**Figure 1**. Green Toad (*Bufo* debilis, UAZ 54811) from Hidalgo Co., New Mexico. Note that the color pattern resembles that of the specimen in Fig. 2 in having the dark markings not joined into a reticulated network. Photo by Erik Enderson.

# Amphibians of the Vekol Valley

**Erik F. Enderson[1] and Robert L. Bezy[2]**

*[1]Drylands Institute, PMB 405, 2509 North Campbell Avenue, Tucson, Arizona 85719, USA.*
*[2]Natural History Museum of Los Angeles County, Los Angeles, California 90007, USA.*

*This winter (2005) a landmark publication, Dry Borders: Great Natural Areas of the Sonoran Desert (Richard Felger and Bill Broyles, editors, University of Utah Press) will become a first for conservation and ecological writing. This book is a rich blend of science and literature from noted authors in Mexico, the U.S. and Canada that includes 41 chapters and gives a fresh view of the Sonoran Desert, from the Gulf of California to the Gran Desierto. It is scientifically accurate and highly readable by a broad audience. The book contains more than 400 illustrations including the compelling photos by Pulitzer Prize-winning photographer Jack Dykinga. This work presents marine and desert ecology and natural history, biodiversity, human history, and biographical information for education, science, and conservation.*

*Much of the region's rich herpetofauna is described in three chapters: The Amphibians of the Vekol Valley by Erik F. Enderson and Robert L. Bezy; Reptiles and Amphibians of Arid Southwestern Arizona and Northwestern Sonora by Philip C. Rosen; and finally, Sea Turtles and the Alto Golfo: A Struggle for Survival by Jeffrey A. Seminoff and Wallace J. Nichols. The Vekol Valley chapter is presented here for the first time, in a slightly edited version for the Sonoran Herpetologist.*

*Richard Felger and Bill Broyles*

It's the kind of place you can get stuck in for days – vast and remote, harsh and mysterious - a place where even the heartiest can become queasy. And although today a few reminders of civilization can be seen, there still remains a sense of total isolation when you are within its confines. It is Vekol Valley; an untamed, unique, bizarre, and ecologically rich region of Sonoran Desert. It is the uniqueness of the Vekol that lured us, specifically, the presence of one toad.

We were drawn into the valley by an animal known as *Bufo debilis* (the Green Toad). This amphibian occurs throughout the Chihuahuan Desert from northern Mexico through Texas and New Mexico to southeastern Arizona. Sometimes considered a Chihuahuan indicator species, in Arizona it thrives in

the semi-arid grasslands of the state's southeast corner and had not been found west of the upper San Pedro Valley. That changed, however, in 1983 when three BLM biologists reported the surprising occurrence of *B. debilis* in the Vekol together with its nearest relative, *Bufo retiformis* (the Sonoran Green Toad; Jones et al. 1983).

The Vekol Valley lies well within the Sonoran Desert with luxuriant Arizona Upland Desert on the upper bajadas and stands of Creosote (*Larrea divaricata*) dominating the lower slopes. The latter are mapped as Lower Colorado Desert, the hottest, driest of the North American deserts, where highs may reach 50°C (120°F) and some years rain does not reach the ground, not exactly where one would expect to find *Bufo debilis*. But the Vekol holds a wild card. In its southern reaches exists the remnant of what once may have been an expansive and spectacular Tobosa grassland community, the same grassland community that supports *Bufo debilis* in the Chihuahuan Desert regions to the east. We wondered if the Green Toad, like the Tobosa grassland and Antelope Jack Rabbits *(Lepus alleni)* we had observed in the Vekol may be relicts that have been isolated in the Sonoran Desert since wetter times prevailed over 10,000 years ago (Van Devender 1990). The question intrigued us and in the summer of two thousand the time seemed right to investigate.

What ensued were three summers of axle-grinding, tire-spinning muddy roads and endless nights sloshing through the sloughs of rain-hydrated cow excrement, fending off ravenous mosquitoes, and crawling through some of the densest mesquite bosques in the Southwest. The nights yielded adventure, surprise, and sometimes disappointment.


**Figure 2**. Museum specimen of Green Toad (*Bufo debilis*; USNM 252776 reported from the Vekol Valley by Jones et al. 1983) that stimulated this study. Photo by Erik Enderson.

## Doppler-mania

Ominous red-centered masses ringed with yellow and green slowly develop in the late afternoon over Sonora's rugged Sierra Madre Occidental and begin moving north. The monsoon had arrived and bright Doppler radar images were again lighting up our favorite on-line weather maps. We watched and waited, sometimes for the entire night. It's like a card game in which you evaluate your chances every 15 minutes as the new image unfolds on your screen. Some nights the colorful masses appeared to be right on target sweeping slowly northwest, their size and intensity growing as they approached the Vekol, only to burst and whither away when they hit what we estimated to be the position of Table Top Mountain. Whether any rain may have spilled over into the Vekol was a judgment call. In desperation we sometimes decided to head out on the long 99 mile (160 km) excursion just to verify that the cells did not reach the Vekol. On more than one occasion large rain-filled puddles and the smell of wet creosote greeted us as we passed north of Table Top on the highway, only to find parchment–like conditions as we dropped into the Vekol.

Eventually our persistence paid off and the torrential summer rains struck the valley, bringing with them an amphibian breeding frenzy, the likes of which we had not previously seen or heard outside of the tropics. The normal nocturnal silence was replaced by the calls of thousands, perhaps tens of thousands, of vocalizing frogs. Some nights their numbers were so great, it was difficult to avoid stepping on them. The once dry pools and ponds were now filled to the rim. Mesquite trees stood like the giant cypress trees in the bayou of the Southeast, with two feet (0.6 m) of water extending up the trunks. The ponds were soon to be bursting with tadpoles. A week would pass and the tadpoles will have metamorphosed into toadlets, so small they fit into the cracks of drying mud, protecting their porous skin from the relentless desert sun. Come nightfall those same cracks serve as a hub to the new community bustling with nocturnal activity.

It all sounds so pleasant - nature at harmony with itself, sharing its wonders with the eager biologists. But don't be fooled. The thorny Vekol is not a gracious host, and many of our trips were full of all manner of pain and anguish, cruel and unusual punishment.

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## Follow That Call

During our anuran (frogs and toads) surveys in the valley we used a common technique to locate our subjects. It involves driving short intervals, stopping the vehicle, silencing the engine, and listening for a frog chorus. When the time and conditions are right anurans can be heard vocalizing

from great distances. Using our ears to home-in, we would set off on foot to locate the breeding aggregations, which, more often than not, were buried deep within the thorny armor of Vekol's immense mesquite bosque.

We left a glowing flashlight on the roof of the truck as we headed out into the darkness with our headlamps, camera, tape recorder, and high hopes. We crossed the open grassland following the frog vocalizations arising somewhere deep in the mesquite grove dead ahead. At first the young mesquites were just shrubs, scarcely 9 feet (3 m) tall and widely scattered across the open terrain. As the chorus grew louder, the mesquites became large trees with interlocking branches. After eons of evolution, it is difficult to forsake our noble upright posture and return to our hands and knees - like "animals" or like infants. But what alternative is there when the branches become unbending and the thorns have ripped your clothes and gouged your arms and face? It's really a lot easier to make progress below the mesquite branches, crawling along with the harvester ants over the cow pies, at eye level with the occasional Mohave Rattlesnake (*Crotalus scutulatus*) out on its nightly search for a packrat.

**Figure 3**. Lowland Burrowing Treefrog (*Pternohyla fodiens*) from the Vekol Valley, the northernmost known locality for the species. Photo by Erik Enderson.

The bosque crawl was particularly grueling that night. At each pause the chorus seemed just a few meters ahead, like a mountain peak that keeps receding as you climb. We went on, placing faith in our standard creed: "the mesquite is thickest just before you reach the levee," and eventually we burst free, staggering up the bank on our feet at last. To our utter disappointment, there on the other side was a sea of inflated vocal sacs of the odious *Bufo cognatus* (Great Plains Toads), floating in the tank. From the onset of the long trek we had recognized that the chorus was composed largely of these ubiquitous, obnoxious, deafening toads, but wanted to make sure that their din was not drowning out the calls of any other species.

Having satisfied ourselves that only *Bufo cognatus* and a few *B. alvarius* (Sonoran Desert Toads) were present in the tank, we faced the depressing prospect of the return crawl. In a desperate attempt to avoid the mesquite thicket, we explored the full length of levee, but nowhere around the enormous horseshoe-shaped structure did the bosque appear any more penetrable. We returned to our original point on the bank and began the long crawl out.

Soon after, we heard it. At first it sounded like a hiss - maybe that of a Gophersnake (*Pituophis catenifer*) intimidating a potential predator. The sound seemed to come from all directions. Pausing in mid-crawl, we turned off our headlamps and listened intently—nothing but silence. We switched the lights back on and the hiss resumed. As we crouched, the noise seemed to grow louder, now only a few feet away. We scanned the ground around us and saw nothing that could explain the ominous sound. Finally, we shined the beam up into the trees and saw it - a massive, hissing swarm of honey bees on the mesquite just above our heads. Carefully and silently, we turned off the lights and slowly crawled away. We were unsure whether or not the bees in the Vekol are "Africanized," but the thought of trying to escape a swarm by crashing through the dense thorny mesquite tangle was not reassuring. Had the swarm turned defensive, our chances of escape would have been slim.

The lantern on the hood of the truck was very dim when we finally reached the road after 0100 h. From then on we tried to avoid crawling through the mesquite. But it was impossible; anurans are integral members of the bosque community in the Vekol.

## The Levees

Amazing, complex, industrious, and just plain bizarre. These are the adjectives that come to mind when trying to describe the levees that now constitute the Vekol Wash. The construction of earthen dams to collect and retain water for cattle is a centuries-old practice in the Southwest, but the levees in the Vekol are truly remarkable in size and complexity. It would be interesting to have the opportunity to hear a resident rancher's perspective on the valley and particularly the history of the complex levees, but on none of our trips to the Vekol have we ever encountered another human being. The history behind these industrious constructions in the Vekol remains a story to be told by others.

The wash, as it still appears on maps, transects the valley from south to north and long ago emptied into the Gila River. Today the wash flows only during the most torrential storms, one of which was observed the night of 6 July 2001. This is largely due to the labyrinth of approximately eight levee-

formed tanks that capture most rainfall and its runoff. The levees themselves are situated in the wash and are formed by long rows of earth approximately 4 - 8 feet (1.5 – 2.5 m) high and some extend and bend to over 500 feet (152 m) long. Each creates large long-standing pools and our observations on 24 June 2001 indicate that at least one of the tanks is likely a semi-permanent water source. However, in June of 2002, one of the driest years on record, we found the tank dry. The ecological effects of these levees in the Vekol have not been studied. Our casual observations suggest that they have likely had a major impact on the valley. There are several areas adjacent to the levees (and clearly outside wash and associated impoundments) that are virtually devoid of vegetation. While these may be the result of over-grazing of the Tobosa grassland, in places it appears as if the top-soil might have been scraped off to form the levees.

The levees, tanks, and associated heavy grazing have very likely been a major factor in converting the grassland to mesquite bosques (c.f. Hastings and Turner 1965). Because the levees usually prevent Vekol Wash from flowing, the surrounding flood plain has expanded to create a mesquite bosque of extraordinary size and density. What impact this may have had on the anurans is difficult to determine. We conjecture that the presence of permanent to near-permanent tanks has increased the densities of the Great Plains Toad (*Bufo cognatus*) and Sonoran Desert Toad (*Bufo alvarius*), species that are known to breed independently of rainfall, particularly in the late spring and early summer. The abundance in the Vekol of the Great Plains Narrowmouth Toad (*Gastrophryne olivacea*) and the Lowland Burrowing Treefrog (*Pternohyla fodiens*), two anuran species found in the Sinaloan Thornscrub, may also be related to the extensive mesquite bosques resulting from the levees.

**Figure 4**. Great Plains Narrow-mouthed Toad (*Gastrophryne olivacea*) from the Vekol Valley, the northernmost known Arizona locality for the species. Photo by Erik Enderson.

## The Anurans

We have documented eight species of frogs and toads in the Vekol Valley (Table 1). Although this anuran fauna is not overly rich in terms of species diversity, it includes several amphibians that are biogeographically quite remarkable. Southern Arizona is home to a number species of amphibians and reptiles whose heartland lies in the Neotropics. While some of these species occur in the lowlands of tropical Mexico, at the latitude of Arizona they are largely restricted to high elevations where relictual populations persist in the Madrean Archipelago due to the presence of monsoonal moisture combined with moderate summer temperatures. Surprisingly, three species of Neotropical frogs that extend into southern Arizona meet the challenges of the arid Sonoran Desert lowlands head-on. These are the Lowland Burrowing Treefrog (*Pternohyla fodiens*), the Great Plains Narrow-mouthed Toad (*Gastrophryne olivacea*) and the Sonoran Green Toad (*Bufo retiformis*), all reaching their northern limits in or very near the Vekol Valley (Sullivan et al. 1996). The Vekol thus represents the northern terminus in the American Southwest of the great lowland Neotropical anuran fauna.

The most interesting of these frogs is *Pternohyla fodiens*, which was discovered in the Vekol in August of 2000 (Enderson and Bezy 2000). This bizarre amphibian is a one of several species of casque-headed frogs of the family Hylidae that are found in the American tropics. The casque head is a heavily boned skull that has protruding lip flanges and that is solidly connected ("co-ossified") with the skin (Duellman and Trueb 1994). This feature facilitates burrowing in the wet soil of temporary ponds. Once buried in the mud at the end of the monsoon, the frog secretes a thick, clear epidermal "cocoon" that retards dehydration (Ruibal and Hillman 1981). This frog is primarily a species of the Thorn Scrub ranging from Colima, Mexico, to the Vekol Valley. Consistent with its occurrence in the Mexican Thorn Scrub, within Arizona it is virtually restricted to dense mesquite bosques. We heard only two or three calling in 2000, but a very large aggregation was encountered on the nights of 11 and 17 July 2001. Most of the calling males were stationed on small (ca 1 m square) islands at the base of mesquites, but some individuals were perched on mesquite branches as high as ca. 2 m above the water. Hearing the distinctive duck-like quack issuing from this broad-billed amphibian is truly one of the most thrilling experiences in the Sonoran Desert.

A second Neotropical frog that reaches its northern limit in the Vekol (Jones et al. 1983) is the

Amazing, complex, industrious, and just plain bizarre. These are the adjectives that come to mind when trying to describe the levees that now constitute Vekol Wash.

**Figure 5**. Sonoran Green Toad (*Bufo retiformis*) from the Vekol Valley. Although this individual has unusually large green blotches, the dark markings are united into a reticulated pattern characteristic of the species. Photo by Erik Enderson.

Great Plains Narrow-mouthed Toad, *Gastrophryne olivacea* (formerly *Gastrophryne olivacea mazatlanensis*, Sinoloan Narrow-mouthed Toad). It represents an interesting example of an amphibian that combines two biogeographic patterns. As indicated by its former subspecies name, it occurs in Thorn Scrub on the Pacific lowlands of Mexico. In Arizona there are two population clusters. One is in the Madrean Woodland of the Pajarito and Patagonia Mountains, an example of a typical thornscrub to Madrean Archipelago pattern. The other northern populations occur in dense mesquite bosques from the Arizona-Sonora border, north through the Tohono O'odham lands to the Vekol (Jones et al. 1983; Sullivan et al. 1996). The population in the Vekol appears to be denser than any other we have observed in the Southwest, and individuals were even encountered on the road surface. The species seemed to be more abundant in the summer of 2000 (than in 2001 and 2002) literally carpeting the ground in some areas. These frogs are primarily ant predators and their skin secretions are quite toxic. They give a high-pitched buzzing advertisement call while immersed in water with only the tips of their pointed snouts protruding from a tangle of mesquite branches and detritus.

The third species is *Bufo retiformis*, the magnificent gold and black jewel of the Vekol. Its heartland lies in the Sonoran Desert of Sonora, extending into Arizona primarily on Tohono O'odham lands north to the vicinity of the eastern flank of the North Maricopa Mts., Maricopa County (Sullivan et al. 1996). It is less restricted to mesquite bosques than the previous two species, occurring also on rocky bajadas. This shy toad often calls from beneath a small bush some distance from the edge of the water, and one or two non-calling (satellite) males may be present (Sullivan et al. 1996, 2000; Enderson, pers. obs.). Although they breed in cattle tank impoundments, we have observed them calling also from newly formed shallow rain ponds on the flats far from the Vekol Wash.

The last species we wish to comment on is *Bufo debilis*, the anuran that originally attracted us to the Vekol. Sullivan et al. (1996) examined the one Vekol specimen (USNM 252776) and compared measurements to those presented by Ferguson and Lowe (1969), concluding that it is a *Bufo debilis*. We also have examined this specimen and our analyses further confirm that it is a *Bufo debilis*. In addition, we considered the possibility that the specimen might represent a hybrid between *Bufo retiformis* and *Bufo punctatus* similar to those that have been found elsewhere in Arizona (Bowker and Sullivan, 1991; Sullivan et al., 1996), but our data do not indicate that this is the case. We spent many hours during the monsoons in the Vekol and have observed, photographed, tape-recorded vocalizations, and obtained tissue samples of numerous *Bufo retiformis*, but found no toads resembling *Bufo debilis* in color and color pattern or in vocalizations (see Sullivan et al., 2000). Although negative evidence is never conclusive, we consider the presence of *Bufo debilis* in the valley to be doubtful, but this has not diminished our fascination with the thorny Vekol.

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**Table 1**. List of anuran species in the Vekol Valley. (?) indicates a species reported from previous works but not observed by the authors.

| | |
|---|---|
| *Bufo alvarius* | Sonoran Desert Toad |
| *Bufo cognatus* | Great Plains Toad |
| *Bufo debilis* (?) | Green Toad |
| *Bufo punctatus* | Red-spotted Toad |
| *Bufo retiformis* | Sonoran Green Toad |
| *Gastrophryne olivacea* | Great Plains Narrowmouth Toad |
| *Pternohyla fodiens* | Lowland Burrowing Treefrog |
| *Scaphiopus couchii* | Couch's Spadefoot |

## Data Needed for Developing Pima County Wildlife Crossings

Elissa Ostergaard, Urban Wildlife Specialist for the Arizona Game and Fish Department (AGFD), is requesting help from herpetologists on locations of reptiles and amphibians found dead on the road in Pima County. The Arizona Department of Transportation (ADOT) hopes to install wildlife crossings along roads and is seeking data to help determine locations for them. AGFD has some roadkill data, but not enough to make educated decisions to address important issues, including which areas and species need the most protection, how many crossings are needed, what size and how far apart they should be, and whether fencing is required.

This is a great opportunity for everyone who has ever recorded information on dead on the road animals (DORs) and hoped it the information would come to good use someday. Elissa is asking for species and location data on DORs (and live animals too, as long as they were found on the road) during the next month or two. Game and Fish plans on mapping the locations and overlaying it with the County's plans for road projects.

If you want to help, please either email Elissa your data, if it is already entered into a spreadsheet, or contact her to request for a blank spreadsheet to fill out. If you have so much data that you know you will never get it entered, please contact Elissa anyway – she may be able to have it entered for you if she borrow or copy your field data. Elissa Ostegaard can be reached at eostergaard@azgfd.gov or (520) 388-4446.

## Seventh Jarchow Conservation Award: Request for Nominations

The Board of Directors of the Tucson Herpetological Society (THS) established the Jarchow Conservation Award (JCA) in July 1992 to honor individuals or organizations for their service to the conservation of the amphibians and reptiles of the deserts of North America. At this time the THS actively solicits nominations for the seventh presentation of the award from members of the Society. Most desirable as candidates are individuals and organizations that have received little recognition and whose conservation work would benefit from the award. A letter (or email) as to why the candidate should receive the award should be sent to the JCA Selection Committee Chair, accompanied by any supporting documents. The deadline for receipt of nominations is Friday, 19 August 2005. The Board of Directors must approve the final selection of any candidate by the committee.

The award is named for James L. Jarchow, D.V.M., of Tucson, and consists of an engraved plaque, a written citation, Honorary Life Membership in the society, and $500. Because of his dedication and contributions to the conservation of amphibians and reptiles for more than 20 years, the First Jarchow Conservation Award (JCA) was given to Dr. Jarchow on 15 September 1992. The Second JCA was awarded to Roger Repp in 1994 followed by Cecil Schwalbe in 1997, Dave Hardy, Sr. in 1999, Dennis Caldwell in 2001, and Dr. Phillip Rosen in 2003. The Seventh JCA is scheduled for October 2005, provided a suitable candidate is nominated to the Selection Committee. The Committee consists of the six previous awardees plus a Chairperson (Taylor Edwards).

The Jarchow Conservation Award is supported entirely by donations made to the society. Those wishing to support the conservation of our region's herpetofauna by the continuation of this important award should send their contributions to the JCA Fund in care of the Tucson Herpetological Society. Information on any aspect of the Seventh Jarchow Conservation Award may be obtained by emailing Taylor at taylore@u.arizona.edu or by calling (520) 795-9292.

Nominations can emailed (taylore@u.arizona.edu) or mailed to Taylor Edwards, Jarchow Conservation Award Chair at:

Tucson Herpetological Society
P.O. Box 709
Tucson, AZ 85702-0709