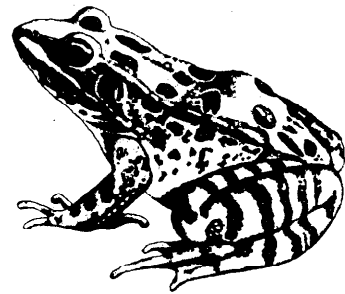


FHR

CURRENTS...

R-5 Fish Habitat Relationship Technical Bulletin
Number 4 May 1991



northern leopard frog

Monitoring Frogs and Toads on Region 5 National Forests

*Hartwell H. Welsh, Amy J. Lind
and Dana L. Waters
Redwood Sciences Laboratory
PSW-Region 5, USFS
1700 Bayview Dr., Arcata, CA 95521
(707) 822-3691*

The Need to Monitor Frogs

This article is a plea for fisheries biologists throughout Region 5 to initiate an inventory of frogs and toads. Learn to identify these species on your forests (Table 1) and incorporate the simple sampling protocol that follows into your stream habitat inventory work. This information will serve to establish baseline data on species presence/absence and relative abundance within drainages across the Region. It will provide a simple, easy, and direct biological assessment and help to establish a useful monitoring program for an environmentally sensitive species group.

Amphibians comprise a major component of stream vertebrate biomass, being both predators and prey in the aquatic food web. Their numbers

and biomass can equal or exceed fish in some streams (e.g., Murphy and Hall, 1981). Over the past several years, accumulated evidence indicates an alarming decline in amphibian populations worldwide. A conference was convened in February 1990 at U.C. Irvine for scientists to share information about this phenomenon and to suggest research strategies to uncover reasons behind these declines (Blanstein and Wake, 1990). Population declines seem to be particularly severe in the western United States. Evidence gathered in the Rocky Mountains of Colorado indicate reduced numbers of western toads, leopard frogs (Corn et. al., 1989) and tiger salamanders (Harte and Hoffman, 1989). In Southern California, three species of frogs, the mountain and foothill yellow-legged frogs and the red-legged frog have all but disappeared. The arroyo toad and the western spadefoot toad are also in severe decline. In the Sierra Nevada, these species, as well as the Cascade frog and Yosemite toad, are also declining.

Amphibians are relatively long-lived and utilize both terrestrial and aquatic habitats in different stages of their life histories. They are unique in that much of their respiration takes place through their skin. This delicate moist membrane is thus highly permeable to compounds in the environment. In addition, amphibians are linked very closely to the habitats they occupy; only a few species migrate, and those only short distances. These combined factors make amphibians excellent biological indicators.

*U.S. Department of Agriculture
Forest Service
Pacific Southwest Region*

Riparian habitats are the life-lines of ecosystems. They sustain and replenish the environment and all of its inhabitants, from invertebrates and fish to human beings. The decline of amphibians, denizens of the riparian zone, is an alarming trend that may indicate serious problems in both aquatic and terrestrial environments.

A dichotomous key and distribution table of the frogs and several sensitive toad species that inhabit the forested areas of Region 5 have been included at the end of this paper. The key and table are intended to be applicable only to the forested areas within Region 5, and include those species that are known to be in need of monitoring. Similar species from which they will need to be distinguished are also included. Also included are brief descriptions and natural history information for these species. For more information on these and other amphibians in Region 5 or the western U.S., we recommend reading Stebbins (1985).

Field Protocol for Frog Monitoring During Spawning Surveys and Habitat Typing

The following are general suggestions for sampling frogs and may need to be modified depending on logistical constraints and the type of information needed on a given forest. We are willing to consult with district and forest biologists to establish appropriate monitoring protocols for their forests.

Sampling Strategies

May through October

We recommend frog monitoring be incorporated into stream surveys for habitat typing. One person on each crew should be responsible for counting frogs. Observations should include visual scans of the stream and stream bank, and searching for egg masses and tadpoles in stream margins. Frogs should be counted every fifth habitat unit when other variables (e.g. shade, substrate, etc.) are recorded. Adult frogs should be recorded by species and egg masses should be

recorded by genus (e.g. treefrogs = *Hyla*). Frog larvae should be identified simply as "tadpoles" because field identification of species is very difficult. Tadpole abundance should be recorded in three categories: 1-10, 11-100, >100.

October through May

Frog counts can also be incorporated into spawning surveys. From October through May, record the number of adult frogs seen throughout the survey reach. In April and May also look for egg masses and tadpoles present along stream margins. Record the length of the stream survey and an average width so rough densities can be calculated.

Frog Age Classes

For the purposes of these surveys, three age classes are most efficient:

eggs - light or dark ovum surrounded by a gelatinous envelope, usually greater than 5mm in diameter; laid singly, in clusters, or cylindrical strings, depending on species:

tailed frog -- eggs unpigmented (cream-colored), rosary or bead-like strings, attached to the underside of rocks in streams.

treefrogs (genus *Hyla*) -- **eggs** pigmented, laid singly or in small clusters (often 20-25 eggs), attached to submerged vegetation or debris in quiet water.

true frogs (genus *Rana*) -- **eggs** pigmented, globular, grape-like clusters (100 - > 1000 eggs), attached to submerged vegetation or rocks in stream margins, ponds, and marshes.

true toads (genus *Bufo*) -- **eggs** pigmented, cylindrical or bead-like strings, entwined among vegetation or rocks in stream margins, ponds, or marshes.

tadpoles - larval stage of frogs, aquatic phase; most are found in edgewater and margins of streams or in temporary pools, except tailed frog tadpoles, which inhabit riffles.

adults -post-metamorphosis, terrestrial phase, usually forage adjacent to or in water.

Data Recording

A sample format to use during habitat typing work has been provided on page 9 of this publication.

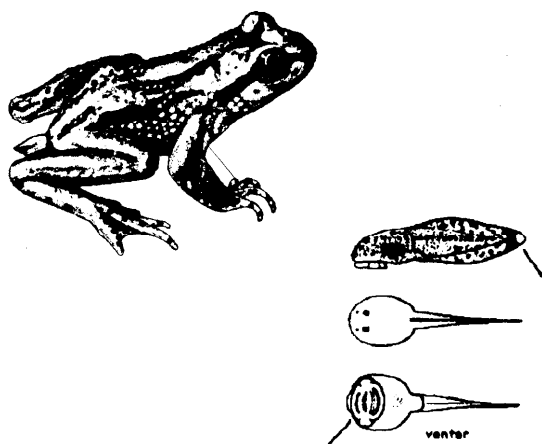
During spawning surveys, record numbers of frogs by reach length on a simple data form of your own design. With the count of frogs by species, be sure to include the date and time of surveys, along with the stream name, district and forest.

We will be happy to process the raw data at the Redwood Sciences Lab. You can send xerox copies of your raw data or electronic files. If you have any questions about data transfer, please call us.

Frogs of California Streams

A summary of key field identification features based on Stebbins (1985) and Nussbaum et al., (1983). For accurate color representations and drawings of key characters, see Stebbins (1985).

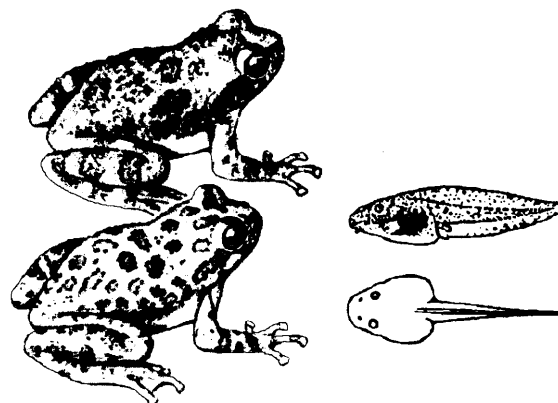
TAILED FROG
(Ascaphus truei) - 01



Olive, brown or grey above with pale yellow or greenish snout and dark eye stripe; flat-bodied with rough skin; eye with vertical pupil; male has tail-like copulatory organ. Tadpoles have distinct sucker mouth.

Inhabits shady riffles in clear, cold, rocky bottomed streams usually in forested areas. Streams can range in size from seepages to small rivers. Frogs usually are not observed unless directly searched for in the stream; active mainly at night; may be found under rocks along stream edges during the day. Coast range Klamath Mountains from Fort Bragg, east to Mt. Shasta, north into British Columbia. Populations also occur in the Rocky Mountains in Idaho, Montana, and Canada. Sea level to timberline.

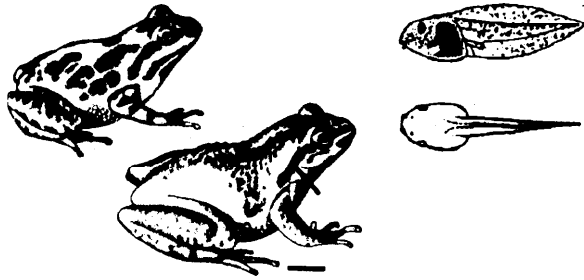
CALIFORNIA TREEFROG
(Hyla cadaverina) - 02



Small frog; grey, white, tan or brown above with dark blotches; toe pads and webbing distinct; no eyestripe; light below.

Inhabits quiet pools in rocky canyon streams and washes, occasionally encountered in stretches of rapidly flowing water. Prefers granite surfaces above water courses. Ranges from the desert and coastal stream courses to the pine belt in the mountains of Southern California to Baja California. Sea level to around 7,500 feet.

PACIFIC TREEFROG
(Hyla regilla) - 03



Small frog with toe pads and dark eye stripe; dorsal coloration highly variable, but usually green or brown, light colored below.

Occurs in all manner of still to slow moving water: lakes, ditches, ponds, slow streams, etc. Usually found on the ground among low plant growth or under objects near water; can be found considerable distances from water. Ranges from British Columbia to Montana and Baja California. From below sea level to over 12,000 feet.

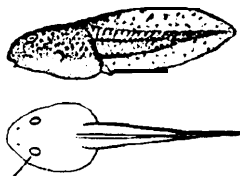
Tan to reddish dorsum with red on lower abdomen and underside of hind legs; often dark banding on legs; prominent dorsolateral folds, skin generally smooth; dark facial mask with light jaw stripe. May elicit a "scream" or "meow" when handled.

Occurs predominantly west of the Sierra crest; found in all manner of still to slow moving water: lakes, ditches, ponds, slow streams, etc. Normally found in or next to dense vegetation and are most active at night. Ranges from British Columbia to Baja California. Sea level to 4,500 feet in California.

FOOTHILL YELLOW-LEGGED FROG
(Rana boylei) - 05



RED-LEGGED FROG
(Rana aurora) - 04



Grey, tan, brown, reddish or olive above; often mottled, distinct yellow or orange (rarely red) patches on underside of hind legs and waist; usually a triangular buff-colored patch on snout; skin granular, no dorsolateral folds, no mask.

Frequents the rocky, sunny banks of riffles along streams and rivers of all size in woodland, chaparral and forest. These frogs are very cryptic and will remain motionless on the stream banks so that one may not observe them until they jump into the water. They occur west of the Cascade crest, Sierra foothills, and coast range from Oregon to Baja California. Sea level to approximately 7,000 feet (rare over 4,800 feet).

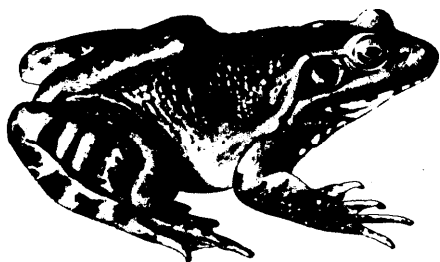
CASCADES FROG
(Rana cascadae) - 06



Tan, olive to orange above with inky black spots on back, yellowish underside of hind legs and groin; distinct dorsolateral folds present.

A diurnal species; often surfaces immediately after jumping in water. Occurs in the mountains in open coniferous forest along the sunny, rocky banks of ponds, lakes, streams, and meadow potholes of the Cascade mountains from Washington to Lassen Peak, California. Populations also occur in the Trinity and Olympic mountains. From approximately 250 to over 9,000 feet.

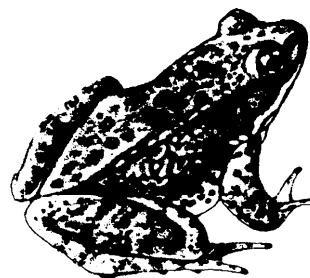
BULLFROG
(Rana catesbeiana) - 07



Introduced species; large frog, olive green or brown above, sometimes with dense spotting on the dorsum, legs banded; no dorsolateral folds, eardrums conspicuous.

Frequents thickly vegetated banks of all manner of standing water: ponds, marshes, etc., and rivers and large streams of prairie, woodland, forest, desert oasis, and farmland. They are active at night, and wary by day. Usually “bleeps” when startled. Tadpoles often overwinter. Range is cosmopolitan over North America, introduced west of the Great Plains. From sea level to 9,000 feet.

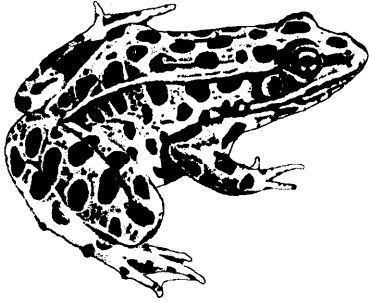
MOUNTAIN YELLOW-LEGGED FROG
(Rana muscosa) - 08



A Sierran and southern California highlands frog: yellowish or reddish brown above with black or brown spots or lichen-like markings; toe tips usually dark, lower abdomen and underside of hind legs are yellow; usually no snout patch (as in foothill yellow-legged frog); skin relatively smooth; weak dorsolateral folds, no mask; when handled they often emit a garlic odor.

Inhabits sunny riverbanks, meadow streams, isolated pools, and lake borders in the high Sierra Nevada from 4,500 feet to over 12,000 feet in elevation, and rocky streams in the mountains of southern California from 850 feet to 7,500 feet. Seem to prefer sloping banks with rocks or vegetation to the water's edge. Tadpoles may overwinter (especially at higher elevations).

NORTHERN LEOPARD FROG
(Rana pipens) - 09



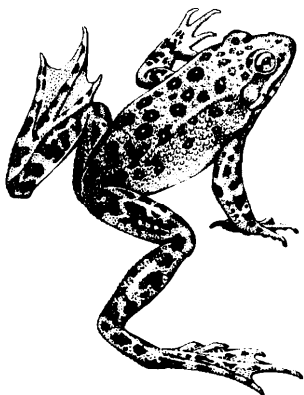
Light to dark brown above, sometimes greyish, with spots having distinct borders and light centers; mask present, sometimes a faint, light jaw stripe; throat and ventral surface often mottled; dorsolateral folds present; undersides of legs orange to red in California.

Frequents marshes, ponds, lakes, streams and rivers from mixed coniferous to subalpine forests, and in grassland and brushland. Highly aquatic during breeding season; found mostly near quiet water. Ranges from Alaska to Alberta, south to Utah, west to Oregon, Nevada and extreme north-eastern California. From sea level to 10,000 feet.

Introduced species; possibly native in the Owens Valley and Northeastern California. Green or brownish with well-defined spots with light borders on back, light to creamy ventrum; slim stature, white upper jaw stripe, well-defined dorsolateral folds.

Occurs in all manner of aquatic habitats: streams, ponds, bogs, canals, reservoirs, etc., frequenting vegetated banks. They are mostly active at night. Range is cosmopolitan over the Midwest to the Rockies, north to Hudson Bay, Canada, west to the east side of the Sierra crest; introduced in the Lake Tahoe basin and west of the Sierra Nevada crest. From sea level to 7,000 feet in California.

SPOTTED FROG
(Rana pretiosa)- 10



Resembles the western toad (see next page) but smaller, with smoother dorsal skin. Sexually dimorphic in color. Males are pale tan to dark olive with small dark flecks or none, and the females are heavily mottled. Small irregular black spots with sharply defined white borders on both sexes; ventrum is white with small black blotches and flecks, and the dorsal stripe is often absent.

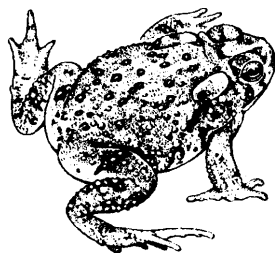
Dwells in the vicinity of lakes or ponds with grassy margins and quiet areas of streams. They are active mostly diurnally. Limited to higher elevations in the Sierra Nevada (4,500 to 12,000 feet).

YOSEMITE TOAD
(Bufo canorus) - 11



ARROYO TOAD
(*Bufo microscaphus californicus*)

- 12



Small, squat, short-legged and normally pale. White, tan, dark brown or grey dorsally with small brown olive or grey blotches. A dark V-shaped mark connecting the front edges of the eyelids. Ventrums is white with few black flecks or spots. Snout is blunt compared to western toad (see next). Dorsal stripe is weak (down one-third of the body) or absent.

Restricted to sandy or gravelly margins of large streams from San Luis Obispo County south. Habitat includes riparian terraces with oaks, willows or cottonwoods, and shallow, gravel-bottomed pools. They are active at night and hop instead of walk. From sea level to 4,500 feet in California.

WESTERN TOAD
(*Bufo boreas*) - 13



Large bodied, pale tan, grey or olive above, depending on location within their range. Usually prominent creamy dorsal stripe from tip of snout to end of body. Throat and chest white with dark blotches. Warts generally small in size, light-colored with variable black borders. This species is highly variable in appearance throughout its range.

Found along all types of aquatic habitats: streams, marshes, ponds, mountain meadows, large reservoirs, etc. Active at night in warm, low-lying areas. Adults are usually found in burrows, under logs, etc. during the day. Tends to walk rather than hop. Found throughout western North America, excluding southwestern deserts. Sea level to 12,000 feet. Normally does not exist with Yosemite toad (limited area of overlap and hybridization).

Two species of unique toads were omitted from this issue because they occur primarily in arid lowlands and would only rarely be found on National Forest lands. The Great Basin spadefoot (*Scaphiopus intermontanus*) may occur on the Modoc, Lassen and Inyo National Forests, and the western spadefoot (*Scaphiopus hammondi*) may occur on the Los Padres, Cleveland, and San Bernardino National Forests. These species are nocturnal and are best identified by their vertical pupils (when exposed to light) and small dark “spade-like” structures on each hind foot.

Dichotomous Key to the Frogs and Toads of California

1.
 - a. Horizontally elliptical pupil ----->2
 - b. Vertically elliptical pupil = *Ascaphus truei*
2.
 - a. Large glands behind eyes and on body. "Fat" bodied. ***Bufo*** spp. ----->3
 - b. Glands small, non-bulbous ----->4
3.
 - a. Throat or chest white without splotches or flecks. Coastal ranges of Southern California only = ***Bufo microscaphus californicus***
 - b. Throat and chest white with numerous dark markings. Large glands behind eyes are separated by more than the width of a gland. Occurs throughout California = ***Bufo boreas***
 - c. Glands behind eyes large but separated by less than the width of a gland. Dorsal stripe often absent. Sierras only = ***Bufo canorus***
4.
 - a. **Toes have pads** = ***Hyla*** spp. ----->5
 - b. No pads on toes = ***Rana*** spp. ----->6
5.
 - a. Body color is light to dark **grey** with or without mottling. No black eye stripe = ***Hyla cadaverina***
 - b. Body color is highly variable but with a black eye stripe ***Hyla regilla***
6.
 - a. Large bodied, marbled green to brown, lacks folds on back, but folds present around eardrum = ***Pana catesbeiana***
 - b. Prominent folds on back. Green to grey to brown body. Well-defined spots with light borders. Underside and groin are white = ***Rana pipiens***
 - c. Folds on back with reddish groin ----->7
 - d. With or without folds on back. 'Yellow to orange groin ----->8
7.
 - a. **Eyes tilted upwards.** Small black blotches on back. Brown to reddish. Modoc NF only = ***Rana pretiosa***
 - b. **Eyes look outward** Reddish to brown on top with peppery blotches with light centers. Does not occur on Modoc NF = ***Rana aurora***
8.
 - a. Many inky black spots on back, neck and head, sides of body. Yellowish to tan body color. Klamath, Plumas, Shasta-Trinity and Lassen NFS only = ***Rana cascadae***
 - b. Body is marbled brown with lighter **lichen-like markings.** Belly is yellow to light orange. **Dark toe tips. Musky odor.** Sierras and Southern California only = ***Rana muscosa***
 - c. **Light stripe across snout between eyes.** Grey, olive to brown. With or without marbling. White toes. No musky odor = ***Rana boylei***

Table 1: Locations of Frog and Toad

	tailed frog 01 ¹	California treefrog 02	pacific treefrog 03	red-legged frog 04	foothill yllw-legged 05	Cascades frog 06
National Forest						
Angeles		X	X	X ²	X ²	
Cleveland		X	X	X ²		
El Dorado			X	?	X	
Inyo			X			
Klamath	X		X	?	X	X
Lassen			X	?	X	X ²
Los Padres		X	X	X	X	
Mendocino	?		X	X	X	
Modoc			X			
Plumas			X	X ²	X	X ²
San Bernardino		X	X	X ²		
Sequoia			X	X ²	X	
Shasta-Trinity	X		X	?	X	X
Sierra			X	X ²	X	
Six Rivers	X		X	X	X	
Stanislaus			X	X ²	X	
Tahoe			X	X ²	X	
Lake Tahoe			X			
Basin Mgt Unit						
Status in Calif. ³	S	S		S,SP	S	

X--Historically present on forest; museum record or verified sighting

?--May be present on forest; need survey information to be sure

¹Species codes for field data forms

²Possibly extirpated on the forest

³Status codes (Jennings 1987):

S--State species of special concern (those animals which may become listed as threatened, endangered or protected in the near future)

SP-- State Listed Protected Species

R--Limited distribution in California; common in adjoining states

Species on Region 5 National Forests

bullfrog 07	mountain yllw-legged 08	leopard frog 09	spotted frog 10	Yosemite toad 11	arroyo toad 12	western toad 13
X	X ²				X ²	X
X	X ²				X	X
X	X	X ²		X		X
X	X	X		X		X
X						X
X	X	X ²				X
X					X	X
X						X
X		X ²	X			X
X	X					X
X	X				X ²	X
X	X					X
X						X
X	X			X		X
X						X
X	X			X		X
X	X	X ²		?		X
X	X	X ²		X ²		X
			S,R	S	S,SP	

Acknowledgments

We thank Dr. Robert Stebbins and the Houghton Mifflin Co. for permitting us to reproduce plates and material from Stebbins (1985); and Dr. Samuel Sweet for helpful comments on an earlier draft. Special thanks to Dr. Mark R. Jennings for his help with species descriptions and verifying localities in Table 1.

All drawings from A Field Guide to Western Reptiles and Amphibians, Robert C. Stebbins, published by Houghton Mifflin Co., Boston. Copyright © 1985 by Robert C. Stebbins, reprinted by permission.

References

- Blaustein, A.R. and D.B. Wake 1990. Declining amphibian populations: a global phenomenon? *Trends in Ecology and Evolution* 5:203-204.
- Corn, P.S., W. Stolzenburg, and R.B. Bury. 1989. Acid precipitation studies in Colorado and Wyoming: interim report of surveys of Montana amphibians and water chemistry. U.S. Fish and Wildlife Service Biological Report 80(40.26):56 pp.
- Harte, John and Erika Hoffman. 1989. Possible effects of acidic deposition on a Rocky Mountain population of the tiger salamander *Ambystoma tigrinum*. *Conservation Biology* 3(2): 149-158.
- Jennings, M.R. 1987. Annotated Checklist of the Amphibians and Reptiles of California. *Southwestern Herpetologists Society, Special Publication* 3:48 pp.
- Murphy, M.L. and J.D. Hall. 1981. Varied effects of clearcut logging on predators and their habitat in small streams of the Cascade Mountains, Oregon. *Can. J. Fish. Aquatic Sci.* 38: 137-145.
- Nussbaum, R.A., E.D. Brodie, and R.M. Storm. 1983. *Amphibians and Reptiles of the Pacific Northwest*. The University Press of Idaho, Moscow, Idaho. 332 pp.
- Stebbins, R.C. 1985. *A Field Guide to Western Reptiles and Amphibians* (second edition, revised). Houghton Mifflin Company, Boston, MA 336 pp.

FHR CURRENTS . . . Purpose

The Fish Habitat Relationship (FHR) Program of R-5 USFS has been established to research and develop information on fish ecology and to coordinate effective applications of this knowledge in managing and protecting our fisheries. By relating life stage requirements of specific species to physical habitat parameters, we are aiming at our main objective: developing a methodology to manage fisheries through the management of habitat.

If you wish to submit a paper for publication in the FHR Currents, please write Jerry Boberg, Dave Fuller (Technical Editors) or Stephanie Gomes (Editor) for information and guidelines at: Six Rivers National Forest, 500 5th Street, Eureka, CA 95501; or call (707) 442-1721.

