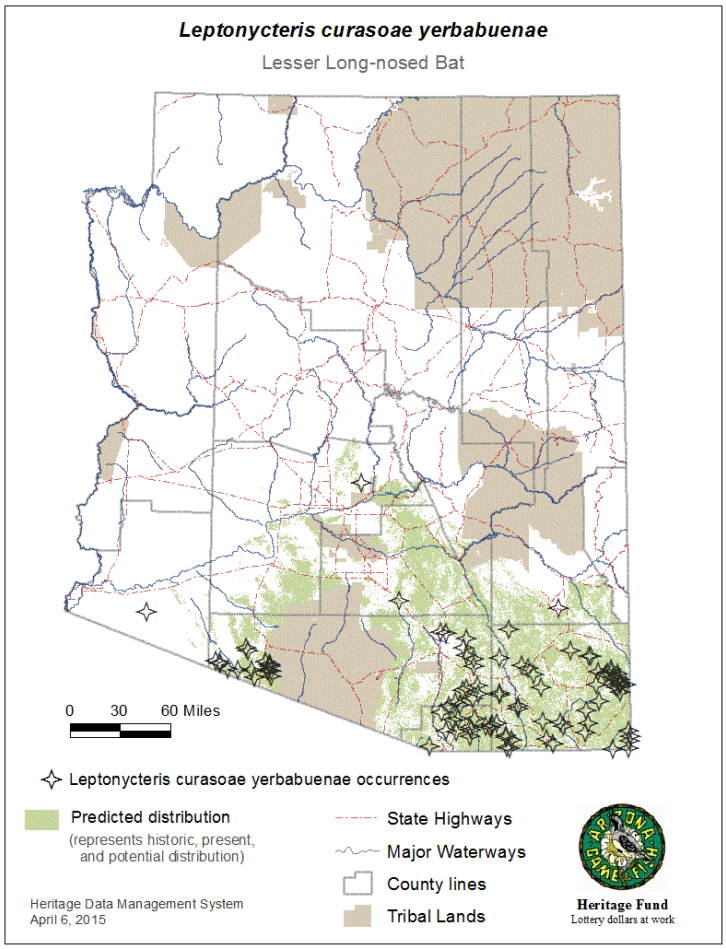
LESSER LONG-NOSED BAT SPECIES CONSERVATION GUIDELINES

INTRODUCTION

Lesser long-nosed bats (*Leptonycteris curasoae yerbabuenae*) occur in Southern Arizona from the Picacho Mountains southwesterly to the Agua Dulce Mountains and southeasterly to the Galiuro and Chiricahua mountains (Fig 1). There are also two late-summer records of immature individuals from the Phoenix area and one from the Pinaleno Mountains. The species is not present in Arizona during winter months. Associated Arizona vegetation includes Semidesert Grassland and shrubland, up to Oak Woodland with saguaro (*Carnegiea gigantea*), organ pipe cactus (*Stenocereus thurberi*), and agave (*Agave* sp.) being vital food sources (Hinman and Snow 2003). Management of suitable habitat varies, including lands owned or managed by U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), National Park Service (NPS), U.S. Forest Service (USFS), Department of Defense (DoD), several Tribes, the State of Arizona, and private entities (USFWS 2001).

Figure 1. Distribution of the lesser long-nosed bat in Arizona.



The lesser long-nosed bat was designated as endangered in 1988 by the USFWS throughout its range in the United States and Mexico, and is listed as a Priority vulnerable species in the Pima County Sonoran Desert Conservation Plan. A recovery plan was adopted by the USFWS in 1997; in 2002 the *Leptonycteris curasoae* Recovery Cooperative (LcRC) was formed with members from Arizona Game and Fish Department (AGFD), USFWS, Bat Conservation International (BCI), the Arizona Sonora Desert Museum, and independent bat researchers to encourage implementation of the 1997 recovery plan (Hinman and Snow 2003).

Population estimates conducted since the listing of this species suggest this species is more abundant than once thought and that the "Endangered" status may not be warranted but the definition of "Threatened" may be more appropriate for LLNB (USFWS 2007). This species' colonial roosting behavior, where a large number of bats congregate to raise young at relatively few roosts, increases the risk of significant declines or extirpation as a result of exclusion, disturbance, and destruction at roost sites (McIntire 2011). Biologists continue searching for new colonies, and monitoring known maternity colonies in both Arizona and Sonora.

The lesser long-nosed bat is considered an important pollinator of various agave species (principally *Agave palmeri*), columnar cacti and other Mexican plant species. Pollen collects on their heads and shoulders (sometimes making them look yellow) when they stick their head into a flower to get nectar. As they go from plant to plant, pollen is rubbed off on the pistils at each flower thus pollinating them. Although an important pollinator of saguaro and agave species, the dependence is not such that loss of LLNB would be likely to result in the loss of an ecosystem, as once thought.

GENERAL BIOLOGY

The lesser long-nosed bat is a medium-sized bat with a total length of 7.5-8.5 cm (2.95-3.35 in), a forearm of 5.1-5.6 cm (2.0-2.2 in), a wingspan of 36-40 cm (14-16 in), and a weight between 15-25g (0.53-0.88 oz). The short, dense fur is grey in young and reddish-brown in adults. It has an elongated snout with a nose-leaf, an erect triangular flap of skin at the tip of the snout. The tongue is long and tipped with brush-like papillae that help mop up nectar. Its nectar diet enables it to be essentially independent of water. Like most nectar feeders, the teeth are modified, having lost the cutting and crushing cusps of the insect feeding species of bats. These bats have large eyes and reduced ears compared to other bats in Arizona. It is distinguished from the other two Arizona Phyllostomids by the complete lack of a conspicuous external tail and the greatly reduced tail membrane. In roosting areas, they can be identified by the distinctive sound made by their wings as they fly (Hinman and Snow 2003).

These bats do not hibernate and they cannot withstand prolonged exposure to cold. They migrate in September/October to Mexico and further south, where they breed and spend the winter. They return to Arizona in the spring to bear young. Neither maximum nor mean lifespan is known; however, one banded individual when recaptured was a minimum of 4 years old (Hinman and Snow 2003).

Reproduction

Females arrive in Arizona pregnant and as early as the second week in April. They join other females in maternity colonies late in pregnancy, sometime in April or early May. Maternity colonies may number in the hundreds to thousands, and in a few places, in the tens of thousands. Females give birth to one young per year, born during May, and feed the pup for four to eight weeks. Young can fly by the end of June after forearm length reaches 46mm. Maternity colonies break up by the end of July (Hinman and Snow 2003).

Parturition is not highly synchronous in maternity roosts and females in different stages of pregnancy and young ranging in age from newborns to nearly volant (capable of flying) juveniles may be found at the same time in maternity roosts. This suggests that females conceive at slightly different times, possibly in different roosts, before occupying maternity roosts in Arizona (USFWS 1995).

Movement

There appear to be both sexual and seasonal differences in the lesser long-nosed bat's Arizona range. During the early part of their stay (late April to late July) pregnant females congregate at traditional roost sites, give birth, and raise their young at lower elevations within the range of columnar cacti. Males and perhaps nonpregnant females do not arrive until sometime in July. By late July, most females and young have dispersed from the maternity colonies and some have moved to higher elevations where they are found feeding on agave flowers. By late September or October all of these bats are migrating south to Mexico, exactly where is not known. At the local scale, individuals can travel great distances. In Mexico, these bats fly up to 30km each night from their roosts on Isla Tiburon in the Sea of Cortez to their feeding grounds in mainland Sonora (Hinman and Snow 2003).

For additional information on the biology of this species, refer to the AGFD unpublished species abstract, produced by the Heritage Date Management System http://www.azgfd.gov/w_c/edits/documents/Leptcuye.fi_001.pdf.

HABITAT REQUIREMENTS

Lesser long-nosed bats are found in desert grassland and shrubland up to oak transition at elevations below about 3,500 feet (1,068 m) from April to at least July. Range expands to include areas up to about 5,500 feet (1,678 m) from about July to late September or October. They roost in caves, mine tunnels, and occasionally in old buildings. Spatters of thin yellow material on the floor or walls of a cave or mine likely indicate the recent presence of this bat or the Mexican long-tongued bat (*Choeronycteris mexicana*) (the

other of the two nectar/pollen-eating bats in Arizona). The yellow material is guano colored yellow by pollen, which the bats have ingested from plants visited for nectar. They forage in areas of saguaro, ocotillo, paloverde, prickly pear and organ pipe cactus and later in the summer among agaves (Hinman and Snow 2003).

Two sets of resources, suitable day roosts and adequate concentrations of food plants are critical for the lesser long-nosed bat. Food requirements of the lesser long-nosed bat are very specific. Adequate numbers of flowers and/or fruit are required within foraging range of day roosts and along migration routes to support healthy populations of this bat. Locations of good feeding sites, therefore, play an important role in determining suitability of potential roosting sites, and roost/food requirements must be considered jointly when evaluating the habitat requirements of this bat. A suitable day roost is probably the most important habitat requirement, but potential roosts must be within reasonable proximity of required food plants before they will be used by this species. Disturbance at occupied roost sites and destruction of roosts during the seasons when bats are not present are significant threats to the species. Fragmentation of foraging habitat or land use changes that eliminate or reduce forage plant populations, between roosts and foraging areas are also significant and may have adverse effects on the use of roosts in the vicinity. Protection of all known roost sites and food plants within a radius of 50 miles (81 km) around known roosts are important in the management of this species. Protection of food resources along migratory pathways may also be important to the survival of the species (USFWS 1995, 2014).

Roost Component

Roosts must provide shelter from the elements, a microclimate suited to the needs of bats, and protection from predators and often include caves or abandoned mines. Specific factors that identify potential roost sites as being "suitable" have not yet been identified, but maternity roosts tend to be very warm and poorly ventilated, at least where the young are actually raised. Such roosts reduce the energetic requirements of adult females while they are raising their young. At night, young bats remain on the ceiling of the maternity colony while their mothers fly in search for suitable forage. Females are believed to return to the same maternity roost year after year. Adult males roost in smaller separate colonies or with adult females and young at maternity sites. Proximity to humans does not necessarily pose a threat, however it does increase the risk of disturbance (USFWS 1995). The bats leave daytime roosts to feed about an hour after sunset. After filling their stomachs, sometimes to the point of appearing pregnant, they go to night roosts, which may be different from day roosts, to rest and groom. Night roosts have been observed in a range of sources, including vaulted roofs, trees and barns (Lowery 2009).

The lesser long-nosed bat has been found living in caves and mines consisting of a variety of microclimates (e.g. dry and hot, wet and hot, dry and cool, and wet and cool), ranging from well-ventilated to poorly ventilated caves. In Arizona, it tends to be the single occupant of caves or mines, although occasionally roosts with other bat species. Because abandoned mines are important roost sites, it is necessary to survey mines for this bat and for other wildlife before they are permanently closed. Even partial closure of mine and cave openings may have a detrimental effect to the bats (USFWS 1995, 2007).

The lesser long-nosed bat appears to be so sensitive to human disturbance that even a single brief visit is sufficient to cause these bats to temporarily abandon their roost and move to another. Land management agencies should develop management plans for roosts within their jurisdictions—in coordination with AGFD expertise and knowledge—that provide restriction or closures to human access during all times when bats are present and keep roost visits to the minimum needed for monitoring. If it is found to be necessary, protection of roosts with gates and other physical barriers should be considered; however, research has indicated they may not be suitable for this particular species and further research is needed (USFWS 1995, 2007). Alternative closure methods, such as signs, perimeter fencing, and motion or light detectors may be used at sites where gating is impractical or undesirable. However, in some cases, signs, fencing, and other such efforts may attract more attention to roost sites. Variation in accessibility, vulnerability, and topology between sites thus requires individual evaluation for protection methods (Hinman and Snow 2003).

Food/Foraging Component

In Arizona, lesser long-nosed bats feed on nectar and pollen from flowers of saguaro and organ pipe cactus in early summer and agave later in the summer and early fall, also feeding on ripe cactus fruits at the end of the flowering season. The flowers and fruits of saguaro and organ pipe cactus provide nearly all of the energy and nutrients obtained by pregnant and lactating females roosting in the Sonoran desert in the spring and early summer. They may also take a few insects incidentally when taking nectar. During the winter period in Mexico, primary food plants, as identified by their pollen, appear to be *Ceiba*, *Bombax*, and *Ipomoea*. Their spring migration from central Mexico northward is thought to follow the sequential blooming of certain flowers from south to north (AGFD 2011, USFWS 1995). These bats can travel 30 miles to forage, although probably most go no more than 15-20 miles. Observations by Howell (1979) indicate they spend about 6 hours a night foraging, alternating between spending time flying and feeding with roosting on plants or rocks and grooming.

Large expanses of suitable foraging habitats must be maintained within proximity to roosts to allow for efficient foraging. Grazing and fire are believed to have negative effects on suitable foraging habitat, such as excessive browsing on newly emergent flower stalks of agaves as well as the trampling of young agaves by livestock. Analyses of data collected from 1995-2003 at the Coronado National Memorial on both grazed and ungrazed plots of agaves (Agave palmeri) showed that compared to grazed plots, ungrazed plots have more agaves in 5 different size classes as well as more agaves that are flowering (Mann 2005). The effects of grazing on forage availability are a more significant issue if environmental conditions (fire, drought, etc.) reduce forage availability. In a larger context, the issues of the effects of fire and grazing still lack adequate data and need additional research (USFWS 2007).

Lesser long-nosed bats are also known to feed on sugar water from hummingbird feeders at night, in Ramsey Canyon in the Huachuca Mountains, in Portal in the Chiricahua Mountains, and in Madera Canyon in the Santa Rita Mountains, as well as in the Tucson

metropolitan area. Some bats have also been observed foraging on night blooming *Cereus* species in backyards with hummingbird feeders. Implications of these artificial food resources on physiology and timing of migration (i.e., possibly delaying departure when natural resources are depleted) as well as their nutritional quality and reliability is unknown and should be investigated (Lowery et al. 2009, 2012).

Lesser long-nosed bats exhibit group foraging behavior (multiple bats foraging together in the same area) which decreases overall energy costs of feeding by minimizing the time spent searching for food. Group memory reduces the potential for visiting flowers that have been emptied on previous nights, and increases the potential of visiting flowers having a large amount of nectar from more than one night of accumulation. These bats will return to foraging areas on consecutive nights and changes in core use areas may be the result of the conclusion of nectar production in the original area. Ober et al. (2000) calculated that a population of 100,000 bats would need an average density of 0.16 flowering plants/ha over a 3,771 km2 foraging area surrounding a roost. However, density over a broad area is probably less of a determinant than arrangement of food plant populations and density of flowering plants within those populations (USFWS 2007; Ober et al. 2000).

Corridor Component

Migration occurs along "nectar corridors" consisting of a series of stepping stones, or patches of flowering plants, that provide nectar for refueling during migration along 2000-6000 km routes (Krebbs et al. 2004). It is suggested that there are two migration routes used by lesser long-nosed bats as they move northward from Mexico: a Pacific coastal route and a Sierra Madrean inland route. Furthermore, lesser long-nosed bats in southwestern Arizona show genetic affinities with bats from Pacific coastal sites while those roosting in southeastern Arizona show genetic affinities with Mexican bats from inland sites. This suggests that these bats move north and south along two distinct paths, one to southwestern Arizona, and another to southeastern Arizona and southwestern New Mexico (Wilkinson and Fleming 1995, 1996).

For a map of the migration routes, visit:
https://www.desertmuseum.org/pollination/images/bat_routes.gif

A study conducted on the urban movement patterns of lesser long-nosed bats in Pima County (Lowery et al. 2009) found that these bats utilized large washes as flight corridors, however they were selecting against areas greater than 2 km from large washes during commutes between day roosts and foraging areas. Lesser long-nosed bats tend to prefer to move through natural open space along wash corridors and within low-density development (typically 1 house/acre or less dense) rather than through or over higher-density urban development. This experience points out the importance of maintaining natural habitat corridors within developed areas to facilitate the movement of the bats between roost sites and foraging areas, as well as between foraging areas. Lowery et al. concluded that future development plans should avoid a distance of 1 km from large washes (10,000 cfs) when possible. Further analysis showed that these bats directly selected areas managed for lower light intensity and avoided areas of greater light

intensity, thus Lowery et al. also suggest that light pollution should be limited along identified flight corridors.

MONITORING

Habitat

A productive method of locating new seasonal day roosts is to first identify foraging areas and associated night roosts. Once these activity areas are known, lesser long-nosed bats can be captured using standard mist nets within these habitats, outfitted with radio transmitters, and tracked back to day roosts that have not been documented (Lowery et al. 2012). Day roosts are monitored simultaneously each year; maternity sites are monitored in June and late summer sites in August.

Populations

For a colonial species such as the lesser long-nosed bat, a more appropriate unit of measurement may be the number of colonies (roost sites) rather than total population numbers (USFWS 2007). Roost-monitoring experience indicates that developing a definitive population estimate for this species is difficult (USFWS 2007). Because dates of presence and roost occupation can vary with season, with elevation and habitat, and with locale, surveying for this bat must be carefully planned. Population trend and presence surveys should coincide with known dates of occupation for particular roosts or localities. Surveys at important roosts in both Arizona and Mexico should be conducted simultaneously. Although times of occupation or presence are known for some sites, they may be only partially known or remain to be determined for others (McIntire 2011).

Roost monitoring accuracy has been improved through the use of infrared video monitoring. Video tapes can be reviewed in the lab, under slow motion, to obtain a more accurate count and improved species identification. Though infrared videography has improved the accuracy of roost exit counts, the additional time and cost associated with the technology makes the efficiency of this technique questionable (USFWS 2007).

Foraging at hummingbird feeders has allowed the AGFD and the USFWS to identify use areas for this species and document relative density. AGFD also coordinates annual lesser long-nosed bat colony counts in Arizona. However, the magnitude and distribution of the lesser long-nosed bats observed as they visit feeders suggest census counts do not accurately represent the overall population size or all of the roost sites used during seasonal movements (Lowery et al. 2012).

KEY THREATS

- The colonial roosting behavior of this species increases the risk of declines from roost-site disturbance or loss. Roost disturbance activities include:
    - Illegal border crossing activities resulting in the occupancy and destructions of roost sites by human individuals and the increase of border patrol infrastructure to combat illegal border crossing.

- Recreational users interested in exploring caves and mines.
- Closure of mines or caves deemed a public safety threat.
- Vandalism.
- Roost deterioration over time.

- Grazing and fire are believed to have negative effects on suitable foraging habitat, such as excessive browsing on newly emergent flower stalks of agaves as well as the trampling of young agaves by livestock.
- The spread of non-native invasive species has an effect on the fire regime and can increase the fuel and intensity of fire and decrease the availability of native LLNB forage habitat.
- Loss and fragmentation of food habitats or obstructions such as land use changes between foraging areas and roost sites.

STANDARD MITIGATION MEASURES

1. **Roosts – Monitor and protect known and potential roosts within suitable lesser long-nosed bat habitat (see "Roost Component" of habitat descriptions above).**

    a. Roosts should be protected from even minimal human disturbance.

        i. Land management agencies should develop management plans for roosts within their jurisdictions—in coordination with AGFD expertise and knowledge—that provide restriction or closures to human access during all times when bats are present and keep roost visits to the minimum needed for monitoring.

    b. Identify and survey mine, cave, bridge and abandoned building sites during project planning and prior to project implementation by a qualified biologist for evidence of bat use either seasonally or year-round. Lesser long-nosed bats are typically present in Arizona from April to October.

    c. If necessary, protection of roosts with gates and other physical barriers should be considered. Alternative closure methods, such as signs, perimeter fencing, and motion or light detectors may be used at sites where gating is impractical or undesirable.

    d. Because abandoned mines are important roost sites, evaluate the status of mines as roosts for this bat and shelters for other wildlife before they are permanently closed. Even closing some but not all exits from mines and caves may have a detrimental effect to the bats.

2. **Corridors (migratory and foraging) – Manage known and potential migratory corridors (see "Corridor Component" of habitat descriptions above).**

    a. Maintain a buffer distance of 1 km from large washes (10,000 cfs) where possible.

    b. Limit light pollution along identified flight corridors between day roosts and foraging areas.

c. Plant native species including agave, replace agave, reduce/remove invasive species.

3. Forage areas – Maintain expanses of suitable foraging habitat within 50 miles of known and potential roost and/or within 1-2km of large washes (utilized as flight corridors) to allow for efficient foraging (see "Food/Foraging Component" of habitat descriptions above).

a. Maintain a density of 0.16 flowering plants/ha over a 3,771 km² foraging area surrounding a roost.

b. Minimize foraging habitat fragmentation, land use changes that eliminate or reduce forage plant populations, or the placement of barriers such as expansive, high intensity development and light pollution between roosts and foraging areas.

c. Plant native species including agave, replace agave, reduce/remove invasive species.

LITERATURE CITED

Arizona Game and Fish Department. 2011. Leptonycteris curasoae yerbabuenae. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 8 pp.

Carpenter, R.E. 1969. Structure and function of the kidney and the water balance of desert bats. Physiol. Zoo. 42:288-302.

Hinman, K.E. and T.K. Snow, eds. 2003. Arizona Bat Conservation Strategic Plan. Nongame and Endangered Wildlife Program Technical Report 213. Arizona Game and Fish Department, Phoenix, Arizona.

Howell, D.J. 1979. Flock foraging in nectar-feeding bats: advantages to the bats and the host plants. The Amer. Nat. 114(1):23-49.

Krebbs, K., Tibbitts T., and Pate A. 2005. Understanding the Fall Migration of the Endangered Lesser Long-Nosed Bat (*Leptonycteris curasoae*): An Extension of the Arizona-Sonora Desert Museum's Migratory Pollinator Project (2-year project). First Year Final Report for 2004. Prepared for The National Park Service and The Arizona Game and Fish Department. 43 pp.

Lowery S.F., S.T. Blackman, and D. Abbate, eds. 2009. Urban Movement patterns of Lesser Long-nosed bats (*Leptoncyteris curasoae*): Management Implications for the Habitat Conservation Plan within the City of Tucson and the Town of Marana. Research Branch, Arizona Game and Fish Department, Phoenix Arizona.

Lowery, S.F., J. Diamond and S. T. Blackman. 2011. Lesser Long-nosed Bat (*Leptonycteris curasoae*) Roost Site Identification: A Showing Success Grant

Project: 2010-2011. Arizona Game and Fish Department, Wildlife Contracts Branch. Phoenix, Arizona.

Mann, S. 2005. Comments submitted 3/18/2005 and 10/14/2005, in response to Federal Register Notice of Review (70 FR 5460) for the lesser long-nosed bat (Leptonycteris curasoae yerbabuenae).

McIntire, A. 2011. Wildlife Field Notes: *Leptonycteris* yerbabuenae: Lesser Long-nosed Bat. Arizona Wildlife Views. March-April 2011. pp. 36

Ober, H.K., R.J. Steidl, and V.M. Dalton. 2000. Foraging ecology of lesser long-nosed bats. Final Report to University of Arizona, School of Renewable Natural Resources, Tucson, AZ. 25 pp.

U.S. Fish and Wildlife Service. 1995. Lesser long-nosed bat recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

U.S. Fish and Wildlife Service. 2001. Lesser (=Sanborn's) Long-Nosed Bat (*Leptonycteris curasoae yerbabuenae*). Arizona Ecological Services. Web abstract. Accessed 06-10-2014, http://www.fws.gov/southwest/es/arizona/Lesser.htm

U.S. Fish and Wildlife Service. 2007. 5-Year Review: Summary and Evaluation: Lesser Long-nosed Bat / Leptonycteris curasoae yerbabuenae. 43pp.

U.S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; 90-day Finding on a Petition To Delist or Reclassify From Endangered to Threatened Five Southwest Species. Federal Register 78(174): 55046-55051.

U.S. Fish and Wildlife Service. 2014. Species Profile: Lesser long-nosed bat (Leptonycteris curasoae yerbabuenae). Environmental Conservation Online System. Web abstract. Accessed 06-11-2014, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A0AD

Wilkinson, G.S. and T.H. Fleming. 1995. Migration of lesser long-nosed bats, Leptonycteris curasoae, inferred from mitochondrial DNA. Final Report for Arizona Game and Fish Department Agreement No. G20088-B. Arizona Game and Fish Department, Phoenix, Arizona. 35 pp.

Wilkinson, G.S. and T.H. Fleming. 1996. Migration and evolution of lesser long-nosed bats Leptonycteris curasoae, inferred from mitochondrial DNA. Molecular Ecology 5(3): 329 – 339.

Wilson, D.E. and S. Ruff (eds.). 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington, in association with the American Society of Mammalogists, pp 76-78.