive breeders and quiet callers, but the method is still applicable for some species in some habitats. Another monitoring approach is to use automated recording equipment. Such equipment is now relatively inexpensive and can be used to monitor fixed points. The recording equipment can be automated to turn on and off at preset times and take audio samples for short periods during any part of the day or night. The recording equipment can be coupled with a data logger to gather additional information on the conditions under which the animals call. For example, Amy Lind of the U. S. Forest Service, Redwood Sciences Lab, is using such





a setup with underwater microphones to study the impact of dams and altered stream flows on the breeding of Foothill Yellow-legged Frogs (*Rana boylii*). A number of researchers are currently working on voice recognition software that in the future may allow automated recording systems to identify species and possibly calculate their relative abundance. For more information on the use of sound by biologists, see *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians*, by Heyer and others.

(Cassette side A)

Part One Reference Section

This reference section presents individual recordings of 38 species of frogs and toads. Species are ordered by taxonomic families following *The Field Guide to Western Reptiles and Amphibians*. See the back cover of this booklet for a species index. For each species, the booklet gives the following information:

Voice: A written description of the call or calls made by the species and the time of day (or night) when the species primarily calls.

Breeding: The dates of the breeding season and a description of the species' breeding habitats.

Recording: A description of the recording(s) for each species also includes information on location, date, air, water, and/or body temperature, and recordist's name. All recordings are monaural unless specifically identified as stereo.

The call descriptions are based on a large collection of field recordings, but also draw heavily on the written descriptions in four field guides: *A Field Guide to Western Reptiles and Amphibians* (Peterson Field Guide Series); *A Field Guide to Reptiles and Amphibians of Eastern and Central North America* (Peterson Field Guide Series); *Amphibians and Reptiles of the Pacific Northwest*; and the *Audubon Society Field Guide to Reptiles and Amphibians*. (See the field guide section of the Bibliography for full citations.) These field guides are also the main sources for the information on breeding activity. In the descriptions below the phrase "in our area" refers to the Rocky Mountain and Southwestern states and provinces covered by this guide: Yukon, Northwest Territories (excluding James Bay), Alberta, Saskatchewan, Montana, Idaho, Wyoming, Colorado, Utah, Nevada, Arizona, and New Mexico.

BARKING FROGS:

Family Leptodactylidae

1. BARKING FROG

Hylactophryne augusti
Also called *Eleutherodactylus augusti*

Voice: A short, low-pitched, grating note, resembling the bark of a small dog. There is a pause of 1 1/2 to 3 seconds between calls. Calls are given in late afternoon and at night.

Breeding: Often during rains, probably from February to June. Eggs are laid on land in caves, fissures, and under rocks and hatch directly into froglets without a tadpole stage.

Subspecies: In our area, the Western Barking Frog (*Hylactophryne augusti cactorum*) and the Eastern Barking Frog (*Hylactophryne augusti latrans*).

Recording: Western Barking Frog (*Hylactophryne augusti cactorum*). Three short recordings of advertisement calls spliced together. El Tigre, Sonora, Mexico. July or August 1964. Darrel R. Frost and M. D. Robinson. University of Kansas Natural History Museum.

SPADEFOOT TOADS:

Family Pelobatidae

2. COUCH'S SPADEFOOT

Scaphiopus couchi

Voice: A plaintive, nasal call resembling the bleat of a lamb. The call is short, lasting 1/2 to 1 1/4 seconds. A chorus can be heard from a long distance. Calls are given primarily at night.

Breeding: From May to September, in temporary pools during or right after heavy rains.

Recording: Two males giving advertisement calls. Background: probably crickets. Near Wickenburg, Maricopa Co., AZ. Approximately 79° F (26° C) air. 7/13/91. Jim Rorabaugh.

3. SOUTHERN SPADEFOOT

Scaphiopus multiplicatus
Also called *NEW MEXICO SPADEFOOT*
Spea multiplicata

Voice: A metallic vibrating snore. The call is longer (3/4 to 1 1/2 seconds) and the vibration more pronounced compared to other spadefoot calls given at the same temperature; however, a cold Plains Spadefoot (*Scaphiopus bombifrons*) sounds much like a warm Southern Spadefoot. Calls are given primarily at night and can be heard from a long distance (over 500 yards). Occasionally Plains and Southern Spadefoots will hybridize, producing individuals with calls intermediate between the two species.

Breeding: During and right after summer rains in temporary pools.

Recording: Chorus in a light rain. Just east of Portal, Cochise Co., AZ. 66° F (19° C) air, 68° F (20° C) water. 12:30am 8/23/94. Carlos Davidson.

4. GREAT BASIN SPADEFOOT

Scaphiopus intermontanus
Also known as *Spea intermontana*

Voice: A short (1/5 to 1 second) low-pitched, hoarse snore (*kw-a-a-h, w-a-a-h* or *kw-a-a-h, r-a-h*) that is repeated over and over. The call is similar to that of the Plains Spadefoot (*Scaphiopus bombifrons*), but the ranges of the two species barely overlap. Calls are given at night and can be heard from a long distance.

Breeding: Sporadic breeders in rain puddles, small lakes, ponds, and irrigation ditches from late March through July. Breeding may be stimulated by warm temperatures combined with rainfall or irrigation.

Recording: Advertisement calls. Veyo, Washington Co., UT. 49° F (9.4° C) air, 59° F (15° C) body. 11:05pm 4/29/68. Philip T. Northen.

5. PLAINS SPADEFOOT

Scaphiopus bombifrons
Also known as *Spea bombifrons*

Voice: A short (1/2 to 3/4 second) rasping bleat or snore. The pulse rate is higher and therefore the calls sound less vibratory than calls of the Southern Spadefoot (*Scaphiopus multiplicatus*). Some populations in Arizona, New Mexico, and farther south have very short calls (1/6 second) which are repeated rapidly and sound like the yap of a small dog or the quack of a duck. Calls are given primarily at night.

Breeding: From May to August in the northern part of its range; in July during summer rains in the southern part of its range. Breeds in temporary pools.

Recordings: 1. Individual advertisement calls. Near Indian Wells, Navajo Co., AZ. 63° F (17.4° C) water. 11:10pm 7/6/68. Philip T. Northen and Steve Pollack.

2. Advertisement calls from a population with short calls. Off Hwy. 54, Otero Co., N.M. 66° F (19°C), 75°F (24°C) water. 1/7/78. M.J. Foquette Jr.

TRUE TOADS:

Family Bufonidae

6. SONORAN DESERT TOAD

Bufo alvarius
Also known as *COLORADO RIVER TOAD.*

Voice: A weak, rising cry, lasting about 1/2 to 1 second. At close range, the call somewhat resembles that of the Woodhouse's Toad

(*Bufo woodhousii*), but is much shorter and quieter. Calls are given primarily at night.

Breeding: May to September, following summer rains.

Recordings: 1. Individual advertisement calls. Background: Red-spotted Toads. 2. Release calls given by hand-held toad. Both recordings are from Skunk Creek, Maricopa Co., AZ. 79° F (26° C) body. 8/24/92. Brian K. Sullivan and Keith B. Malmos.

7. WESTERN TOAD

Bufo boreas

Voice: A very soft, high-pitched, plinking sound, like the peeping of a chick. The Western Toad's call was long thought to be solely a release call. However, lone male Western Toads (*Bufo boreas halophilus*) have been observed calling, indicating that the same call may serve other functions. Calls are given night and day.

Breeding: January to mid-July, in ponds, marshes, and shallow lake, stream, and river margins. Breeding lasts from a few days to 2 or 3 weeks at any given site.

Subspecies: The California Toad (*Bufo boreas halophilus*) and the Boreal Toad (*Bufo boreas boreas*).

Recordings: 1. Lone male California Toad (*Bufo boreas halophilus*). Background: Pacific Chorus Frogs. Boulder Creek, near Descanso, Cleveland National Forest, San Diego Co., CA. 72° F (22° C) water. 5/24/73. Frank T. Awbrey.

2. Boreal Toad (*Bufo boreas boreas*). Small group calling while clasping females and fighting. Meta Lake, Mount St. Helens Volcanic National Monument, Skamania Co., WA. 4/25/92. Ann and Steve Dunsky.

8. AMARGOSA TOAD

Bufo nelsoni

Voice: Only known call is a release call. The call is very similar to that of the Western Toad (*Bufo boreas*) and sounds like the weak peeping of chicks or geese heard from a distance. The release call is quiet and most likely to be heard in the evening or at night.

Breeding: Mid-March to early April in several desert springs and in the Amargosa River.

Recording: Release calls given by hand-held toad. Individual collected from Oases Valley, Nye Co., NV. Recorded in the laboratory of Karin Hoff, University of Nevada, Las Vegas. 3/28/95. Greg Budney and Karin Hoff. Library of Natural Sounds, Cornell Laboratory of Ornithology (Cat. No. 69099).

9. WOODHOUSE'S TOAD

Bufo woodhousii

Voice: Resembles an infant's cry or a scream in a horror movie. The explosive nasal *w-a-a-a-ah* lasts about 1 to about 3 1/2 seconds and often suddenly drops in pitch at the end. Calls are given primarily from dusk to dawn.

Breeding: February through June, although breeding may extend as late as early September. Breeds in wetlands bordering still or slow-moving water.

Subspecies: In our area, the Western Woodhouse's Toad (*Bufo woodhousii woodhousii*) and the Southwestern Woodhouse's Toad (*Bufo woodhousii australis*).

Recordings: 1. Individual advertisement calls (*Bufo woodhousii woodhousii*). Background: crickets and river. Harding Hole, Yampa River, Dinosaur National Monument, Moffat Co., CO. 6/20/89. Carlos Davidson with Anne Bradley.

2. Individual advertisement calls (*Bufo woodhousii australis*). Background: Red-spotted Toads (*Bufo punctatus*). New River, Maricopa County, AZ. 73° F (22.6° C) air. 4/13/93. Brian K. Sullivan and Mike Demlong.

10. SOUTHWESTERN TOAD

Bufo microscaphus

Voice: A long, musical trill, usually lasting 6 to 10 seconds. The call usually rises in pitch and pulse rate at the start and ends abruptly. Calls are given primarily at night. In central Arizona and along the Virgin River, Southwestern Toads and Woodhouse's Toads (*Bufo woodhousii*) may hybridize, producing individuals with trilled calls similar to those of the Southwestern Toad.

Breeding: March to July, in stock ponds and shallow pools of slow-moving streams in semi-arid regions. Breeding is not dependent on rainfall.

Subspecies: In our area, the Arizona Toad (*Bufo microscaphus microscaphus*).

Recording: Advertisement calls. Background: Lowland Leopard Frog (*Rana yavapaiensis*) and people talking. Hassayampa River, near Wickenberg, Maricopa Co., AZ. 60° F (15.7° C) body. 3/4/94. Brian K. Sullivan.

11. RED-SPOTTED TOAD

Bufo punctatus

Voice: A prolonged, high-pitched trill or scream, lasting from 6 to 10 seconds, occasionally dropping in pitch at the end. The call resembles that of the Southwestern Toad (*Bufo microscaphus*), but is higher pitched. Calls are given primarily at night.

Breeding: March to September, independent of rains in spring, and during or after rains in the summer. Breeds in springs, reservoirs, temporary rocky pools, and intermittent streams.

Recording: Several individuals. Foreground: crickets. Cottonwood Springs, Joshua Tree National Monument, Riverside Co., CA. 80° F (26° C) air. 5/22/83. Paul Matzner. California Library of Natural Sounds (Cat. No. A-260-2).

12. GREAT PLAINS TOAD

Bufo cognatus

Voice: A harsh, high-pitched, metallic trill or chatter resembling a jackhammer. Calls last from 5 to more than 50 seconds. At close range a large chorus can be deafening (one researcher reported three days of ringing ears after listening to a chorus of more than 200 toads). Calls are given primarily at night.

Breeding: February to September, usually during or after heavy rainfall.

Recording: Individual advertisement calls. Near Wilcox, Cochise Co., AZ. 70° F (21° C) body.

8/5/92. Brian K. Sullivan and Keith B. Malmos.

13. TEXAS TOAD
Bufo speciosus

Voice: A loud, explosive trill, repeated over and over, and likened to a riveting machine. Calls last about 1/2 to 1 1/2 seconds and sound similar to those of the Great Plains Toad (*Bufo cognatus*), but are much shorter and higher pitched. Calls are given at night.

Breeding: April to September following heavy rains in ponds, reservoirs, and temporary pools.

Recording: Individual advertisement calls. Background: chorus. Near Valentine, Jeff Davis Co., TX. 73° F (23° C) air and water. 6:00pm 7/19/53. Texas Memorial Museum (Cat. No. 18).

14. CANADIAN TOAD
Bufo hemiophrys

Voice: A soft, low-pitched, tremulous trill, lasting 1 1/3 to 5 seconds. The call ends abruptly and is repeated 2 to 3 times a minute. Similar to the Woodhouse's Toad (*Bufo woodhousii*), but in our area the ranges of the two species do not overlap. Calls are given primarily at night.

Breeding: May to July in shallow lake or pond margins with emergent vegetation.

Subspecies: The Canadian Toad (*Bufo hemiophrys hemiophrys*) and the Wyoming Toad (*Bufo hemiophrys baxteri*), which only occurs in a small area of Wyoming.

Recordings: 1. Two Canadian Toads alternating advertisement calls. Near Wheatôn, Traverse Co., MN. 70° F (21° C) air, 77° F (25° C) water. 6/14/56. W. Frank Blair. Library of Natural Sounds, Cornell Laboratory of Ornithology (Cat. No. 74431).

2. Single Wyoming Toad giving advertisement calls. Background: Boreal Chorus Frogs (*Pseudacris triseriata maculata*). Mortenson Lake, Adams Co., WY. Approximately 66° F (9° C) air. 11:30pm 6/15/89. Greg Hallen and Don R. Miller.

15. GREEN TOAD
Bufo debilis

Voice: A long (3 to 7 seconds) buzz or trill at a constant pitch, like the sound of a cricket or an electric buzzer. Pauses of 5 seconds or longer usually occur between calls. Calls are given at night.

Breeding: April to August, in temporary rain pools and streams. May use irrigation ditches and reservoirs.

Subspecies: In our area the Western Green Toad (*Bufo debilis insidior*).

Recording: Individual advertisement calls. Background: crickets and several other Western Green Toads in distance. San Simon River wash, San Simon Valley, Hidalgo Co., NM. 64° F (17.8° C) air, 66° F (19° C) water. 10:30pm 8/20/94. Carlos Davidson. Stereo.

16. SONORAN GREEN TOAD
Bufo retiformis

Voice: An explosive, high-pitched buzz, lasting 1 to 3 seconds and ending abruptly. Similar to the Western Green Toad (*Bufo debilis insidior*) but shorter and more wheezy (the pitch is less constant). The call can be deceptive, often seeming farther away than it really is. Calls are given at night.

Breeding: July to August in washes and temporary rain pools.

Recording: Individual advertisement calls. Background: Great Plains Toad (*Bufo cognatus*). Gunsight Wash, Route 85 crossing, Pima Co., AZ. 81°o F (27.2° C) body. 8/20/93. Brain K. Sullivan and Erik W. A. Gergus.

TREEFROGS, CHORUS FROGS and CRICKET FROGS:

Family Hylidae

17. NORTHERN CRICKET FROG
Acris crepitans

Voice: A metallic clicking sound, like that made by striking together two pebbles. Calls are given rapidly in a series, with the call rate slowly increasing and then decreasing at the end. Call rates vary by location. The two recordings heard here sound different because of differences in both location and temperature. Calls are given night and day.

Breeding: February to August.

Subspecies: In our area the Blanchard's Cricket Frog (*Acris crepitans blanchardi*).

Recordings: 1. Balmorhea, Reeves Co., TX. 68° F (19.7° C) body. 6/30/67.

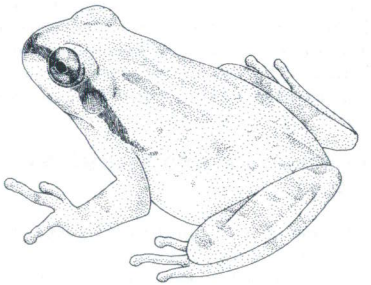
2. Enchanted Rock, Gillespie Co., TX. 75° F (23.7° C) body. 7/1/67. Both recordings by Robert R. Capranica. Library of Natural Sounds, Cornell Laboratory of Ornithology (Cat. No. 60085).

18. PACIFIC CHORUS FROG
Pseudacris regilla

Also known as the *PACIFIC TREEFROG*
Hyla regilla

When Hollywood movie makers wanted to convey the feeling of nighttime outdoors, they used the sound of local Pacific Chorus Frogs. Consequently the ribbit-ribbit calls of this species have become the stereotypical frog call, even in regions where they don't occur.

Voice: The advertisement call is a loud, two-part *kreck-ek*, or *ribbit*, often repeated many times. There is some geographic variation in calls, but all versions are easily recognizable as Pacific Chorus Frogs. In addition to advertisement calls, males have a one-part (monophasic) call which is a "superstimulus" or enhanced mate-attraction call given when they sense nearby vibrations, potentially indicating a female is close. Males also give a slow trilled encounter call in close interactions



Pacific Chorus Frog *Pseudacris regilla*

with other males. A dry land call made by males away from breeding ponds is a single note, *krr-r-r-ek*. Calls are given mainly in the evening and at night, and sporadically during the day at the height of the breeding season.

Breeding: November to July in any type of still or slow-moving water.

Recordings: 1. Advertisement calls, several individuals. Fulmer Reservoir, San Bernardino National Forest, Riverside Co., CA. 47° F (8° C) air, 59° F (15° C) water. 5/22/94. Carlos Davidson. Stereo.

2. Full chorus. Sibley Regional Park, Alameda Co., CA. 2/24/92. Carlos Davidson.

3. Individual one-part (monophasic) calls. Background: people. Cotati, Sonoma Co., CA. 66° F (19° C) air. 4/12/91. Philip T. Northen.

4. Individual trilled encounter calls. Background: advertisement calls and people. Cotati, Sonoma Co., CA. 66° F (19° C) air. 4/12/91. Philip T. Northen.

5. Release calls. Santa Rosa, Sonoma Co., CA. 2/86. Philip T. Northen.

6. Single male making dry land calls. Individual collected from Santa Cruz Island, Santa Barbara Co., CA. Recorded in the laboratory of H. Bradley Shaffer, University of California, Davis. Approximately 60° F (16°C) air. 1/23/94. Carlos Davidson.

19. STRIPED CHORUS FROG

Pseudacris triseriata

Voice: A loud, vibrating chirping sound, *prreep prreep prreep*. The call can be imitated by running a finger over the teeth of a pocket comb. A single call lasts from 1/2 to 1 1/2 seconds and frogs give 30 to 90 calls per minute. Calls are given primarily at night, and also during the day at the height of the breeding season.

Breeding: Breeds from November through July, although sporadic calling may continue into August. Breeding takes place in shallow, temporary, open pools and in deeper permanent water in dense woods.

Subspecies: In our area, the Boreal Chorus Frog (*Pseudacris triseriata maculata*) and the Midland or Western Chorus Frog (*Pseudacris triseriata triseriata*). Some researchers treat the two as separate species (*Pseudacris maculata and Pseudacris triseriata*). Their calls are similar, although on average the Boreal Chorus Frog has a longer call with a slower pulse rate than the Western Chorus Frog.

Recordings: 1. Several Midland Chorus Frogs. Douglas Co., KS. 41° F (5° C) air, 45°F (7° C) water. 3/19/63. Linda Trueb. University of Kansas Museum of Natural History (Cat. No. 327-32).

2. Small chorus of Boreal Chorus Frogs. Matthews Pond, Roosevelt National Forest, Larimer Co., CO. 36° F (2°o C) air, 46° F (8° C) water. 10:00pm 6/10/95. Carlos Davidson and Stephen Corn.

20. SPOTTED CHORUS FROG

Pseudacris clarkii

This species occurs in Texas very near the New Mexico border and may be found in New Mexico in the future.

Voice: A short, rasping note with a rising inflection, *wrrank-wrrank-wrrank*, repeated over and over. The calls resemble the quack-like calls of the Northern Casque-headed Frog (*Pternohyla fodiens*) or the fast-trill of Plains Spadefoot (*Scaphiopus bombifrons*) but are higher pitched and more rasping. Calls are given night and day.

Breeding: Season unclear in the west. Farther east and south, breeding peaks in April and May, but may follow rains in any month.

Recording: Individual advertisement calls. Background: Great Plains Narrow-mouthed Toad (*Gastrophryne olivacea olivacea*). Near Independence, Montgomery Co., KS. 71° F (21.5° C) water. 6/20/65. Richard Zweifel. University of Kansas Museum of Natural History (Cat. No. 860-92).

21. NORTHERN CASQUE-HEADED FROG

Pternohyla fodiens

Voice: A loud, low-pitched, raspy *quack-quack-quack*. Calls are 1/5 to 1/2 second long and repeated 2 to 3 times per second. Calls are given at night.

Breeding: June to September following summer rains.

Recording: Small chorus. 45 mi. N. of Hermosillo, Sonora, Mexico. 84° F (29° C) air and body. 7/14/61. Texas Memorial Museum (Cat. No. 406A).

22. CANYON TREEFROG

Hyla arenicolor

Voice: An explosive series of short notes, *brrurt-brrurt-brrrurt*, likened to a rivet gun. Calls last 1/2 to 3 seconds and at close range sound as if they are being given inside a tin can. Calls are given at night.

Breeding: March to July, possibly into August if summer rains are late. Breeds in pools in rocky streams.

Recording: Several individuals giving advertisement calls. Bavispe River, Huasabas, Sonora, Mexico. 6:00am 4/7/80. Harriette Barker. Library of Natural Sounds, Cornell Laboratory of Ornithology (Cat. No. 25171).

23. MOUNTAIN TREEFROG

Hyla eximia

Voice: A short (less than 1/2 second), low-pitched, one-part, metallic clack or quack. The rate of calling is highly variable, from 40 to 150 times per minute. Also gives a trilled call similar to the trilled encounter call of the Pacific Chorus Frog (*Pseudacris regilla*). Calls are given at night.

Breeding: June to August during and right after summer rains.

Recording: Entire bout of calling by small chorus. Background: crickets. Lost Lake, Mogollon Rim, Coconino National Forest, Coconino Co. AZ. 58° F (14.4° C) air, 62° F (16.7° C) water. 10:00pm 8/18/94. Carlos Davidson and Cynthia Kaufman. Stereo.

TRUE FROGS:

Family Ranidae

24. RED-LEGGED FROG

Rana aurora

The California Red-legged Frog (*Rana aurora draytonii*) has been introduced in two locali-

ties in central Nevada.

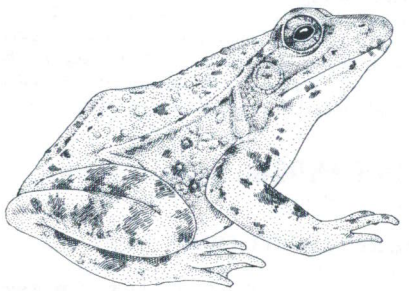
Voice: A series of 4 to 7 low notes, often with a growl or groan at the end. The call can be imitated by saying the word "want" repeatedly, stretching the "a"—"waant-waant-waant-waant" with emphasis at the end. The call is very quiet. Calls are given primarily at night, but occasionally during the day. Calls are given in air and possibly underwater.

Breeding: In Nevada breeding probably occurs from late February to early April. At any single location, breeding lasts only one to two weeks.

Recording: Single male calling. Foreground: Pacific Chorus Frogs. Ponds near Bass Lake, Point Reyes National Seashore, Marin Co., CA. 2/18/89. Thomas G. Sander.

25. WOOD FROG
Rana sylvatica

Voice: A series of strained, grating sounds resembling the quacking of a small duck or the sound made by rubbing an inflated balloon. Each note is short (about 1 second) and of medium volume. The calls are similar to the chuckling calls of the Northern Leopard Frog (*Rana pipiens*), but unlike that species, the Wood Frog does not have a "rattle" call. Calls are given night and day.



Red-Legged Frog *Rana aurora*

Breeding: In our area, breeds from April to June for a one-to-two week period.

Recording: Large chorus. Near Candor, Tioga Co., NY. 45° F (7° C) air. 11:30pm 7/4/91. Steve Pantle. Library of Natural Sounds, Cornell Laboratory of Ornithology (Cat. No. 53161). Stereo.

26. SPOTTED FROG
Rana pretiosa

Voice: A rapid series of 5 to 50 faint, low-pitched, hollow, notes. The call can be roughly imitated by knocking on wood with a fist or clicking the tongue against the roof of the mouth. Spotted Frogs sometimes call underwater. Calls are given primarily during the day.

Breeding: Late February to early July, in permanent bodies of water, after the winter thaw.

Taxonomic note: In the future the Spotted Frog may be recognized as two separate species, the Oregon Spotted Frog and the Columbia Spotted Frog. Only the latter occurs in our area.

Recording: Single call sequence from east of the Cascade Mountains (Columbia Spotted Frog). The same recording is repeated three times. Background: American Robin, Pacific Chorus Frogs, and Mallard. Virginian Ridge, Okanogan National Forest, near Winthrop, Okanogan Co., WA. 54° F (12° C) air, 46° F (8° C) water. 4/25/94. Jonathan Storm. Library of Natural Sounds, Cornell Laboratory of Ornithology (Cat. No. 71693).

27. MOUNTAIN YELLOW-LEGGED FROG
Rana muscosa

Voice: A short, rasping call, often accelerating and rising in pitch at the end. The call is sometimes preceded by several calls without the rising end, forming the phrase *uuun-uuun-unch*. The call sounds strained, as if the frog is struggling to produce it. Calls are made primarily underwater and are given during the day and possibly also at night.

Breeding: May to August, in high-elevation streams or wet meadows as soon as the snow and ice melts. At lower elevations, breeding occurs in streams following high-water runoff.

Recording: Underwater recording of single male calling underwater. Background: Pacific Chorus Frogs. Summit Meadow, Yosemite National Park, CA. 64.5° F (18° C) water. 6/14/93. Tim C. Ziesmer.

28. NORTHERN LEOPARD FROG
Rana pipiens

Voice: Males make a variety of calls, including a long, loud, accelerating rattle (often described as a "snore") and low-pitched chuckling, grunting, and grating sounds similar to the sound made by rubbing an inflated balloon. Surprised individuals may give a squawk alarm call as they leap into the water. When caught by a predator, they may emit a scream. Calls are given night and day.

Breeding: Mid-March to early June, soon after ice and snow have melted. Generally breeds in still or slow moving water with aquatic vegetation such as cattails.

Recording: Individual advertisement calls followed by small chorus. Background: Midland Chorus Frogs (*Pseudacris triseriata triseriata*). Walpole Island, Ontario, Canada. 4/8/69. William W. H. Gunn. Library of Natural Sounds, Cornell Laboratory of Ornithology (Cat. No. 69299).

29. CHIRICAHUA LEOPARD FROG
Rana chiricahuensis

Voice: A vibrating or grating, hollow rattle, without the accelerating quality of the rattle made by the Northern Leopard Frog (*Rana pipiens*). Calls last 1 to 2 seconds. Also gives "mew" and short grunt or croak calls. Calls are given primarily at night.

Breeding: May to August at higher elevations. At lower elevations or warmer locations from mid-March to June, extending intermittently through the fall.

Taxonomic note: In the future, populations on the Mogollon Rim of Central Arizona may be treated as a separate species.

Recordings: 1. Single individual calling. Headquarters Windmill Pond, Chiricahua Mountains, Coronado National Forest, Cochise Co., AZ. 58° F (14° C) air, 61° F (16°C) water. 7:15pm 8/30/92. Jim Rorabaugh.

2. Several individuals from the Mogollon Rim population. Three Forks Meadow, White

Mountains, Apache-Sitgreaves National Forest, Apache Co., AZ. 56° F (13° C) air, 62° F (17° C) water. 8:20pm 8/19/94. Carlos Davidson and Cynthia Kaufman. Stereo.

(Cassette side B)

30. RAMSEY CANYON LEOPARD FROG
Rana subaquavocalis

Voice: A long, hollow rattle given underwater. The calls are much longer (3/5 to more than 3 seconds) and have a lower pulse rate than those of other leopard frogs and hence sound quite vibratory. Also gives short chirp or bark calls as well as short rattles. Calls are given at night.

Breeding: Late March to the end of August.

Recording: Underwater recording. Single individual calling underwater. Background: water beetles. Ramsey Canyon, Huachuca Mountains, Cochise Co., AZ. 64° F (18° C) water. 7/12/92. James E. Platz.

31. PLAINS LEOPARD FROG
Rana blairi

Voice: The advertisement call is a high-pitched, hissy *chuck-chuck-chuck*, often followed by a series of short, low-pitched, grunting notes. The call can be imitated by making short, fast, kissing sounds. The call is similar to that of the Lowland Leopard Frog (*Rana yavapaiensis*), but the ranges of the two species do not overlap. Calls are given primarily at night and possibly during the day at the height of the breeding season.

Breeding: March to October.

Recording: Several individuals giving advertisement and other calls. Background: Northern Cricket Frog (*Acris crepitans*). Quivira National Wildlife Refuge, Stafford Co., KS. 5/24/94. Lang Elliot. Stereo.

32. RELICT LEOPARD FROG
Rana onca

This species was considered extinct until 1991 when researchers discovered a small population of unidentified leopard frogs near Lake Mead in Nevada. It is unclear if these frogs are Relict Leopard Frogs or some other leopard frog.

Voice: Individuals from the unidentified population have a chuckling call like that of the Lowland Leopard Frog (*Rana yavapaiensis*); however, in historic accounts the Relict Leopard Frog's call is described as a "snore." Calls are given primarily at night, and sometimes during the day.

Breeding: Historically Relict Leopard Frogs bred from March to May. Based on limited observation, frogs from the unidentified population breed from January to March and from October to November.

Recordings: Single calling male from the unidentified population. Overton arm, Lake Mead, Lake Mead National Recreation Area, Clark Co., NV. 66° F (19° C) water, 70° F (21° C) body. 2/28/92. Randy D. Jennings.

33. LOWLAND LEOPARD FROG
Rana yavapaiensis

Voice: Males make a series of high-pitched rattle or chuckling notes and short, guttural, grunting calls. Calls are given primarily at night, and sometimes during the day.

Breeding: February to April, although sometimes breeds in the fall.

Recording: Several individuals. Background: road noise. Hassayampa River, Hassayampa River Preserve, Maricopa Co., AZ. 64° F (18° C) water. 4/24/94. Jim Rorabaugh.

34. RIO GRANDE LEOPARD FROG
Rana berlandieri

A native species in New Mexico, the Rio Grande Leopard Frog was recently introduced into Arizona and California.

Voice: A loud, low-pitched rattle lasting about 1/2 to 2/3 second. Can be roughly imitated by saying *p-r-r-r-r-r-r-t* with the tongue fluttering against the roof of the mouth. The rattle call is given singly or in a series of two to three calls. This species also gives a short rasping or squealing call that is repeated several times in a row. Calls are given at night.

Breeding: In our area, breeds primarily in the spring and following summer rains, but may breed almost any time of year after rains.

Recording: Individual calls.Background: Airplane noise. Near Yuma, Yuma Co., AZ. 59° F (15°C) water. 10/29/84. Jim Rorabaugh.

35. BULLFROG
Rana catesbeiana

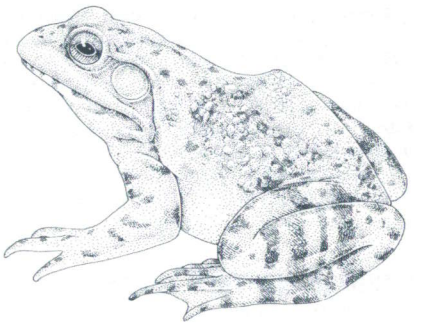
Native to the eastern and central United States and Canada, the Bullfrog has been introduced throughout the West. Bullfrogs are voracious predators and may have contributed to the decline of a number of native Rocky Mountain and Southwest amphibians.

Voice: The advertisement call is a deep-pitched bellow or bray, variously described as *jug-o-rum* or *barroom*. Calls are given both day and night and carry a long distance. The Bullfrog's encounter call is a quick *phoot*. Frightened individuals, especially juveniles, may give a scream or squeak alarm call when they leap into the water. Apparently Green Frogs (*Rana clamitans*) are the only other western species with a similar squeak alarm call.

Breeding: In our area, from May to late August in slow-moving or still water with aquatic vegetation.

Recordings: 1. Individual advertisement calls and chorus.

2. Phoot encounter calls. Both from Twitchell Lake, Andirondack Mountains, St. Lawrence Co., NY. 10:30pm 6/10/91. Steven



Bullrog *Rana catesbeiana*

R. Pantle and Joel Govostes. Library of Natural Sounds, Cornell Laboratory of Ornithology (Cat. No. 53182). Stereo.

3. Alarm calls and splashes as Bullfrogs leap into the water. Five Brooks Pond, Point Reyes National Seashore, Marin Co., CA. 75° F (24° C) air. 9/2/94. Carlos Davidson and Cynthia Kaufman.

36. GREEN FROG

Rana clamitans

An introduced species from the East Coast, now found at a few locations in the western states and provinces.

Voice: An explosive *bung* or *c'tung*, resembling the plucking of a banjo bass string. The call is usually given as a single note, but may be repeated rapidly several times. Calls are given both day and night. Surprised individuals give a high squeak while leaping into the water, very similar to the Bullfrog (*Rana catesbeiana*) alarm call.

Breeding: In the West, breeding begins with warm temperatures in late spring or early summer.

Recordings: 1. Advertisement calls. Connecticut Hill Wildlife Management Area, Tompkins Co., NY. 7/28/88. Greg Budney. Library of Natural Sounds, Cornell Laboratory of Ornithology (Cat. No. 60445). Stereo.

2. Alarm calls. Background: crickets. Tompkins Co., NY. 9/15/91. Lang Elliot.

NARROW-MOUTHED TOADS:

Family Microhylidae

37. GREAT PLAINS NARROW-MOUTHED TOAD

Gastrophryne olivacea

Voice: A long (1 to 4 seconds) buzz or bleat or *whaaah* preceded by a quick peep or whit sound. The buzz resembles the sound made by party whistles with roll-out paper tubes. The peep or whit helps distinguish the Great Plains Narrow-mouthed Toad from other species that have a buzzing call. Calls are given at night.

Breeding: March to September, stimulated by heavy rains.

Subspecies: The Plains Narrow-mouthed Toad (*Gastrophryne olivacea olivacea*) and the Sinaloan Narrow-mouthed Toad (*Gastrophryne olivacea mazatlanensis*), although these subspecies designations have been dropped by many authors.

Recordings: 1. Small chorus of Plains Narrow-mouthed Toads. Grimes Co., TX. 6/29/63. Texas Memorial Museum.

2. Several individual Sinaloan Narrow-mouthed Toads. 20 km. east of Kino, Sonora, Mexico. 79° F (26° C) air, 82° F (28° C) water. 9:15pm 9/29/63. L. M. Hardy. University of Kansas Museum of Natural History (Cat. No. 781-53).

TONGUELESS FROGS:

Family Pipidae

38. AFRICAN CLAWED FROG

Xenopus laevis

This frog is an introduced species in Arizona and California.

Voice: A low-pitched, rising and falling, two-part trill. Each rise and fall lasts about 1/2 to 3/4 seconds and may be repeated continuously for over a minute. Calls are given underwater both night and day, and can be heard only faintly in the air.

Breeding: Unclear in Arizona. In southern California, breeds November to June.

Recording: Underwater recording of single male calling underwater. Laboratory of John Gerhart, University of California, Berkeley. 1/25/94. Carlos Davidson.

Part Two Test Section

Use this section to test your ability to identify species by their calls. Each short recording is followed by an announcement of the species name(s). Listen carefully for species calling in the background.

To hear all the species occurring in the Yukon, Northwest Territories, Alberta, Saskatchewan, Wyoming, Idaho, and Montana, listen to test recordings 1 through 16. For those species occurring in Utah and Colorado, listen to test recordings 4 through 26. To hear species that occur in Nevada, Arizona, and New Mexico, listen to test recordings 5 through 49.

Recordings: Unless otherwise indicated the recordings in this section are the same as those in the reference section (Part One). Information on a recording can be found by looking in the reference section under the name of the first species indicated in the narration for each of the test recordings. Recordings that are not included in the reference section are described below. The number before each description matches the number announced before the recording.

4. Wood Frog (*Rana sylvatica*) and Boreal Chorus Frog (*Pseudacris triseriata maculata*). Matthews Pond, Larimer Co., CO. 44.6° F (7° C) air, 50° F (10° C) water. 11:30pm 6/1/95. Stephen Corn.

5. Pacific Chorus Frog (*Pseudacris regilla*). Advertisement calls, several individuals. Patterson Reservoir, Warner Mountains, Modoc National Forest, Modoc Co., CA. Approximately 40° F (4.5° C) air. 8:00pm 6/18/93. Carlos Davidson.

9. Two hand-held Boreal Toads (*Bufo boreas boreas*) giving release calls. Rocky Mountain National Park, Larimer Co., CO. 6/2/95. Stephen Corn.

10. Boreal Chorus Frog (*Pseudacris triseriata maculata*) and Great Basin Spadefoot (*Scaphiopus intermontanus*). Near Roosevelt, Uinta Co., UT. 9.5° F (12.5° C) air, 60° F (15.5° C) water. 6/15/78. M. J. Foquette, Jr.

14. Bullfrog (*Rana catesbeiana*) advertisement calls followed by aggression call. Tomales Bay Trail ponds, Point Reyes National Seashore, Marin Co., CA. 81° F (27.2° C) air, 84° F (28.9° C) water. 4:30pm 6/25/95. Carlos Davidson and Cynthia Kaufman.

15. Boreal Chorus Frog (*Pseudacris triseriata maculata*)and Northern Leopard Frog (*Rana pipiens*). Near Solen, Souix Co., ND. 5/5/87. Carola Haas. Library of Natural Sounds, Cornell Laboratory of Ornithology (Cat. No. 39730).

18. Southwestern Toad (*Bufo microscaphus microscaphus*) and Canyon Treefrog (*Hyla arenicolor*). Baker Reservoir, Washington Co., UT. 57° F (14° C) air, 61° F (16° C) water. 6/18/55. W. Frank Blair. Library of Natural Sounds, Cornell Laboratory of Ornithology (Cat. No. 60083).

33. Couch's Spadefoot (*Scaphiopus couchi*) and Great Plains Narrow-mouthed Toad (*Gastrophryne olivacea mazatlanensis*). Near Quijotoa, Pima Co., AZ. 75° F (24° C) water. 12:30am 8/8/93. Brian K. Sullivan.

39. Couch's Spadefoot (*Scaphiopus couchi*) and Northern Casque-headed Frog (*Pternohyla fodiens*). North of Hermosillo, Sonora, Mexico. 7/-/61. M.J. Foquette, Jr.

45. Northern Casque-headed Frog (*Pternohyla fodiens*) and Great Plains Narrow-mouthed Toad (*Gastrophryne olivacea mazatlanensis*). Alamos, Sonora, Mexico. 8/20/55. Texas Memorial Museum (Cat. No. 539).

46. Woodhouse's Toad (*Bufo woodhousii*) and Rio Grande Leopard Frog (*Rana berlandieri*). Near Yuma, Yuma Co., AZ. 59° F (15° C) water. 10/29/84. Jim Rorabaugh.

47. Pacific Chorus Frogs (*Pseudacris regilla*) and a single California Red-legged Frog (*Rana aurora draytonii*). Ludsen Marsh, Ana Dell State Park, Santa Rosa, Sonoma Co., CA. 3/25/92. Philip T. Northen.

Closing spadefoot chorus. Just east of Portal, Cochise Co., AZ. 66° F (19° C) air, 68° F (20° C) water. 12:30am 8/23/94. Carlos Davidson.

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Making your own recordings

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The following organizations are dedicated to recording and conserving natural sounds. Both hold field recording workshops and publish newsletters with information on recording:

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For most Rocky Mountains and Southwest frog and toad species, only a few recordings exist. If you make a new recording, consider donating a copy to a recognized sound archive.