Short Note

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Eastern fox squirrel (*Sciurus niger*, Linnaeus 1758) introduction to the Sonoran Desert

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Abstract: The eastern fox squirrel, native to the eastern and midwestern United States, was recently documented in the Sonoran Desert in the vicinity of Yuma, Arizona, constituting the first state record for this species. We surveyed the people of Yuma to determine when and how the squirrels arrived. The squirrels were first observed in the 1960s, but may have been resident for a longer period. Since the 1960s, squirrels have spread throughout the city limits and extended south ~15 km into Somerton, Arizona. How the squirrels arrived is not clear, but must be the result of an introduction, as no nearby populations exist. The persistence of eastern fox squirrels in this unique habitat is due to synanthropic relationships.

Keywords: Arizona; eastern fox squirrel; ecological distribution; introduced population.

The eastern fox squirrel (*Sciurus niger,* Linnaeus 1758), native to the eastern and central regions of the United States, was introduced into a number of cities in the western United States (Flyger and Gates 1982, Koprowski 1994) in the early part of the 20th century (Becker and Kimball 1947, King et al. 2010) where they have flourished. Despite this long occupancy, little information is known about these populations, including the full extent of their distribution in the western United States (Claytor et al. 2015). Our paper documents the first record of the eastern fox squirrel (*S. niger*) in the Sonoran Desert of Arizona, a >270 km range extension through inhospitable desert vegetation, and assesses the apparent current distribution.

On 8 April 2011 a road kill of a female fox squirrel (*Sciurus niger*) was collected in Yuma, Arizona and accessioned into the University of Arizona collection (UA27658), representing the first documented occurrence in Arizona. Yuma is a city of ~100,000 people located on the Colorado River at 43.1 m elevation. The surrounding areas consist of Sonoran Desert vegetation (Phillips and Comus 1999), containing few trees and experience extreme aridity and temperatures (mean annual high temperature=31.2°C and mean annual precipitation=85.3 mm; NOAA 2015). Using the online survey program Surveymonkey.com, we attempted to determine how and when eastern fox squirrels (*S. niger*) arrived in Yuma, as well as the current distribution. We solicited responses by publishing a story in the *Yuma Sun* newspaper in both hard copy and Internet format. In addition to questions that asked when and where squirrels were first seen, the survey contained color pictures of the eastern fox squirrel and native ground squirrels (rock squirrel, *Otospermophilus variegatus* Erxleben, 1777; round-tailed ground squirrel, *Xerospermophilus tereticaudus* Baird, 1858; and Harris' antelope squirrel, *Ammospermophilus harrisii* Audubon and Bachman, 1854) that could be seen in the area for comparison to ensure that the data collected were regarding the target species. We confirmed the existence of eastern fox squirrels (*S. niger*) at all reported locations in March–April 2015 and assessed distribution through vehicle survey by traversing all roads in Yuma at 45 km/h during morning hours when activity of squirrels is high (Flyger and Gates 1982).

We received 14 responses to the on-line survey and nine emails, providing a rough timeline as to when the squirrels were first seen in the area. All respondents were confident in their identification of the squirrels as eastern fox squirrels (*Sciurus niger*) when compared to other local squirrels. Eleven (48%) of the responses have the squirrels being in Yuma as early as 1980, with the earliest year of actual observation being 1960. Three other respondents

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(13%) also mentioned seeing fox squirrels as early as the 1960s (i.e. 1962, 1968, and "prior to 1962"). However, two respondents (9%) suggested much earlier introductions (1946 and 1920s) based on second-hand information, but we could not verify these dates. Fox squirrels (*S. niger*) also now occur in Somerton, a small community 15 km southwest of Yuma, and have been there as early as 1986 according to one respondent and verified by JLK. The earliest sightings (1960s) were in the Pecan Grove neighborhood, where a number of respondents state the squirrels were initially released. Given their tendency to travel distances over 500 m (Koprowski 1994, Shepherd and Swihart 1995) and disperse at a rate up to 3.4 km per year (King et al. 2010), we are not surprised that squirrels are now found throughout much of the Yuma metropolitan area (Figure 1). How the squirrels reached Yuma is still unclear. Most respondents assumed they had always been in Yuma or did not know how they arrived (78%), while four (17%) respondents heard that a resident of Yuma brought them here and released them, but we were unable to verify the individual's identity.

The population in Yuma is more than likely the result of an introduction because the nearest population is in Balboa Park, San Diego, California, over 273 km to the

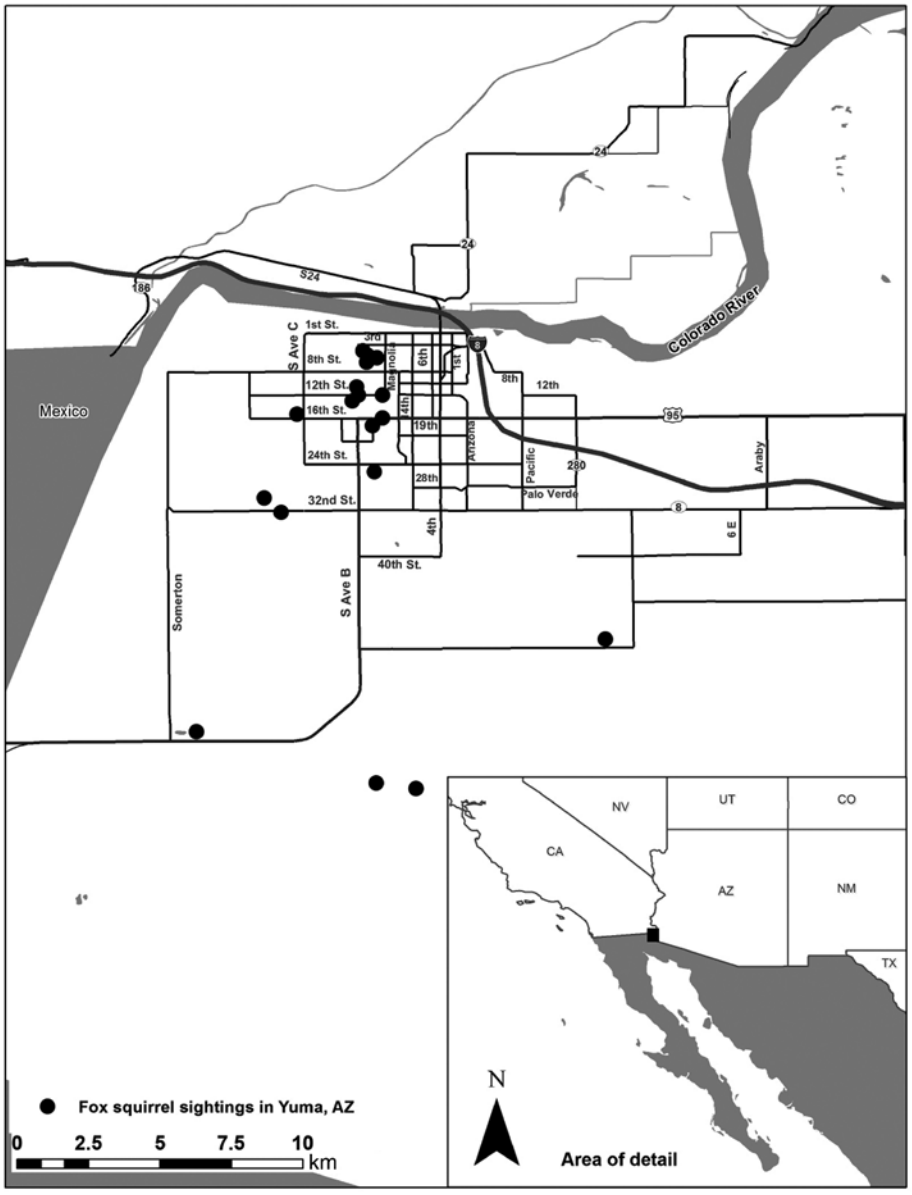

Figure 1: The current distribution of the eastern fox squirrel (*Sciurus niger*) in Yuma, Arizona as determined through first person sightings and an on-line survey through SurveyMonkey.com.

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west through Sonoran desert habitat (Koprowski, per obs.). At this time, Yuma and Somerton are the only cities in Arizona with a known population of the eastern fox squirrel (*Sciurus niger*). The eastern fox squirrel seems to have been a part of the Yuma landscape for quite some time, dating back to at least the 1960s and possibly earlier. Common in the urban ecosystem with no native tree squirrel competitors, and other resident squirrels being ground squirrels (Thorington et al. 2012), they have had little competition, allowing them to expand throughout the metropolitan area. Aided by the availability of mast producing trees [e.g. pecan, *Carya illinoinensis* (Wangenh.) K. Koch, etc.] the squirrels expanded their range over the years, extending to the southeastern corner of the city (Figure 1), and apparently dispersed or were introduced into Somerton. Such a pattern of expansion through urban areas and orchards is common (King et al. 2010, Frey et al. 2013). The ability to persist in the Sonoran Desert appears due to synanthropic relationships that provide trees and food sources. Although the fox squirrel is found throughout Yuma, data on the ecology and demographics of the population do not exist, hampering assessment of any ecological or economic impact of the species on mast-producing tree species or native wildlife.

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