

Fig. 1. Arizona Night Lizard (*Xantusia arizonae*) with the color pattern most frequently seen in adults of the species.



The Night Lizards (*Xantusia*) of Arizona

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1. Peralta Fever

In 1856 Spencer Fullerton Baird described *Xantusia vigilis* (Desert Night Lizard) and established the family Xantusiidae on the basis of two specimens collected by the eccentric Hungarian naturalist János Xántus at Fort Tejon, California (Bezy 1988; Moll 2003), but it was to be another 75 years before Night Lizards were eventually discovered in Arizona. In August 1931, the peerless Southwestern herpetologist Laurence M. Klauber and his son Philip drove from San Diego to northeastern Arizona to document the snake dances of the Hopi at Mishongnovi (Klauber 1932). On their return trip, motoring through the Weaver Mts. (Yavapai Co.), Klauber was struck by the surprising similarity of the habitat to areas in southern California where he was familiar with *X. henshawi* (Granite Night Lizard). A true field biologist, Klauber followed his instincts and ignored that he was hundreds of miles from then-known populations of any species of *Xantusia*. The “inventor” of road-driving for snakes stopped his vehicle, got out, and began searching for Night Lizards. In very little time he discovered a *Xantusia* that was unlike any he had seen before. Later he remarked that the discovery of a species new to science “was a thrill such as the collector always

anticipates but (in this settled country, at least) all too seldom achieves” (Klauber 1931:1).

In 1931, transporting live Night Lizards across the Lower Colorado Desert in August was no easy task, but Klauber managed to arrive back in San Diego with three of the six *Xantusia* alive in a jar he had wrapped in a cloth and continually moistened. One of the surviving females gave birth to two dead off-spring, leading him to conclude that the new species, like other *Xantusia*, is viviparous.

Although academic tenure and promotion were not a concern for this highly successful engineer, Klauber was quick to see the results of his research into publication. A month and a half after his discovery in the Weaver Mts., he published the description of the new species, *Xantusia arizonae*, complete with photographs of the habitat and of a live individual, together with a summary of what was known at the time about all members of the genus. He listed six features of scalation and body proportions that easily distinguished the larger, flatter, and more boldly spotted *X. arizonae* (Arizona Night Lizard) found in rock-crevices from the then-available specimens of *Xantusia vigilis* (Desert Night Lizard) living in yuccas. From the publication it is clear that the rock-crevice habitat and the presence of discrete differences in scale counts were crucial to Klauber’s decision to recognize the new *Xantusia* as a distinct species rather than as a subspecies of the more widely distributed yucca-inhabiting *X. vigilis*. My perusal of Klauber’s extensive publications suggests that he usually

judged populations with non-overlapping scale characters to represent separate species, whereas he considered that subspecies represent populations with color pattern differences and scale counts that are statistically different but have overlapping ranges of variation.

Not one to rest on his achievements, Klauber continued to explore the distribution of reptiles in Arizona and elsewhere in the Southwest, extending the range of *Xantusia arizonae* southeast to the Superstition Mts. (Pinal Co) and northwest to the McCloud (Yavapai Co.; Klauber 1938) and Cottonwood Mts. (Mohave Co.; Klauber 1940). He was also the first to report *X. vigilis* from Arizona, finding it under yuccas at several localities north of the Hualapai Mts. (Mojave Co.; Klauber, 1939).

This was more or less what was known about *Xantusia* in Arizona when as a youngster I began exploring lizards with my brother Bill on our grandfather's property in the Weaver Mts. Before I had actually encountered my first Night Lizard there, my grandfather started selling shares in a gold mine he had discovered on his land and shortly thereafter was hospitalized with a cerebral hemorrhage. The gold mine was never re-located and unfortunately his property, which included the type locality of *Xantusia arizonae*, was sold to developers.

But my fascination with Night Lizards continued. During my high school years I began searching for *Xantusia* in central Arizona to better document variation and distribution. With my friend Jim Fitzsimmons, I climbed to the summit of the Harquahala Mts. where we found *Xantusia vigilis* under agaves (reported 25 years later from the range by Jones et al., 1982). I discovered Night Lizards in several other ranges where they were previously unrecorded, but despite repeated attempts, I had not succeeded in locating them in the Superstition Mts. from which Klauber had reported a specimen collected by Vic Householder. Not to be deterred, I looked-up Householder in the Phoenix phone book, called to make an appointment, and interviewed him. He reported that the lizard had been taken somewhere deep in the range possibly near Weaver's Needle. That did it. Not only were the Superstitions and the Peralta Land Grant alleged to be the home of the Lost Dutchman's Mine, an assortment of gold-crazed murderous prospectors, and a

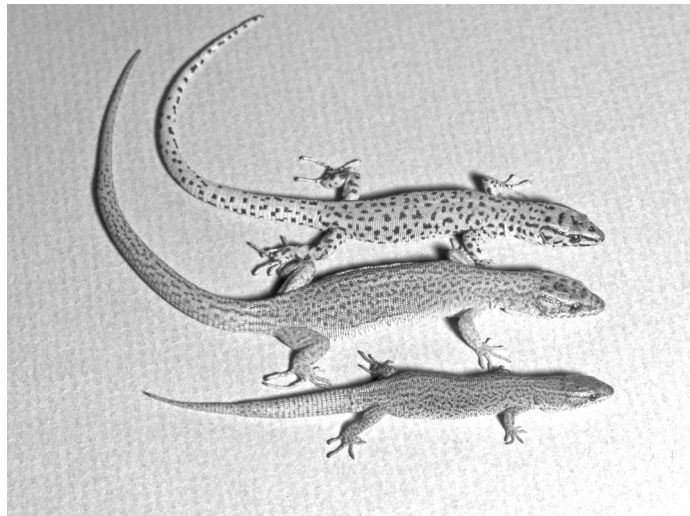


Fig. 2. Arizona Night Lizards (*Xantusia arizonae*) with a bold color pattern (upper) and with a fine color pattern (middle) similar to that of the Desert Night Lizard (*Xantusia vigilis*; lower). Note the relatively short and narrow head of *X. vigilis*.

phantom band of Apaches, but now the area harbored a lost *Xantusia*. I came down with a full-blown case of Peralta Fever, from which I have never fully recovered.

Finding *Xantusia* in the Superstitions became an obsession. When I arrived at the University of Arizona as an incoming freshman, I asked my mentor-to-be, Dr. Charles H. Lowe, if he knew where Night Lizards occurred in that range. To my shock, he admitted he did not know, but suggested I should look wherever *Rhus ovata* (Sugar Bush) is present. Some years later, with the help of Wade Sherbrooke, I finally located *Xantusia* in the range, although at the time I was worried that a sting received from a *Centruroides* (Bark

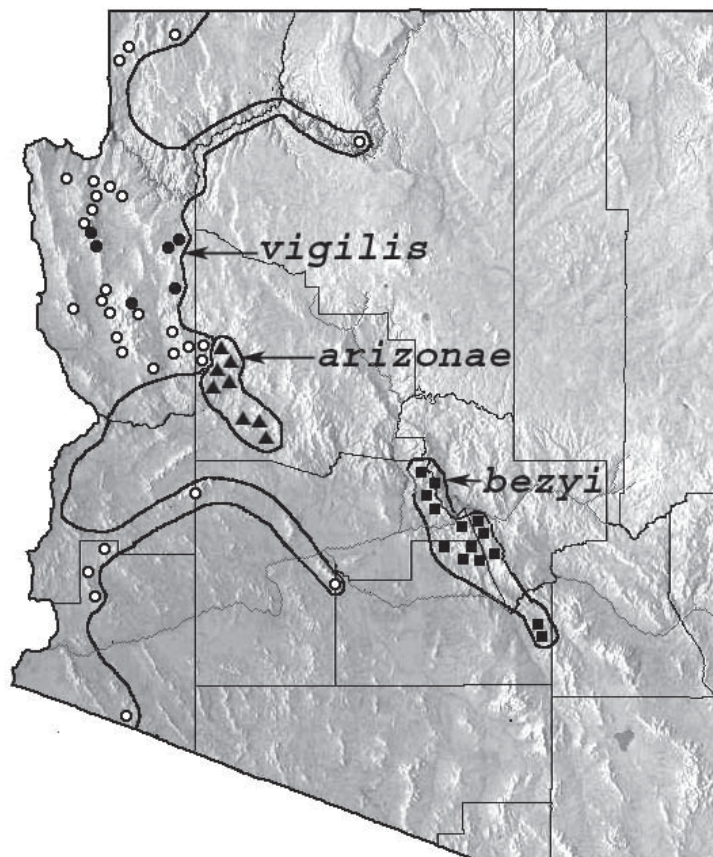


Fig. 3. Geographic distribution of the three species of Night Lizards (*Xantusia*) in Arizona. Solid symbols indicate populations found primarily in rock-crevices; hollow dots indicate those found primarily in decaying plants. Lines encompass known localities and do not imply continuous distribution.

Scorpion) might leave me the “Lost Herpetologist of the Superstitions”.

2. Oculotaedium

Studying Night Lizards from central Arizona I was struck by the extraordinary variation in color pattern (Figs. 1-2, 4-8). The size, number, and arrangement of dark dorsal spots differed wildly among individuals and mountain ranges. Some of the differences appeared to be related to body size, as larger individuals tended to be more boldly spotted than smaller ones. In ranges where the lizards seemed to attain a smaller maximum size they were less boldly spotted. Some *Xantusia arizonae* from rock-crevice habitats were virtually identical in color pattern to specimens of *X. vigilis* found in yuccas. This dizzying array of variation within and among mountain ranges led me to conclude that color pattern was not a reliable feature for distinguishing the two species.

I embarked on the tedious, eye-straining task of counting scales and measuring body proportions on these tiny lizards to determine if there were any discrete differences (i.e. features with non-overlapping ranges of variation) between the samples of *Xantusia* from rock-crevice habitats in Arizona and those from yuccas, agaves, and other plants. I examined the characters that Klauber had found useful in distinguishing *X. arizonae* from *X. vigilis* and added some of my own. The resulting data were remarkably parallel to the variation I had observed in color pattern. Lizards from some mountain ranges reached not only larger body sizes and had more boldly spotted color patterns, they also had higher scale counts and relatively longer limbs and heads compared to those from yuccas and agaves, consistent with the original observations of Klauber (1931). But lizards from some ranges were intermediate between *X. arizonae* and *X. vigilis* in all external features and the conclusion seemed inescapable that the two forms represented the ends of an ecological and morphological continuum and were not distinct species. I proposed (Bezy 1967) that there were two subspecies in Arizona: *X. v. vigilis* found in yuccas, agaves, and other decaying plants in western Arizona from the Kofa Mts. (Yuma Co.) north to the Hualapai Valley (Mohave Co.); and *X. v. arizonae* found primarily in rock-crevice habitats from the Superstition Mts. (Pinal Co.) northwest to the Cottonwood Mts. (Mohave Co.).

3. Molecular Degeneration

From its kaleidoscopic pattern of variation, I suspected that *Xantusia v. arizonae* might not represent even a legitimate subspecies, but rather a series of populations that had independently evolved, to varying degrees, specializations for the rock-crevice habitat. Perhaps it was an ecomorph, akin to dark populations of rodents and lizards found on various lava flows scattered across the Southwest (Norris and Lowe 1964).

To test this idea I needed to look at features of *Xantusia* that were independent of their physical adaptation to rock-crevice habitats.

My first step down the slippery slope of reductionism was to focus on chromosomes. During the mid 1960's, I learned techniques for preparing, documenting, and comparing karyotypes (photographs revealing the number, size, and shape of the chromosomes) from Jim Patton and Jay Cole who at the time were fellow graduate students at the University of Arizona. This was still the “space race” era and my research was supported by NASA. Night Lizards turned out not to be easy subjects due to their small size and low metabolic rate, but I succeeded in obtaining karyotypes of 10 species of the Xantusiidae (Bezy 1972). Among the various results was the first clue that there were deeper differences between the Arizona populations of *Xantusia*: *X. v. arizonae* from the Weaver Mts. differed in the centromere position on one pair of chromosomes from *X. v. vigilis* in the nearby Arrastra Mts. (Yavapai Co.) and in the Kofa Mts. (Yuma Co.), as well as from populations in the Sonoran and Mohave Deserts of California. But this difference was complicated by variation found elsewhere in the range of *X. vigilis*.

The next step was to compare gene products (enzymes) among various xantusiids. Working with Jack Sites at Brigham Young University, we found a large number of differences among three rock-crevice populations of *Xantusia* in Arizona: (1) the Mazatzal Mts. (Maricopa Co.); (2) the Weaver Mts.; and (3) the Cerbat Mts. (Mohave Co.). The lizards from rock-crevice habitats in the Cerbats were nearly identical in allozymes (but not in appearance) to the surrounding populations of *X. v. vigilis* found in yuccas in the Mohave Desert (Bezy and Sites 1987). It was the genetic evidence that some of the Arizona rock-crevice populations were actually *X. v. vigilis* rather than *X. v. arizonae* that provided the key piece to the puzzle.

Focusing down to the molecular level, Sinclair et al. (2004) compared nucleotide sequences for portions of two mitochondrial genes from 87 localities throughout the range of *Xantusia*. The analyses confirmed earlier data (Bezy and Sites 1987; Papenfuss et al. 2001) and clearly indicated that there are actually three species present in Arizona: two found predominately in rock-crevices (*X. arizonae*, *X. bezyi*) and one (*X. vigilis*) occurring in yuccas and other plants at some localities, but in rock-crevices at others. Thus I have come full circle in my appraisal of the species status of *Xantusia* in Arizona. But even systematists are bound by the methods of science and must reject hypotheses that are no longer supported by the data at hand (see Vitt 2003 for a similar discussion on species of Night Lizards in Arizona). The 3 species found in Arizona are summarized below.

4. *Xantusia arizonae* Klauber, 1931 Arizona Night Lizard

As re-defined by Sinclair et al. (2004), *Xantusia arizonae* is known only from Yavapai Co., Arizona, where it has been found from the Weaver Mts. to the McCloud Mts. and associated ranges (Fig. 3; Bezy 1967; Klauber, 1931, 1939). It extends from the Saguaro-Paloverde association of the Arizona Upland Sonoran Desertscrub at 760 m (2500 ft) elevation to Interior Chaparral at 5000 ft (Brown 1994). The species occurs primarily in rock-crevice habitat, but also has been found in *Neotoma* (Pack Rat) nests and in decaying *Yucca baccata* (Banana Yucca; Bezy 1967; Klauber 1931, 1938; Gloyd 1937 and pers. comm.; Wood 1944). This is a relatively large species, reaching a maximum snout-vent length of 60 mm (2.4 in). Most individuals are boldly spotted, and there is often a tendency for the dark spots to be linearly aligned. In many individuals there is a pair of dark spots on the posterior dorsal head scales (Fig. 1-2). However, some *Xantusia arizonae* have a finely spotted dorsum similar to that of *X. vigilis* from which they can be distinguished only by features of scalation, by having a relatively longer and broader head (Fig. 2, Bezy 1967), and by DNA (Sinclair et al. 2004). I have found *X. arizonae* within 20 km (12 mi) of *X. vigilis*. The DNA evidence strongly indicates that the nearest relative of *X. arizonae* is a species of *Xantusia* found in Sonora, rather than either *X. bezyi* or *X. vigilis* found nearby in Arizona (Sinclair et al. 2004).

Little is known of the biology of the species beyond habitat and distribution. The Arizona Night Lizard gives birth to one (3 females) or two (4 females) young around 1 September (Brattstrom 1951; Klauber 1931). The diet consists primarily of ants, with a few flies, beetles, bugs, and soft-bodied larvae (Brattstrom 1952; Klauber 1931).

5. *Xantusia bezyi* Papenfuss, Macey, and Schulte, 2001 Bezy's Night Lizard

The species ranges from the Mazatzal Mts. (Maricopa Co.) south to the Galiuros. (Pinal Co.; Fig. 3; Bezy 1967; Johnson et al. 2001; Klauber 1938; Papenfuss et al. 2001; Sinclair et al. 2004). It is found from the Saguaro-Paloverde Association of the Arizona Upland Sonoran Desertscrub at 730 m (2400 ft) elevation, through Semi-desert Grassland to Interior Chaparral at 1770 m (5800 ft). It occurs primarily in

rock-crevices, but also has been found in decaying *Dasyllirion wheeleri* (Sotol; Bezy 1967), under plant debris on the desert floor (Vitt 2003), and in buildings (Don Swann, pers. comm.).

The species is quite variable in maximum body size and in color pattern within and among localities. The largest (maximum snout-vent length, 60 mm, 2.4 in), most boldly spotted individuals (Figs. 4-5) occur in the northern part of the range with smaller, more finely spotted individuals (Fig. 6) predominating to the south. One distinctive feature of some populations is the presence of a narrow bar across the back of the head (i.e. immediately behind the postparietals), but this (like virtually all features of color pattern) varies among populations (Figs. 4-6). The northern-most population was discovered ca 1971 by Laurie Vitt and Justin



Fig. 4. Bezy's Night Lizard (*Xantusia bezyi*) with the color pattern most frequently seen in adults of the species.



Fig. 5. Bezy's Night Lizard (*Xantusia bezyi*). An adult with large spots.

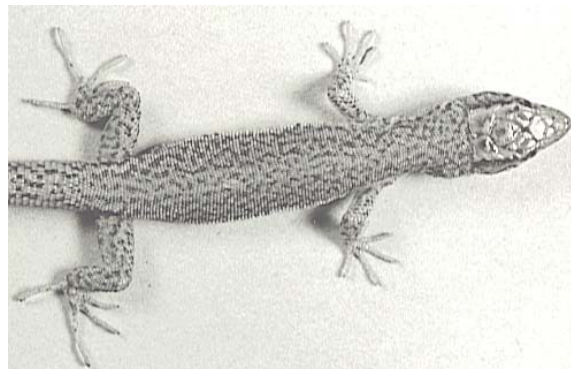


Fig. 6. Bezy's Night Lizard (*Xantusia bezyi*). An adult with small spots.

Fig. 7. Desert Night Lizard (*Xantusia vigilis*) with the color pattern most frequently seen in adults of the species in Arizona. Photo by Erik F. Enderson.



Congdon and they (and Don Tinkle) originally perceived that it represented an undescribed species (Vitt 2003), but were dissuaded from describing it due to the variation found in other parts of the geographic range (Bezy 1967). The allozyme (Sites and Bezy 1987) and DNA (Papenfuss et al. 2001; Sinclair et al. 2004;) data indicate that all Arizona populations east of the Verde River represent a distinct species lineage (*X. bezyi*), but it is quite variable in external features and its morphological diagnosis requires further study. Nothing has been published about the biology of the species.

6. *Xantusia vigilis* Baird, 1859 Desert Night Lizard

The species occurs at widely scattered localities in western Arizona (Fig. 3) from the Cabeza Prieta Mts. (Yuma Co.) north to the Virgin Mts. (Mohave Co.) and east to the Sierra Estrella (Maricopa and Pinal Cos.) and into the Grand Canyon (Coconino Co.; Bezy 1967, 1972; Jones et al. 1981, 1982; Klauber 1939, 1940; Lowe 1964; Sinclair et al. 2004; Tomko 1975). In Arizona, It lives primarily in Mohave and Arizona Upland Sonoran Desertscrub where it has been found in decaying plants of the following species: *Yucca brevifolia* (Joshua Tree), *Y. schidigera* (Mohave Yucca), *Y. baccata* (Banana Yucca), *Agave deserti* (Desert Agave), *A. utahensis* (Utah Agave), *Nolina biglovii* (Biglow nolina), *Carnegiea gigantea* (Saguaro), *Opuntia cf. engelmannii* (Engelmann Prickly Pear) and *Prosopis velutina* (Velvet Mesquite); it also occurs inside houses

(Brattstrom pers. comm.), in rock-crevices (Klauber 1940 as *X. arizonae*), and in *Neotoma* (Pack Rat) nests.

This is the smallest species of Night Lizard in Arizona, reaching a maximum snout-vent length of 45 mm (1.8 in) in most populations. Color pattern usually consists of small dark dots on a tan to gray background and a dark edged light stripe may be present on the sides of the neck (Figs. 2, 7). Some Arizona individuals are virtually patternless (Fig. 8).

Populations found in rock-crevice habitats in the eastern Hualapai, Cottonwood, and Cerbat Mts. (Fig. 3) were formerly considered to be *Xantusia (v.) arizonae* (Bezy 1967; Jones et al. 1981; Klauber 1940). They are intermediate in maximum size and in appearance between *X. arizonae* and *X. vigilis* and could be viewed as hybrids or intergrades (Bezy 1967). Evidence from allozymes (nuclear gene products; Sites and Bezy 1987) and mitochondrial DNA (Sinclair et al. 2004) clearly indicates that these populations are *X. vigilis* as they lack any genetic markers identified with *X. arizonae*. There is an extensive literature on the species largely based on populations in California (e.g. Zweifel and Lowe 1966; summaries in Bezy 1882, 1988), but little is known about the biology of the species in Arizona.

7. Conservation Status

None of the three species of Night Lizards found in Arizona is currently listed as Endangered or Threatened or as a Candidate under the Endangered Species Act. *Xantusia vigilis arizonae* is listed as a sensitive species by the U. S. Forest Service. A small portion of the range of *Xantusia bezyi* is protected by its

occurrence on Tonto National Monument. No species of Night Lizards were included in the March 1996 list of Wildlife of Special Concern in Arizona (Arizona Game and Fish Department Non-game Branch 2004), but AGFD regulation R12-4-303-C prohibits the use of manual or powered jacking or prying devices to take reptiles or amphibians, providing an important measure of protection for *Xantusia* in the state.

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Fig. 8. Desert Night Lizard (*Xantusia vigilis*). An Arizona individual virtually lacking color pattern. Photo by Erik F. Enderson.

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