



BULLETIN

BATS OF THE BAHAMAS: NATURAL HISTORY AND CONSERVATION

**Kelly A. Speer, J. Angel Soto-Centeno, Nancy A. Albury,
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BATS OF THE BAHAMAS: NATURAL HISTORY AND CONSERVATION

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ABSTRACT

The Bahamas are well known for their karst landscape, with vast cave systems and inundated caves called blue holes that formed during the Pleistocene. Despite this, the biota of these islands has not been well documented when compared to other West Indian islands. It is important that Bahamians have the knowledge and tools to preserve the flora and fauna of their islands in the face of increasing development. This review provides an accessible resource for Bahamians and researchers by consolidating the available knowledge on bat biology from literature and natural history collections. Bats represent the most diverse group of mammals in The Bahamas and no study has thoroughly characterized their biology on these islands. There are currently 10 species of bat in The Bahamas, one of which is endemic and considered “near threatened” by the IUCN. While 9 of the 10 are considered species of “least concern,” bats in The Bahamas may be at higher risk of local extinction than in other parts of their ranges. As previous local conservation efforts have shown, it is imperative to gain support for bat research and conservation through outreach and education. We hope this review enables outreach efforts and research projects key to the conservation of bat populations in The Bahamas.

Key words: Chiroptera, Bahamas, species accounts, natural history collections, outreach.

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INTRODUCTION

Conservation of roosting and foraging habitat is crucial to the maintenance of bat biodiversity. This is of special importance on islands, where bats are often the most abundant native terrestrial mammals (Gannon et al., 2005; Fleming and Racey, 2010). Excluding livestock, there are 15 species of native and introduced terrestrial mammals in The Bahamas, 10 of which are bats (Table 1; Buden, 1986). As these islands become increasingly developed, human disturbance of bat roosting and foraging habitat poses a threat to terrestrial mammal diversity. However, it can be difficult to gain public support for conservation of bats because they are culturally associated with fear, danger, ugliness, and disease (Hutson et al., 2001; Knight, 2008; Kunz et al., 2011). Based on limited records, there have been no documented transmissions of rabies from wildlife to humans in The Bahamas (Belotto et al., 2005). More information is needed on the role bats play in disease maintenance and transmission, but negative perception of bats in The Bahamas may be caused by a lack of knowledge and misrepresentations of bats in folklore and media, rather than fear associated with disease potential (Hutson et al., 2001). The lack of information about the natural history of bats poses the greatest threat to their conservation (Hutson et al., 2001).

BATS SUPPORT HEALTHY ECOSYSTEMS

Bats are economically beneficial to humans and make important contributions toward maintaining healthy ecosystems (Hutson et al., 2001; Kunz et al., 2011). Insectivorous bats naturally control insect populations, often consuming over 25% of their body weight in insects in a single night (Kunz et al., 2011). In southwest Texas (United States), the presence of bats increased the amount of harvestable cotton and decreased the number of pesticide sprays for an estimated monetary benefit of \$688,000 per year (McCracken et al., 2012). Six of the 10 bat species in The Bahamas consume members of the insect Order Diptera, which includes mosquitoes. Although the amount and type of insects that Bahamian bats consume is

largely unknown, they likely play an important role in controlling insect populations on these islands.

Frugivorous (fruit-eating) and nectarivorous (nectar-eating) bats provide a direct benefit to ecosystems through seed dispersal and pollination (Kunz et al., 2011). Commercially important bat-pollinated plants (e.g., agave, bananas, mangos, etc.) are artificially pollinated, but bats help maintain genetic diversity in wild populations of these plants through pollination (Kunz et al., 2011). Frugivorous bats are able to transport seeds great distances and are more likely to disperse them in open, disturbed areas, which have favorable conditions for early successional plants responsible for regrowth in disturbed areas (Muscarella and Fleming, 2007; Kunz et al., 2011). Through insect population control, seed dispersal, and pollination, bats provide economic benefits for humans and are instrumental in maintaining healthy ecosystems, making preservation of bat populations an important conservation issue.

EFFECTS OF CLIMATE AND HUMAN COLONIZATION

Bats represent a significant proportion of the extant mammal fauna in The Bahamas, but little effort has been made to protect their populations. Compared to other West Indian islands (e.g., Cuba, Hispaniola, Jamaica, and Puerto Rico), vertebrate species diversity is low in The Bahamas. This is partly due to island area and the unique geologic and climatic history of these islands (Hedges, 1996; Dávalos and Russell, 2012). All exposed land in The Bahamas was deposited relatively recently, less than 500,000 years ago, and underwent significant changes in response to past sea level changes (Carew and Mylroie, 1995; Mylroie, 2008). As The Bahamas have maintained their geographic position at least through the Quaternary, colonization of The Bahamas by terrestrial animals likely occurred by over-water dispersal, with non-volant animals aided by floating vegetation, flotsam, or by human introduction.

Sea level changes during glacial-interglacial cycles of the Pleistocene (ca. 2.5 Ma–11 ka) affected the occurrence and distribution of animals in The Bahamas, and other islands of the West Indies, by

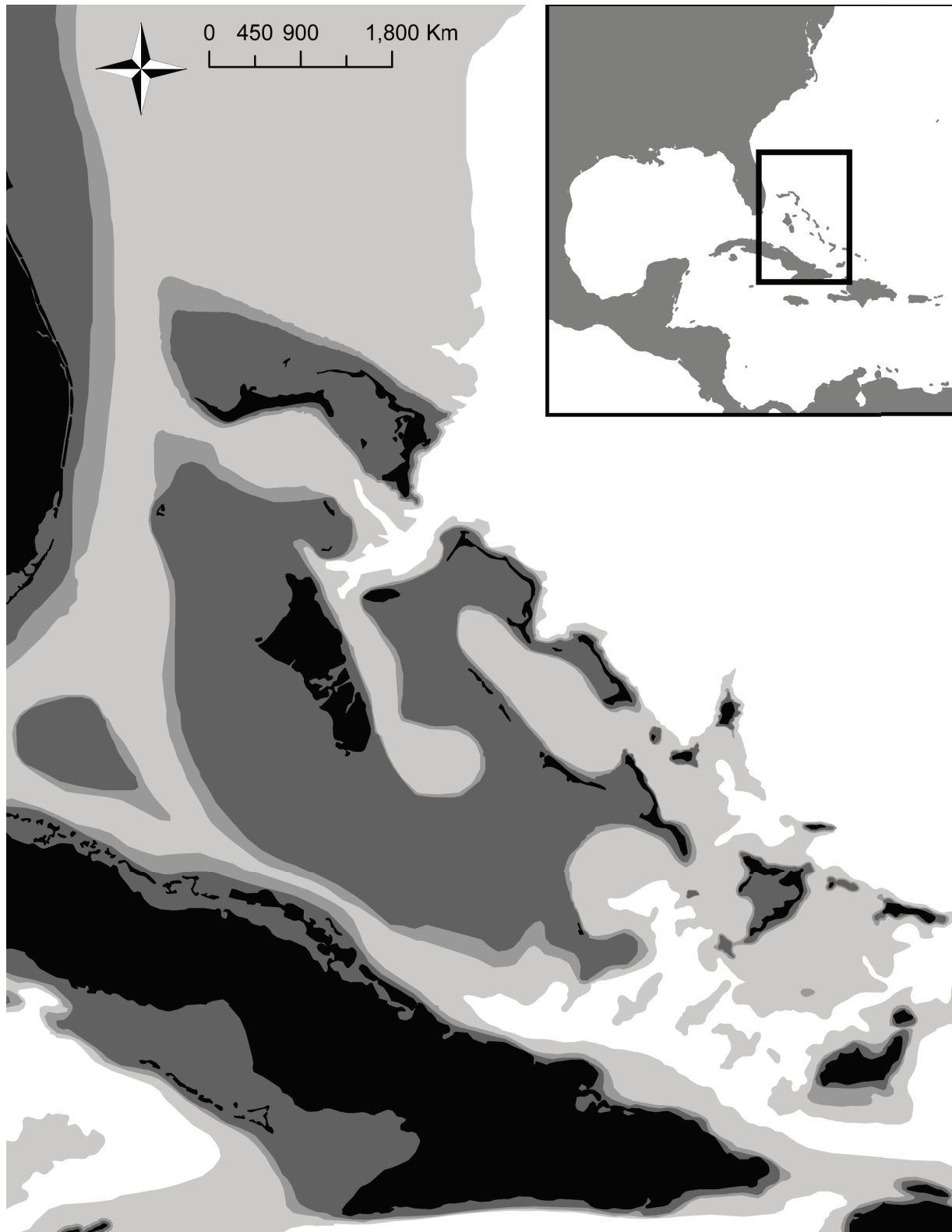


Figure 1. Map of The Bahamas indicating bathymetry. Black areas represent land, dark gray represents ocean < 200 m in depth, medium gray represents 201–500 m in depth, light gray represents 501–2500 m in depth and white represents depths > 2500 m. In the case of The Bahamas, most of the dark gray area is < 30 m in depth and is only slightly larger in area than the land area that would have been exposed during Pleistocene glacial periods

altering island size and distance between landmasses (Pregill and Olson, 1981). These ancient, global climate fluctuations caused periods of extreme cooling (glacials) followed by periods of warming (interglacials). During periods of glaciation, ice sheets would form in temperate latitudes and freeze seawater to such an extent that global sea levels decreased. During interglacials, ice sheets would melt, releasing water and causing global increases in sea level. The Bahamas are low-lying islands on top of shallowly submerged platforms and even small changes in sea level influenced the amount of available habitat and the distance to other landmasses (Pregill and Olson, 1981). During the last interglacial (130–117 ka), sea level was between 6–10 m higher than it is today (Hearty and Kaufman, 2000). The amount of exposed land in The Bahamas would have been less than half of its current area (Morgan, 1989). Inundation of large portions of land caused loss of habitat and an increase in the distance between landmasses, potentially leading to isolated populations and local extinctions (Dávalos and Russell, 2012). During the last glacial period (80–10 ka) sea levels remained at least 15 m below present until glaciers began to melt, approximately 17 ka (Richards et al., 1994). At the lowest estimated sea levels during this period (120 m below present), the islands of the Great Bahama Bank (Andros; Bimini; the Berry Islands; Cat Island; Eleuthera; the Exuma Islands, collectively known as the Exumas; Long Island; New Providence; and Ragged Island) and those of the Little Bahama Bank (the Abaco Islands, collectively referred to as the Abacos, and Grand Bahama Island) would have formed two large islands, the extent of which follows the contour of the carbonate platforms that create the shallow sea surrounding the Bahamas (Fig. 1; Morgan, 1989). Decreases in water depth and increases in island size may have facilitated colonization and dispersal by animals.

Dramatic habitat change following colonization by humans may have also caused local animal extinctions. Prevalence of arid-adapted species in the fossil record suggests that The Bahamas were much drier during the Pleistocene

(Pregill and Olson, 1981). Human colonization of The Bahamas after 1.1 ka may have also changed habitat composition (Kjellmark, 1996). Evidence from a sediment core in Andros indicates that human-induced fires associated with agriculture may have caused recent, rapid changes in plant communities (Kjellmark, 1996), which resulted in habitat loss for terrestrial animals. Some evidence suggests that Pleistocene climatic fluctuations and more recent habitat changes may not have had as great an impact on animal extinctions, which instead seem to correspond better to human colonization events (Steadman et al., 2014; Soto-Centeno and Steadman, 2015). Fossils from Abaco indicate that 41% of terrestrial animals became locally extinct following human colonization (Steadman et al., 2014). Bats did not experience the level of local extinctions seen in other terrestrial mammals, but underwent the greatest loss in diversity in The Bahamas compared to other West Indian islands (Morgan, 2001).

AIMS

Conservation of bats in The Bahamas is dependent on increasing our knowledge of island populations and changing negative public perception of bats to viewing bats as important providers of ecosystem services. This review of literature and historical collections is meant to provide information to the people of The Bahamas allowing a better understanding of bat species that inhabit their islands. We reviewed studies conducted on island bats from the literature and collected data from natural history collections. We note that very few studies have been conducted in The Bahamas and the most recent review of Bahamian bats was almost 30 years ago (Buden, 1986). To enable future research on ecology and natural history of bats in The Bahamas, we have updated the locality data where bats have been vouchered and preserved in natural history collections. By providing foundational information on the presence and distribution of bat populations, we can enable effective conservation efforts directly involving the public and encourage future research focusing on the natural history of Bahamian bat populations.

MATERIALS AND METHODS

SPECIES ACCOUNTS

Buden (1986) counts 15 species of bat in The Bahamas, excluding *Brachyphylla nana*, which is found in the Turks and Caicos. However, two of these (*Pteronotus parnellii* and *Mormoops blainvillei*) are only known from fossils. An additional three species (*Lonchorhina aurita*, *Glossophaga soricina*, and *Lasionycteris noctivagans*) are documented from single specimens, which are likely vagrants that do not represent resident populations in The Bahamas. After excluding these, we are left with 10 species of bats in The Bahamas (Table 1; *Tadarida brasiliensis*, *Chilonatalus tumidifrons*, *Nyctiellus lepidus*, *Noctilio leporinus*, *Artibeus jamaicensis*, *Erophylla sezekorni*, *Macrotus waterhousii*, *Monophyllus redmani*, *Eptesicus fuscus*, and *Lasiurus minor*). Most of these solely use cave roosts, but one roosts in trees under foliage (*Lasiurus minor*), and four have been collected or observed in both caves and buildings (*Eptesicus fuscus*, *Erophylla sezekorni*, *Macrotus waterhousii*, and *Tadarida brasiliensis*). Bat populations on other islands of the West Indies (e.g., Cuba and Puerto Rico) are better studied and provide some insight into the ecology of island bats. We review information on the 10 extant bat species in The Bahamas, focusing on studies conducted on island populations when possible. Conservation status is taken from the International Union for Conservation of Nature (IUCN). Species collected from the same cave are listed in most accounts, because previous research suggests that bats form non-random species assemblages possibly related to the roosting climate (Rodríguez-Durán, 1998). These lists are preliminary and caves have dynamic microclimates that may also influence the species composition of a roost.

LOCALITY INFORMATION

We downloaded locality information for all bats collected in The Bahamas from VertNet (vertnet.org). In many cases historical localities were georeferenced at the center of the island from which specimens were collected, because many bat specimens were collected prior to the availability of handheld GPS. We provide more

accurate geographic coordinates when possible. We also identified potentially redundant collecting sites using GPS coordinates and specific locality descriptions associated with museum records. We consolidated sites that were geographically close and/or had matching locality descriptions using local and professional knowledge. We pair specific descriptions taken from museum databases with our updated information to clarify and add detail to locality data. Our database of updated and consolidated information on every site where bats have been collected in The Bahamas is presented in Table 1. We do not necessarily recommend that locality records curated at natural history collections be updated based on the data in Table 1. Curators and collection managers must adhere to the locality descriptions provided by collectors; in contrast, we have the luxury of extrapolating from these descriptions based on our local expertise. Due to the sensitivity of cave ecosystems to tourism and human disturbance, and their cultural importance as burial sites for Lucayan Taino Indians, we only provide coordinate data to two decimal places. Maps were constructed in ArcGIS™ v.10.2 (ESRI, Redlands, California) and indicate presence or absence of a species on a given island. Presence of a species on an island is defined as any island where specimens have been collected and preserved in a natural history collection. Field observations of a species, without voucher specimens or tissues are not included in these maps.

SPECIES ACCOUNTS

MOLOSSIDAE (FREE-TAILED BATS)

TADARIDA BRASILIENSIS (SAINT-HILAIRE, 1824)

Common Name.—Brazilian free-tailed bat

Type Locality.—“Curityba, Paraná, Brazil” (Shamel, 1931)

Conservation Status.—“least concern” (IUCN, 2014)

Tadarida brasiliensis is a small (10–12 g), insectivorous bat with distinctive vertical wrinkles or grooves on the upper lip. Pelage is typically short and dense, and hairs are uniformly brown with ventral pelage slightly lighter than dorsal pelage (Wilkins, 1989). Like other members of the

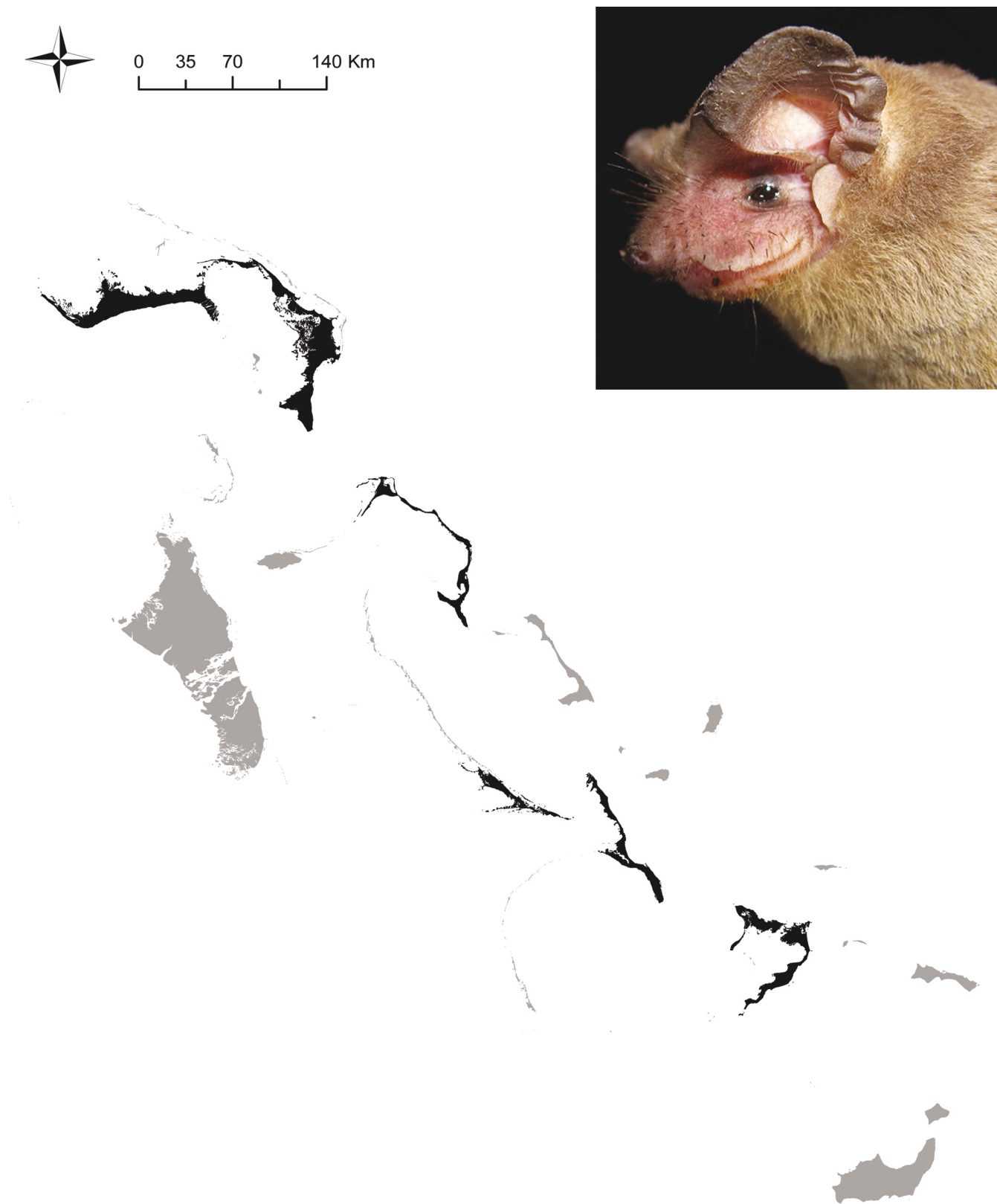


Figure 2. Presence/absence map of *Tadarida brasiliensis* in The Bahamas. The Bahamas are indicated in gray. See Figure 1 for geographic reference. The islands on which *T. brasiliensis* is found are indicated with black fill. Photograph of *T. brasiliensis* by J. A. Soto-Centeno.

family Molossidae, approximately half of the tail extends freely beyond the tail membrane, giving the name “free-tailed bat”. The characteristically wrinkled upper lip makes *T. brasiliensis* easily distinguishable from other bats in The Bahamas (Fig. 2).

Tadarida brasiliensis is widely distributed across the southern United States, Mexico and Central America, portions of South America, and the Greater and Lesser Antilles, making it one of the most widely distributed species of bat in the Americas. In The Bahamas, *T. brasiliensis* was previously known only from Great Abaco, Eleuthera, Long Island, and the Exumas (Koopman et al., 1957). Current records available from museum databases extend this distribution to include Grand Bahama Island, Crooked and Acklins Islands, and Long Cay (Table 1; Fig. 2). Fossil evidence suggests *T. brasiliensis* has become locally extinct in New Providence (Morgan, 2001). Approximately 270 *T. brasiliensis* individuals have been collected from The Bahamas and are preserved in natural history collections, attesting to its abundance in The Bahamas.

Island colonies of *T. brasiliensis* roost in buildings or caves with good ventilation and cool air (Koopman et al., 1957; Silva-Taboada, 1979; Gannon et al., 2005; Rodríguez-Durán and Christenson, 2012). Solitary individuals or small groups are found in fissures or on walls and ceilings of caves and manmade structures, whereas larger groups of tens of bats occupy bell holes, and groups of hundreds or thousands roost in large flat places on the ceiling of caves (Silva-Taboada, 1979). Normally, individuals are tightly clustered forming a mass, but this may vary depending on the temperature of the roost (Koopman et al., 1957; Wilkins, 1989; Gannon et al., 2005). In The Bahamas, *T. brasiliensis* has been documented in the same roost as *Eptesicus fuscus*, *Erophylla sezekorni* and *Macrotus waterhousii* (Koopman et al., 1957; Wilkins, 1989; Speer, pers. obs.).

Tadarida brasiliensis is highly adapted for rapid, sustained flight due to its narrow, pointed wings (Norberg and Rayner, 1987). This flight pattern allows for fast aerial capture of prey insects, but decreases maneuverability so foraging

normally occurs above the canopy or in open areas (Norberg and Rayner, 1987). To compensate for lower maneuverability, it has been suggested that the wrinkled upper lip of *T. brasiliensis* allows it to open its mouth wider to more effectively catch insects in air (Wilkins, 1989). Wing and flight adaptations allow *T. brasiliensis* populations in temperate regions to fly long distances to foraging sites and undertake annual long-distance migrations (Fleming and Eby, 2003). In Cuba and Puerto Rico, populations do not seasonally migrate and it is likely that *T. brasiliensis* in The Bahamas show a similar behavior, because food is available throughout the year (Silva-Taboada, 1979; Gannon et al., 2005).

As in many insectivorous bats, foraging is focused at dusk and dawn during peaks of insect activity (Silva-Taboada, 1979). Large colonies of *T. brasiliensis* normally leave the roost together at dusk, flying in a serpentine pattern across the sky before dispersing (Wilkins, 1989). Generally, insular colonies are smaller than those on the mainland and emergence may be more diffuse (Gannon et al., 2005; Rodríguez-Durán and Christenson, 2012). In Cuba and Puerto Rico, *T. brasiliensis* feeds mainly on flies (Diptera), wasps and ants (Hymenoptera), moths (Lepidoptera), and true bugs (Homoptera; Silva-Taboada, 1979; Whittaker and Rodríguez-Durán, 1999), while populations in New Mexico and Texas feed mainly on moths and beetles (Coleoptera; McWilliams, 2005). In more temperate regions, seasonal climate fluctuations strongly impact abundance and diversity of available food sources (McWilliams, 2005). Dietary variation may also be caused by composition of bat communities in the West Indies or on the mainland (Gannon et al., 2005). On some islands, mustached bats (family Mormoopidae) feed mainly on moths and beetles and may exclude *T. brasiliensis* from this niche (Gannon et al., 2005). Similarly, bats of the genera *Myotis* and *Pipistrellus* (family Vespertilionidae) may compete with *T. brasiliensis* on the mainland, but are absent from the Greater Antilles, and may account for variation of fly consumption between mainland and insular populations (Whittaker and Rodríguez-Durán, 1999).

As in other bats, *T. brasiliensis* gives birth to one pup a year in the late spring and early summer. Little is known about the reproduction of *T. brasiliensis* in the Greater Antilles, but Silva-Taboada (1979) documented gestation from April to June and lactation in July and August in Cuban populations. Studies conducted on mainland populations and our field observations in The Bahamas suggest that there is little parental care of pups, with females depositing their young in large groups, returning to nurse their young until weaned (Gustin and McCracken, 1987).

Ecology of insular populations of *T. brasiliensis* is known mainly from Cuba and Puerto Rico, and future research should focus on better characterizing annual movement, dietary variation, social and community structure, reproduction, and roost ecology of Bahamian colonies. *T. brasiliensis* is currently listed by the IUCN (2014) as “least concern,” but population declines in other regions have occurred due to destruction or disturbance of large colony roost sites and indirect poisoning by pesticides (Gannon et al., 2005). *T. brasiliensis* is known to occupy buildings in The Bahamas, and extermination of these colonies may threaten large portions of the bat communities on certain Bahamian islands. For example, *T. brasiliensis* on the Abacos has only been collected from buildings and bats at these sites likely represent a large portion of the populations on these islands (Table 1). We advocate non-lethal exclusion of bats from buildings (information is available through Bat Conservation International, <http://www.batcon.org/resources/for-specific-issues/bats-in-buildings>) and preservation of cave roosts to decrease interaction between humans and bats and to maintain healthy populations of *T. brasiliensis*.

NATALIDAE (FUNNEL-EARED BATS)

CHILONATALUS TUMIDIFRONS (MILLER, 1903)

Common Name.—Bahamian funnel-eared bat

Type Locality.—“Watling Island [= San Salvador],” Bahamas

Conservation Status.—“near threatened” (IUCN, 2014)

Chilonatalus tumidifrons is the only bat

endemic to The Bahamas, and one of only two endemic terrestrial mammals along with the Bahamian hutia (*Geocapromys ingrahami*, Order Rodentia). *C. tumidifrons* is a small bat (ca. 4–7 g) with wide ears that are shaped like a funnel. The ears are so expanded that they cover the eyes when observed from the side (Fig. 3A). Pelage is dense and long, ranging from light brown to orange brown. Hair is bi-colored with light color at the base and dark at the tips (Allen, 1905). The ears can appear light yellowish brown and darkening to grayish brown toward the edges (Miller, 1903). *C. tumidifrons* has a characteristic and prominent “moustache” of hair that is ventrally curved along the upper lip (Fig. 3A). Males have a large and externally prominent natalid organ, about half the length of the skull, located between the ears (Miller, 1903; Dalquest, 1950; Tejedor, 2011). The natalid organ is only present in the family Natalidae and its function is not well known. Some authors suggest it may aid in communication among individuals, or have sensory or glandular functions (Dalquest, 1950; Tejedor, 2011). *C. tumidifrons* is similar to other members of the family Natalidae, having a short body, long tail, and thin legs that support a large tail membrane. These characteristics may cause *C. tumidifrons* to be confused with *Nyctiellus lepidus* (Natalidae) in The Bahamas. Nonetheless, *C. tumidifrons* can be differentiated by the presence of hairs along the free edge of the tail membrane and by a natalid organ that is more prominent than in *N. lepidus* (Dalquest, 1950).

Chilonatalus tumidifrons is known from Andros, the Abacos, and San Salvador (Fig. 3; Allen, 1911; Dávalos, 2005; Tejedor, 2011). Fossils have been reported from Andros, Cat Island, the Exumas, and New Providence (Morgan, 2001). *C. tumidifrons* is an uncommon species and only 120 specimens, collected over the course of more than 100 years, are preserved in natural history collections (Table 1).

Chilonatalus tumidifrons exclusively roosts in caves in The Bahamas and prefers chambers with constant warm temperatures and high humidity (Table 1). Individuals form small colonies ranging from 10 to 500 individuals, roosting away from one

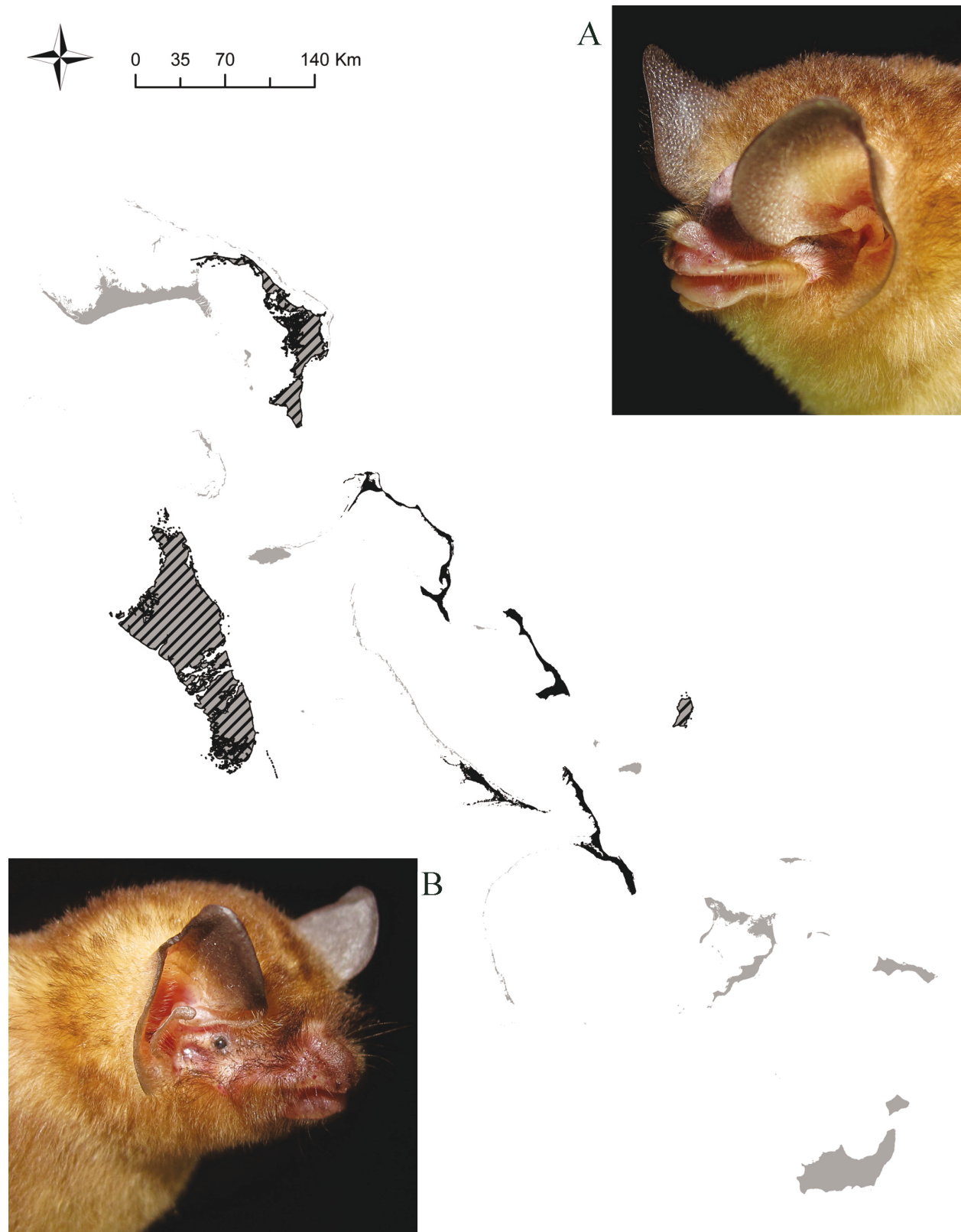


Figure 3. Presence/absence map of *Chilonatalus tumidifrons* and *Nyctiellus lepidus* in The Bahamas. The Bahamas are indicated in gray. See Figure 1 for geographic reference. The islands on which *C. tumidifrons* is found are indicated with black hatching and those on which *N. lepidus* are found are filled in black. Photographs of *C. tumidifrons* (A) and *N. lepidus* (B) by J. A. Soto-Centeno.

another, often hanging by one foot (Allen, 1905; Soto-Centeno, pers. obs.). *C. tumidifrons* has been found to share cave roosts with *Eptesicus fuscus*, *Erophylla sezekorni*, and *Macrotus waterhousii*, but are never observed roosting in the immediate vicinity of any of these species (Allen, 1905; Soto-Centeno, pers. obs.). Some roosting groups have been observed to move between roosts (ca. 1 km apart) on a daily basis (Tejedor, 2011).

Chilonatalus tumidifrons begins to forage at dusk and is insectivorous, like other members of the family Natalidae, but no study has comprehensively analyzed the diet of this bat. The small body and short broad wings of *C. tumidifrons* allow it to have a slow and very maneuverable flight pattern that can be compared to that of the large “bat moth” (also known as money moth or black witch moth; *Ascalapha odorata*). This flight pattern allows *C. tumidifrons* to use habitats with dense, woody vegetation like coppice (dry broadleaf forests) and shrubs (Andersen, 1994). The maneuverable of flight of *C. tumidifrons* allows it to easily detect and avoid mist-nets, even when netting in areas of high activity near roosts (Soto-Centeno, pers. obs.).

Nothing is known about the reproduction of *C. tumidifrons*. Allen (1905) observed a colony of about 300 individuals on Great Abaco that was composed primarily of males. This observation suggests that, as in other species of bats, males and females may segregate after mating.

Efforts towards the conservation of *C. tumidifrons* are perhaps more imperative than any other bat species in The Bahamas. The IUCN (2014) considers *C. tumidifrons* near threatened due to its limited distribution and the potential for loss of habitat and roosts. Preservation of coppice communities in the midst of increasing deforestation (Larkin et al., 2012) will protect valuable foraging grounds for *C. tumidifrons*. Maintenance of pristine cave ecosystems is also important for the conservation of *C. tumidifrons*, which is especially susceptible to disturbance due to its strict roosting conditions and preference for small roosting colonies (Dávalos, 2005).

C. tumidifrons is the only endemic bat of The Bahamas, however, the majority of available

information for this species is speculative, primarily based on the life history accounts of other members of the family Natalidae. Fossil evidence suggests that this species was once widespread on the Great Bahama Bank, but currently only inhabits three islands (Great Abaco, Andros, and San Salvador). As *C. tumidifrons* has previously undergone local extinction from much of its historic range, we agree with the IUCN classification of this species as “near threatened.” Until the status of this species is properly assessed via research and population surveys, we encourage conservation of cave habitat and coppice and pine woodland.

NYCTIELLUS LEPIDUS (GERVAIS, 1837)

Common Name.—Gervais’ funnel-eared bat

Type Locality.—“Cuba” (specific locality and collector unknown)

Conservation Status.—“least concern” (IUCN, 2014)

Nyctiellus lepidus is the smallest of all Bahamian bats (ca. 3–5 g) and one of the smallest bats in the world (Tejedor, 2011). It has short and narrow ears that are somewhat shaped like a funnel (Fig. 3B). Like other members of the family Natalidae, *N. lepidus* is characterized by its small size, short body, long tail, and thin legs that support a large tail membrane (Tejedor et al., 2005; Tejedor 2011). As in *Chilonatalus tumidifrons*, males can be distinguished from females by the presence of the natalid organ located between the ears (Tejedor et al., 2005). Pelage is dense and long, ranging from grayish brown to reddish brown, and is lighter ventrally (Silva-Taboada, 1979). The head of *N. lepidus* is characterized by a low brain case and prominent “moustache” of hair along the upper lip (Fig. 3B; Tejedor, 2011). It can be easily differentiated from *C. tumidifrons* by the absence of hairs along the free edge of the tail membrane and among males, a less prominent natalid organ (Dalquest, 1950; Tejedor et al., 2005; Tejedor, 2011).

In the Greater Antilles, *N. lepidus* is widely distributed on Cuba and Isla de Pinos (Allen and Sanborn, 1937; Dalquest, 1950; Silva-Taboada, 1979; Tejedor et al., 2005). The Bahamian

populations of this species occur on Cat Island, Eleuthera, the Exumas, and Long Island (Fig. 2B; Allen and Sanborn, 1937; Dalquest, 1950; Koopman et al., 1957; Tejedor, 2011). Fossils of *N. lepidus* have been reported from Andros and the Exuma Islands (Morgan, 2001). Currently, there are over 600 specimens of *N. lepidus* preserved in natural history collections, which attests to the abundance of this species throughout its range (Table 1).

Nyctiellus lepidus is exclusively a cave dwelling species in The Bahamas. In Cuba, it has been found primarily in caves with high humidity (Silva-Taboada, 1979). Individuals in large colonies can be observed widely spread out from one another (Soto-Centeno, pers. obs.). On Long Island, *N. lepidus* has been observed roosting in deep, narrow bell holes of well-ventilated chambers, forming small groups of 10–15 individuals (Soto-Centeno, pers. obs.). The shape of these narrow bell holes may serve as a small thermal chamber that helps maintain stable temperature and humidity. *N. lepidus* has been observed in the same cave as *Eptesicus fuscus*, *Erophylla sezekorni*, *Macrotus waterhousii*, and *Tadarida brasiliensis* in The Bahamas (Soto-Centeno, pers. obs.).

The small size and highly maneuverable flight of *N. lepidus* allows it to feed in cluttered environments within the forest understory and in grasslands (Tejedor, 2011). Although the diet of *N. lepidus* on The Bahamas has not been studied, populations on Cuba feed exclusively on insects like true bugs (Homoptera), flies (Diptera), small bees (Hymenoptera), moths (Lepidoptera), and termites (Isoptera; Silva-Taboada, 1979). Foraging bouts occur around dusk and dawn when most small insects are swarming (Tejedor, 2011). *N. lepidus* normally forages for short periods of time, likely using small home ranges and traveling only short a distance from the roost (Tejedor 2011).

Reproduction in *N. lepidus* takes place during winter (December–February) and pregnant females can be observed between March and July (Tejedor, 2011). Female-only maternity colonies form after mating and males can be seen forming groups in the external areas of the caves (Allen and Sanborn,

1937). Bats are known to have some of the largest offspring known in mammals (Kurta and Kunz, 1987; Hayssen and Kunz, 1996; Soto-Centeno and Kurta, 2003) and newborn *N. lepidus* often average more than 35% of the mother's weight (Silva-Taboada, 1979). Nonetheless, females commonly carry their pups during flight while foraging until pups begin to fly in late spring (Silva-Taboada, 1979).

Nyctiellus lepidus is considered a species of “least concern” by the IUCN (2014). Tejedor (2011) suggests *N. lepidus* may be resilient to disturbance as long as roost habitats are preserved, citing its preference for forming large colonies and its ability to use a variety of feeding habitats. *N. lepidus* is a cave specialist that prefers sheltered areas of caves that are humid and maintain a constant temperature (Silva-Taboada, 1979). The availability of climatically stable cave roosts may limit the possibility of dispersal of this species into new localities if current roosts are disturbed. Alteration of the microclimate in caves has been implicated in the local extinction of other members of the family Natalidae from some Bahamian islands (Dávalos, 2005) and colonies of *N. lepidus* may be at risk if human disturbance changes the conditions of roosting sites. Information about sustainable guano mining can be found through Emerging Wildlife Conservation Leaders (<http://wildlifeleaders.org/projects/bats/>).

NOCTILIONIDAE (FISHING BATS)

NOCTILIO LEPORINUS (LINNAEUS, 1758)

Common Name.—Greater Bulldog Bat or Fishing Bat

Type Locality.—“America” (Linnaeus, 1758), limited to “Suriname” by Thomas (1911)

Conservation Status.—“least concern” (IUCN, 2014)

Noctilio leporinus is an insectivorous and piscivorous (fish-eating) bat, living in tropical lowland areas of the Neotropics (Hood and Jones, 1984). It is the largest bat (ca. 50–65 g) inhabiting The Bahamas, being slightly heavier than *Artibeus jamaicensis* (Hood and Jones, 1984; Ortega and Castro-Arellano, 2001). *N. leporinus*

has a characteristically pronounced snout and lips and the chin has well-defined ridges, giving it a bulldog-like appearance (Fig. 4B). It also has cheek pouches, unique to the family Noctilionidae, used for food storage during foraging (Hood and Jones, 1984). Pelage is short and ranges in color from orange to grayish brown. *N. leporinus* can be identified by its enlarged hind feet and claws (Hood and Jones, 1984), and is not likely to be confused with any other bat species in The Bahamas.

Noctilio leporinus is distributed from northeastern Mexico to northern Argentina, and is widespread across the West Indies (Hood and Jones, 1984). Populations are focused along coastlines, estuaries and lowlands, and are rare in arid or montane regions across its range (Gannon et al., 2005). Schwartz and Thomas vouchered the only specimens collected in The Bahamas in 1967 on Great Inagua from a single cave locality (Table 1). *N. leporinus* has not been documented in The Bahamas since this initial collection, although we do not know of an expedition revisiting this locality. *Artibeus jamaicensis* was collected in the same roost, but was not likely roosting in the immediate vicinity of *N. leporinus* (Table 1). Fossils are known from Cuba, Isla de Pinos, Puerto Rico, and Antigua, but there are no fossil records of *N. leporinus* in The Bahamas (Morgan, 2001), suggesting that this species recently colonized The Bahamas. Due to a paucity of information, we do not know the current status of *N. leporinus* in The Bahamas.

While *N. leporinus* has only been found in a cave in The Bahamas, in other parts of its range it also roosts in abandoned buildings, hollow trees and rock crevices that have a fairly stable temperature and high humidity (Brooke, 1997; Silva-Taboada, 1979). Normally, they roost in close contact with each other in small groups of less than 30 individuals. The groups can be harems, with one or two males and the rest female, or in bachelor colonies where all individuals are young males (Brooke, 1997). There can be multiple small groups in a single roost (Brooke, 1997). Females in the same roosting group form tightly linked social groups that are sometimes maintained

during foraging, a trait that is rare in bats (Brooke, 1997). In each harem, resident males are replaced approximately every two years, but females within the group are stable and roosting groups tend to occupy the same physical place in a roost over several years (Brooke, 1997; Gannon et al., 2005).

Noctilio leporinus forages in short bouts totaling 1.3–2.5 hr/night (Brooke, 1997). It consumes a diversity of small fish (less than 15 cm in length) and insects from bays and coastlines, estuaries, streams, and ponds (Hood and Jones, 1984; Brooke, 1994; Bordignon, 2006). When catching fish, these bats use echolocation to detect disturbances at the water surface and use their large hind feet to rake across the surface, spearing their prey with their claws (Altenbach, 1989; Schnitzler et al., 1994). *N. leporinus* does not use its tail membrane during capture of fish, but may use it during capture of insects from the air (Altenbach, 1989; Schnitzler et al., 1994). *N. leporinus* can catch insects off the surface of water, in the air, or from the ground (Schnitzler et al., 1994). In the wet season, insects represent the majority of the diet of *N. leporinus*, where fish are the major dietary component in the dry season (Brooke, 1994). The diet of *N. leporinus* may also vary between the sexes. In Brazil, females feed solely on insects during the spring (October–December), potentially corresponding with lactation (Bordignon, 2006). During this time, males feed on fish, insects, and crustaceans (Bordignon, 2006).

Mating occurs in November and December and females give birth from April to June (Hood and Jones, 1984). Females give birth to a single young during each pregnancy and only leave their pup to forage at night. Pups are able to fly once they reach nearly adult size at 1 to 2 months of age (Silva-Taboada, 1979; Brooke, 1997). Births may be timed with an increase in insect abundance during the wet season, allowing lactation to occur during months of highest resource availability (Brooke, 1997). In some cases, females may become pregnant for a second time in a single year, following the birth of their first young, but this is not true for every population (Hood and Jones, 1984; Gannon et al., 2005).

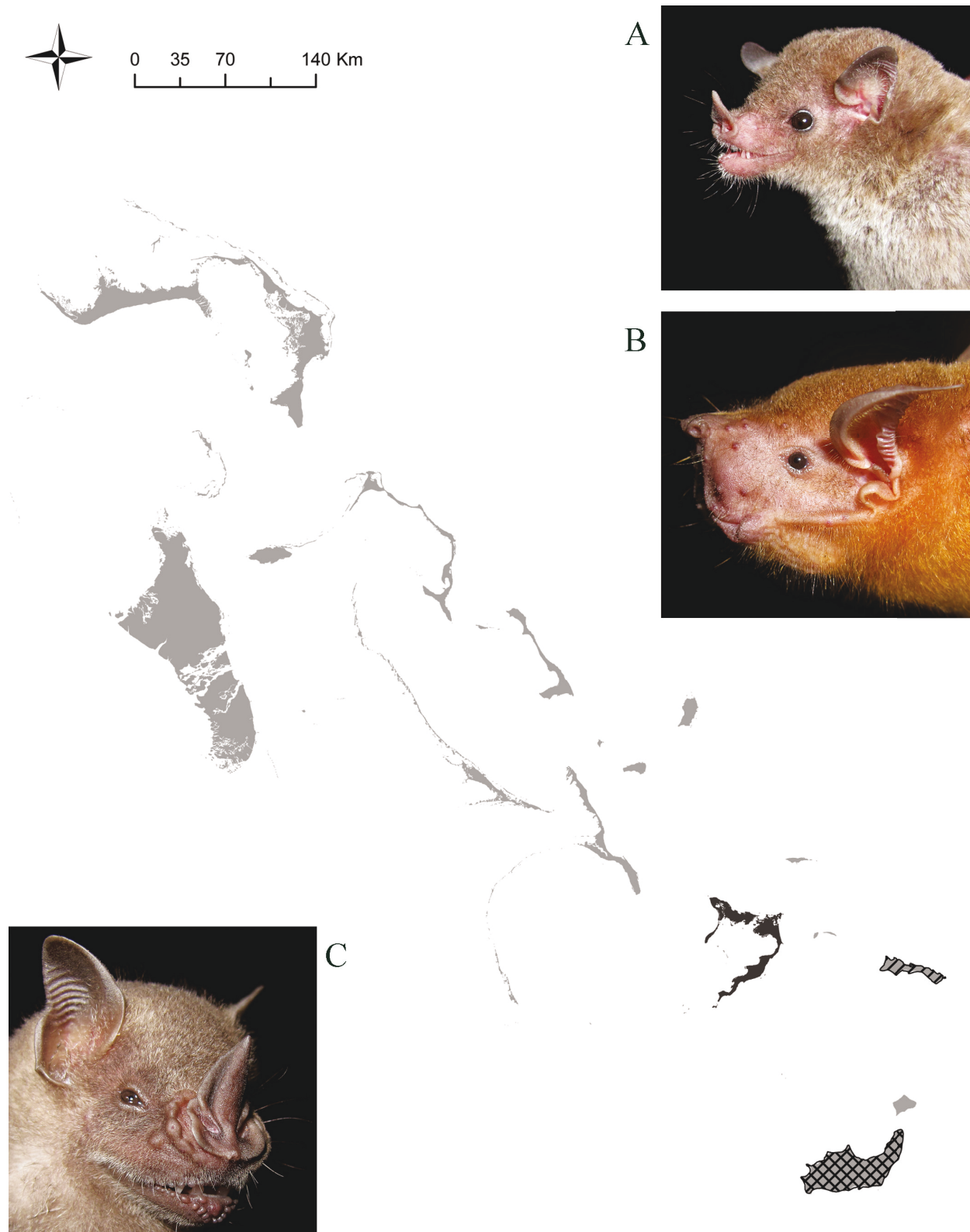


Figure 4. Presence/absence map of *Noctilio leporinus*, *Artibeus jamaicensis*, and *Monophyllus redmani* in The Bahamas. The Bahamas are indicated in gray. See Figure 1 for geographic reference. The islands on which *A. jamaicensis* is found are indicated with black hatching. Islands on which *N. leporinus* and *A. jamaicensis* are found are indicated by cross-hatching. Presence of *M. redmani* is indicated by black fill. Photographs of *M. redmani* (A), *N. leporinus* (B), and *A. jamaicensis* (C) by J. A. Soto-Centeno.

Noctilio leporinus is classified as “least concern” according to the IUCN (2014) due to its widespread distribution and population abundance. However, our knowledge of *N. leporinus* in The Bahamas is based on individuals collected almost 50 years ago from a single locality, and the status of current populations is unknown. Given the fidelity of roosting groups at a single site across multiple years, we recommend preservation of cave and forest habitats to minimize disturbance of colonies. Without further fieldwork to document populations of *N. leporinus* in The Bahamas, we are unable to assess threats to this species.

PHYLLOSTOMIDAE (LEAF-NOSED BATS)

ARTIBEUS JAMAICENSIS (LEACH, 1821)

Common Name.—Jamaican Fruit Bat

Type locality.—“Jamaica” (Leach, 1821:75)

Conservation Status.—“least concern” (IUCN, 2014)

Artibeus jamaicensis is a medium to large bat (ca. 36–48 g) and one of only two frugivorous bats found on The Bahamas along with *Erophylla sezekorni*. The face is characterized by a prominent nose-leaf and white stripes above and below the eyes, which are more defined in populations with dark pelage (Fig. 4C; Ortega and Castro-Arellano, 2001; Gannon et al., 2005). The ears are broad and triangular separated at the base, and the tragus is short with 4–5 small serrations on the outer border (Ortega and Castro-Arellano, 2001). The wings are broad and dark gray, and the tail membrane is thin and U-shaped when stretched out (Ortega and Castro-Arellano, 2001; Gannon et al., 2005). Pelage ranges from ashy gray to brown to black and is white at the base (Ortega and Castro-Arellano, 2001; Gannon et al., 2005). Unlike other bats on The Bahamas, *A. jamaicensis* has no external tail (Ortega and Castro-Arellano, 2001). It is unlikely that *A. jamaicensis* would be confused with any other bat in The Bahamas.

Artibeus jamaicensis is distributed from Mexico and Central America to northwest South America, and is found throughout the Greater and Lesser Antilles (Larsen et al., 2007). In The Bahamas, *A. jamaicensis* has been collected from cave localities on Inagua and Mayaguana (Table

1). *Noctilio leporinus* was collected from the same locality on Inagua, but neither bat is known to form mixed species colonies (Silva-Taboada, 1979). In the West Indies, fossils have been documented in Cuba, Isla de Pinos, Jamaica, Hispaniola, Ile de la Gonâve (Haiti), and Puerto Rico (Morgan, 2001). Molecular analyses and fossil data suggest that *A. jamaicensis* colonized the West Indies through Central America during the Pleistocene, and began inhabiting the southern Bahamas relatively recently (Morgan, 2001, Larsen et al., 2007, Ruiz et al., 2013).

Artibeus jamaicensis occurs throughout many habitat types including evergreen forests, cloud forests, and arid habitats (Ortega and Castro-Arellano, 2001; Gannon et al., 2005). On the mainland and Cuba, *A. jamaicensis* can be found in trunks and foliage of trees, palm leaf tents, caves and manmade structures (Silva-Taboada, 1979; Ortega and Castro-Arellano, 2001). However, in Puerto Rico, *A. jamaicensis* has only been documented in manmade structures and caves (Gannon et al., 2005). In The Bahamas, *A. jamaicensis* has only been documented from caves.

In caves, juveniles roost solitarily or in small, unstructured groups in exposed areas or near solution cavities (Kunz et al., 1983; Ortega and Arita, 1999). Adults form harems consisting of several females and their offspring are defended by one or two males (Kunz et al., 1983; Ortega and Arita, 1999). Dominant males sire the majority of offspring in harem groups and maintain their dominance status for two reproductive seasons (Ortega et al., 2003). Harems are relatively stable, but females often change harems between periods of reproduction (Ortega and Arita, 1999). Females give birth to one pup twice per year from March to July, which coincides with the rainy season when fruits are more abundant (Gannon et al., 2005).

Artibeus jamaicensis is a generalist frugivore, but also consumes other plant materials, including pollen, flowers, leaves, or nectar (Ortega and Castro-Arellano, 2001; Gannon et al., 2005). Figs are often the primary fruit consumed by *A. jamaicensis*, but dietary composition varies geographically. In Puerto Rico, trumpet tree, turkey berry, jag, almond,

and elder were the most commonly consumed fruits (Gannon et al., 2005). In Panamá, *A. jamaicensis* begins foraging after sunset and returns before dawn, but may return to the day roost on especially moonlit nights as a predator avoidance technique (Morrison, 1978). However, this behavior is not exhibited by individuals on Puerto Rico, which is not inhabited by many of the nocturnal predators that prey on bats (Gannon et al., 2005). While foraging, *A. jamaicensis* carries fruit or plant material to a proximal feeding roost or back to the day roost to eat, subsequently dispersing seeds from the parent plant (Silva-Taboada, 1979; Ortega and Castro-Arellano, 2001; Gannon et al., 2005). In some regions, *A. jamaicensis* is known to visit the same fruiting plant on consecutive nights, but in Puerto Rico and potentially The Bahamas, which have low fruiting plant density, *A. jamaicensis* does not revisit foraging sites on consecutive nights (Gannon et al., 2005).

According to IUCN (2014), *A. jamaicensis* is of “least concern” across their range. However, this species only occurs on Inagua and Mayaguana in The Bahamas and the status of these populations is not known. 1977 was the last time *A. jamaicensis* was documented on Inagua and also the last time any bats were collected from this island. *A. jamaicensis* transports seeds of the fruit it eats into disturbed areas, preserving populations of this bat can increase the health of the ecosystems on Inagua and Mayaguana. Future surveys in the Bahamas are especially needed in the southern islands, whose bat populations have not been examined in over 30 years.

EROPHYLLA SEZEKORNI (GUNDLACH, 1861)

Common Name.—Buffy Flower Bat

Type Locality.—“Cuba” (Gundlach, 1861)

Conservation Status.—“least concern” (IUCN, 2014)

Erophylla sezekorni is a medium-sized bat (ca. 14–18g) with a flat forehead and elongated, conical snout (Fig. 5; Baker et al. 1978). Its nose-leaf is often notched at the tip and is generally less prominent than that of other phyllostomids (Baker et al., 1978). The bottom lip is split and the tongue extends through this slit (Speer pers.

obs.). The tail membrane is narrow and U-shaped with the tail extending only slightly beyond the edge of the membrane. Wing morphology of *E. sezekorni* is indicative of maneuverable but slow flight (Jennings et al., 2004). Pelage is white at the base and tipped with brown (Baker et al., 1978). Hair on the face and head is uniform in color and lighter than hair on the body (Baker et al., 1978). *E. sezekorni* is easily distinguished from other bats in The Bahamas by its small nose-leaf and blonde or light brown coloration.

The genus *Erophylla* is endemic to the West Indies and consists of two species: *E. sezekorni* distributed in Cuba, The Bahamas, Jamaica, Turks and Caicos, and the Cayman Islands; and *E. bombifrons*, which occurs on Puerto Rico and Hispaniola (Baker et al., 1978; Timm and Genoways, 2003). Until recently, there was considerable debate on the recognition of these two species and Baker et al. (1978) considered *E. bombifrons* a subspecies of *E. sezekorni*. Because *E. bombifrons* and *E. sezekorni* are closely related and have similar ecological habits, we use information collected from *E. bombifrons* to infer aspects of the natural history of *E. sezekorni* where data is sparse. In The Bahamas, *E. sezekorni* is the most widespread bat, found on the Abacos, Andros, Cat Island, Crooked and Acklins Islands, Eleuthera, Great Exuma, Grand Bahama, Great Inagua, Long Island, Mayaguana, New Providence, and San Salvador (Table 1; Fig. 5; Morgan, 1989). It is known from fossil deposits on Great Abaco, Andros, the Exumas, and New Providence, as well as Cuba, and Jamaica (Morgan, 2001). Notably, *E. sezekorni* populations persist on every island where they are documented in the fossil record, meaning this species has not undergone a single local extinction in The Bahamas (Morgan, 1989).

Little is known about the habitat preference of *E. sezekorni*. It has mainly been captured in lowland areas of variable vegetation (Baker et al., 1978). *E. sezekorni* has been vouchered mainly from caves. In Grand Bahama, it has been collected from one abandoned building (Table 1) and its feces have been observed in an abandoned hotel (Soto-Centeno and Speer, pers. obs.), suggesting



0 35 70 140 Km



Figure 5. Presence/absence map of *Erophylla sezekorni* in The Bahamas. The Bahamas are indicated in gray. See Figure 1 for geographic reference. The islands on which *E. sezekorni* is found are indicated with black fill. Photograph of *E. sezekorni* by J. A. Soto-Centeno.

these bats might opportunistically roost in man-made structures. *E. sezekorni* is sensitive to roost temperature and humidity changes and prefers cooler portions of hot caves or cavities of cooler caves, but roosts in variable levels of light (Silva-Taboada, 1979; Murray and Fleming, 2008). In a study conducted on *E. bombifrons* (referred to as *E. sezekorni*, op. cit.), individuals preferred stable ambient cave temperatures 25–28° C and only roosted in tight clusters in cooler temperatures (Rodriguez-Durán and Soto-Centeno, 2003). This suggests that members of the genus *Erophylla* are likely sensitive to overheating (Rodriguez-Durán and Soto-Centeno, 2003). In The Bahamas and Caymans, colonies range in size from a few individuals to a few hundred (Hall et al., 1998; Murray and Fleming, 2008).

Originally thought to be predominantly nectarivorous, the diet of *E. sezekorni* consists of insects, fruits, and nectar (Silva-Taboada, 1979; Soto-Centeno and Kurta, 2006). Dietary studies based on analysis of feces suggest that *E. bombifrons* in Puerto Rico has an omnivorous diet (Soto-Centeno and Kurta, 2006). Similarly, Silva-Taboada (1979) found *E. sezekorni* in Cuba consumed insects in addition to fruit and nectar. Recent evidence shows that although insects are consumed frequently, fruit and nectar play a greater role in the diet of this species (Soto-Centeno et al., 2014).

Females give birth to one pup per year, with gestation occurring from February to May and lactation occurring from June through September (Silva-Taboada, 1979). On the Exuma Islands, *E. sezekorni* formed mixed-gender groups that were maintained during mating and the maternity season (Murray and Fleming, 2008). Males use wing and vocal displays, but non-displaying males were shown to father just as many young as displaying males (Murray and Fleming, 2008). This suggests that other strategies to increase mating success are likely employed by males to attract females (Murray and Fleming, 2008). *E. sezekorni* employs a promiscuous mating strategy, with males and females in a small group mating multiple times (Murray and Fleming, 2008).

Erophylla sezekorni is listed as a species of “least concern” by IUCN (2014) due to its large population and widespread distribution. *E. sezekorni* is one of three bats species in The Bahamas that is currently found on all islands where it has been recorded in the fossil record. This suggests that populations have withstood climate and habitat changes. More information specific to Bahamian populations is necessary to assess the risks that temperature sensitivity, habitat loss, and roost disturbance potentially pose.

MACROTUS WATERHOUSII (GRAY, 1843)

Common Name.—Big-eared bat or Waterhouse’s leaf-nosed bat

Type Locality.—“Hayti” (Gray, 1843)

Conservation Status.—“least concern” (IUCN, 2014)

Macrotus waterhousii is one of the most widespread bats of the Greater Antilles and The Bahamas along with *Erophylla sezekorni* (Koopman et al., 1957). *M. waterhousii* is a medium-to-large sized bat with broad wings and a large tail membrane (Anderson, 1969). Pelage is typically uniformly brown-gray across the body with Bahamian populations having lighter pelage than other West Indian populations (Anderson, 1969; Buden, 1975a). *M. waterhousii* can be easily distinguished from other Bahamian bats by its distinct nose leaf and large ears (Fig. 6; Buden, 1975a).

Macrotus waterhousii occurs on the mainland from the southwestern United States, through western Mexico to Guatemala, and in the West Indies in Cuba, Hispaniola, Jamaica, Turks and Caicos, The Bahamas, and the Cayman Islands (Anderson and Nelson, 1965). There are two subspecies in the West Indies, with *M. w. minor* occurring on Cuba, the northern islands of the Great Bahama Bank (as far south as Long Island), and the Cayman Islands and *M. w. waterhousii* occurring on the southern islands of the Great Bahama Bank, Jamaica, and Hispaniola (Buden, 1975a). Genetic analyses suggest that there has been historic gene flow between populations on Cuba and those on Hispaniola, Jamaica, and islands of The Bahamas (Muscarella et al., 2011). It is hypothesized that there is little recent gene flow between populations

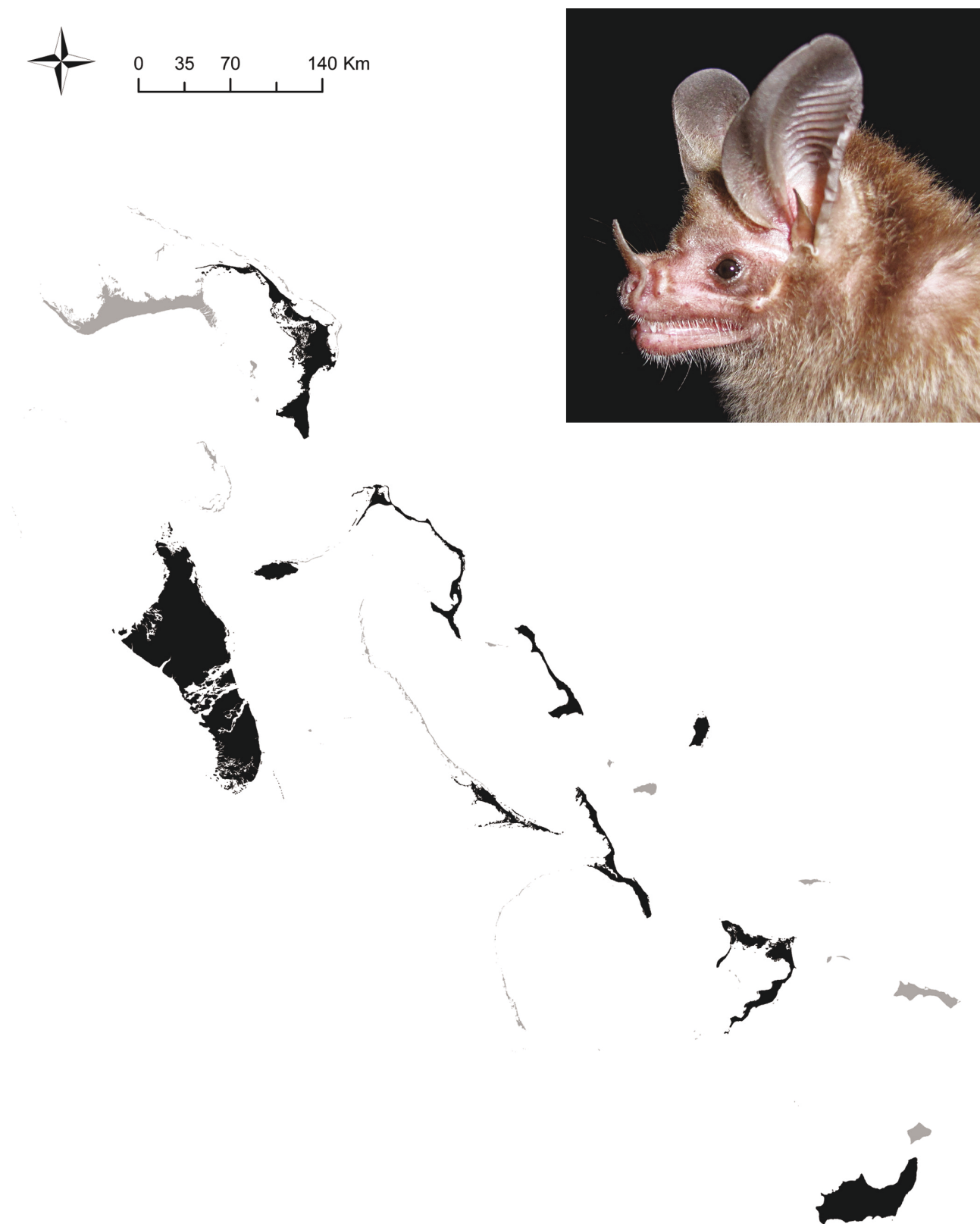


Figure 6. Presence/absence map of *Macrotus waterhousii* in The Bahamas. The Bahamas are indicated in gray. See Figure 1 for geographic reference. The islands on which *M. waterhousii* is found are indicated with black fill. Photograph of *M. waterhousii* by J. A. Soto-Centeno.

on different islands (Muscarella et al., 2011). As populations on each island are distinct from those on neighboring islands, *M. waterhousii* may be more susceptible to local extinction events than bats that disperse more frequently. West Indian fossil records of *M. waterhousii* are known from Cuba, Jamaica, Hispaniola, Puerto Rico, Grand Caicos, Grand Cayman, Cayman Brac, Anguilla, Barbuda, and from The Bahamas in Great Abaco, Andros, the Exumas, and New Providence (Morgan, 2001). Based on current distributions (Fig. 6B), *M. waterhousii* has become locally extinct in Puerto Rico, Anguilla, and Barbuda, but is currently found on all islands in The Bahamas where it has been documented in the fossil record (Morgan, 2001). The genetic isolation of populations and the local extinctions of *M. waterhousii* suggest that colonization events are rare for this species (Muscarella et al., 2011).

Macrotus waterhousii is found primarily in dry areas and rarely in evergreen lowland forests (Reid, 1997). This bat roosts in caves and occasionally buildings, forming colonies of up to 500 individuals (Reid, 1997). In The Bahamas, solitary individuals have been observed in abandoned buildings and caves (Albury pers. obs.). *M. waterhousii* generally prefers humid, sheltered caves, but can be found in more exposed areas (Silva-Taboada, 1979). When roosting in caves, *M. waterhousii* tends to be found in very dark areas, but when roosting in buildings, it tolerates more light (Silva-Taboada, 1979).

Macrotus waterhousii is a gleaner insectivore, meaning it captures insect prey from a surface rather than catching insects directly from the air. *M. waterhousii* typically hunts in densely foliated habitats (Emrich et al., 2013). In Cuba, its diet is composed primarily of moths and butterflies (Lepidoptera) and grasshoppers and crickets (Orthoptera; Silva-Taboada, 1979). However, in Jamaica its diet is more heavily composed of beetles (Coleoptera) and flies (Diptera; Emrich et al., 2013). This variation in diet is likely due to competition and resource partitioning, which can vary across small geographic areas (Emrich et al., 2013). After *M. waterhousii* catches its prey, it

visits a nocturnal roost to eat rather than consuming its prey directly at the capture site (Silva-Taboada, 1979). Nocturnal roosts are visited frequently and can be caves or the external architecture of buildings (Silva-Taboada, 1979). The wings of insect prey are often found beneath nocturnal roosting sites used by *M. waterhousii* (Silva-Taboada, 1979). In The Bahamas, wings of cockroaches and moths have been found in hypothesized nocturnal roosts (Albury, pers. obs.) It has also been suggested that *M. waterhousii* consumes fruit in some portions of its range, but this is not evidenced in Cuban populations and is unlikely in Bahamian populations (Silva-Taboada, 1979).

Little is known about the mating system or social structure of *M. waterhousii*, especially in West Indian populations. Females give birth to one pup a year and have a uniquely slow gestation in which embryos undergo delayed development (Anderson, 1969; Silva-Taboada, 1979). Copulation occurs in the fall, but females do not show any signs of pregnancy until February (Silva-Taboada, 1979). Embryos can be detected from February to April and lactation occurs from March to August (Silva-Taboada, 1979). Females leave pups that are unable to fly in the cave while they hunt at night, but carry pups with them when roosting during the day (Silva-Taboada, 1979).

Macrotus waterhousii is listed as “least concern” according to the IUCN (2014) due to large population, widespread distribution, and occurrence in protected habitats. However, genetic analyses suggest that *M. waterhousii* populations are vulnerable to local extinction events, because movement between populations and colonization events are infrequent (Muscarella et al., 2011). This bat is already known to have suffered extirpations on several West Indian islands (Morgan, 2001). Because populations in The Bahamas may represent a unique subset of *M. waterhousii* (Buden 1975a), disturbance of roosting and foraging habitat may have unforeseen negative consequences for this bat. We recommend future research efforts to clarify the natural history of *M. waterhousii* in The Bahamas and conservation efforts should seek to maintain caves and dense shrub and forest habitat.

MONOPHYLLUS REDMANI (LEACH, 1821)

Common Name.—Greater Antillean long-tongued bat or Leach's single leaf bat

Type Locality.—"Jamaica" (Leach, 1821)

Conservation Status.—"least concern" (IUCN, 2014)

Monophyllus redmani is the only primarily nectarivorous bat in The Bahamas. It is a small bat, weighing ca. 8–14 g (Silva-Taboada, 1979), and is found only on islands of the Greater Antilles and The Bahamas (Homan and Jones, 1975). Its elongated snout is characteristic of nectar-feeding bats, and distinguishes this species from other bats found on The Bahamas (Fig. 4A). *Erophylla sezekorni* also has an elongated snout, but it is lighter in color than *M. redmani* and has a less-prominent nose leaf, with a small ridge just behind it on the snout (Gannon et al., 2005). *M. redmani* ranges in color from brown to gray and is normally darker dorsally (Buden, 1975b; Silva-Taboada, 1979).

Monophyllus redmani is only known from Cuba, Hispaniola, Jamaica, Puerto Rico, and The Bahamas. In The Bahamas, *M. redmani* has only been documented from Crooked and Acklins islands (Fig. 4; Buden, 1975b). Fossil evidence suggests this bat previously occurred on Great Abaco, Andros, and New Providence but has become locally extinct on these islands (Morgan, 2001).

Monophyllus redmani primarily roosts in hot, humid caves and can be found in large colonies of many thousands of individuals (Silva-Taboada, 1979; Gannon et al., 2005). In The Bahamas, *M. redmani* has been seen and collected from dry caves that are normally well ventilated (Buden, 1975b). These bats were found roosting in bell holes in groups of 15–20 individuals (Buden, 1975b). In Cuba and Jamaica, *M. redmani* has been documented in mixed species roosting groups with *Pteronotus parnellii* (Silva-Taboada, 1979).

Monophyllus redmani is an omnivorous bat, mainly feeding on nectar and insects, only sometimes consuming fruit (Soto-Centeno and Kurta, 2006). While nectar seems to be the primary food item according to studies of dental morphology

and diet, soft-bodied insects like flies (Diptera), wasps (Hymenoptera), and butterflies and moths (Lepidoptera) also represent a significant portion of the diet (Gannon et al., 2005; Soto-Centeno and Kurta, 2006). This bat is well adapted for hovering, potentially enabling it to access nectar more efficiently than other bats that cannot hover (Norberg and Rayner, 1987; Soto-Centeno and Kurta, 2006). Its dietary focus on nectar may allow *M. redmani* to better recover after hurricanes, while fruit-eating bats often take longer to attain pre-hurricane population levels (Soto-Centeno and Kurta, 2006). In Cuba, bats with specialized morphology for consuming nectar also tended to have high incidence of insect remains in their feces (Clairmont et al., 2014). Even among other nectar-specialized omnivores, dietary reliance on insects in *M. redmani* is greater than expected given its classification as a nectarivorous bat (Soto-Centeno et al., 2014).

Unlike other bats, *M. redmani* undergoes two reproductive peaks per year, but females give birth to only one pup per year (Gannon et al., 2005). In Cuba, pregnant females have been recorded mainly from March to June and again in October (Silva-Taboada, 1979). Pregnant females form maternity colonies, roosting separately from males (Gannon et al., 2005). Females give less parental care to young than other bats and newborns are often found roosting alone (Gannon et al., 2005).

According to IUCN (2014), *M. redmani* is characterized as a species of "least concern" due to its abundance within its restricted range and occurrence in protected habitats. While *M. redmani* remains prevalent on larger islands across its range, this is not true for populations in The Bahamas. *M. redmani* has not been collected from any of the islands (Great Abaco, Andros, and New Providence) where it has been documented in the fossil record. The current distribution of this species in The Bahamas is limited to Crooked and Acklins, and the presence of these populations has not been confirmed since 1973, the year of the most recent collecting on these islands. Updated occurrence data will allow accurate conservation assessment of this species in The Bahamas.

VESPERTILIONIDAE (EVENING BATS)

EPTESICUS FUSCUS (BEAUVOIS, 1796)

Common Name.—Big Brown Bat

Type Locality.—Philadelphia, Pennsylvania (Beauvois, 1796)

Conservation Status.—“least concern” (IUCN, 2014)

Eptesicus fuscus is a small bat (ca. 11–23 g) that is widely distributed (Kurta and Baker, 1990). Pelage is dark brown on the dorsum, but slightly paler ventrally, and the face and ears are also darkly colored. Pelage is long and soft and has an oily appearance (Fig. 7; Kurta and Baker, 1990). The ears are thick, short, and rounded. The tail membrane is large and has hair at the base (Kurta and Baker, 1990). *E. fuscus* may be confused with *Tadarida brasiliensis* in The Bahamas, because they are both small and darkly colored. However, *E. fuscus* is distinguishable because it does not have the characteristic wrinkled lips of *T. brasiliensis*. In addition, *E. fuscus* has a prominent, smooth snout, and its tail only slightly extends beyond the edge of the tail membrane (Kurta and Baker, 1990).

The range of *E. fuscus* is nearly as broad as that of *T. brasiliensis*, reaching from southern Canada to very northern edge of South America, and includes islands of the Greater Antilles, The Bahamas, Grand Cayman, Barbuda, and Dominica (Kurta and Baker, 1990; Gannon et al., 2005). In The Bahamas, *E. fuscus* is known from fossil deposits on Great Abaco, Andros, the Exumas, and New Providence (Morgan, 2001). *E. fuscus* is still present on these islands, in addition to Long Island, San Salvador, and Crooked and Acklins (Table 1; Fig. 7). Based on morphological data, *E. fuscus* in The Bahamas has been split into two subspecies (Buden, 1985, 1986). *E. f. bahamensis* occurs on New Providence and San Salvador and *E. f. dutertreus* is found on Andros, the Exumas, Crooked and Acklins, and Long Island, and intermediate specimens are found on San Salvador (Timm and Genoways, 2003). However, more recent morphological analyses of specimens in the Albert Schwartz Collection suggest that there is little difference between these subspecies, and further genetic and morphometric analyses are

needed to fully elucidate the taxonomy of *E. fuscus* in The Bahamas (Timm and Genoways, 2003).

Eptesicus fuscus is common in urban areas in the North American part of its range, and has been documented in forested highlands and suburban areas in Puerto Rico (Gannon et al., 2005; Soto-Centeno pers. obs.). This bat is commonly found roosting in buildings and caves in Cuba, but has only occasionally been documented from buildings in The Bahamas (Table 1; Silva-Taboada, 1979; Albury, pers. obs.). In caves, they roost in a similar habit as *T. brasiliensis*, with many individuals being tightly packed together (Gannon et al., 2005). *E. fuscus* roosts in large colonies in well ventilated, open areas of caves, or in smaller groups in solution cavities (Silva-Taboada, 1979). In Cuba, *T. brasiliensis* and *E. fuscus* are occasionally found roosting together (Silva-Taboada, 1979). In Hillside Grocery Cave, Long Island, 2 individuals of *E. fuscus* were observed roosting on the outside edge of a colony of *T. brasiliensis* (Soto-Centeno, pers. obs.).

Eptesicus fuscus is an aerial insectivore and is known for the incredible precision of its echolocation (Kurta and Baker, 1990). *E. fuscus* has long, narrow wings and is less maneuverable than other species, typically flying above the canopy or in open areas (Kurta and Baker, 1990). It mainly consumes beetles (Coleoptera), but also preys on cockroaches (Dictyoptera), flies (Diptera), wasps (Hymenoptera), butterflies (Lepidoptera), and lacewings (Neuroptera; Silva-Taboada, 1979). There have been no dietary studies on these bats in The Bahamas. Foraging occurs throughout the night, beginning soon after sunset and ending just before sunrise (Silva-Taboada, 1979). In mainland portions of their range, bats fly 1–2 km from roost sites to foraging areas with total flight times averaging 100 min. per night (Kurta and Baker, 1990), but in Cuba they stay close to the roost (Silva-Taboada, 1979).

In cooler portions of its range, *E. fuscus* hibernates in response to food shortage that occurs in the winter when it is too cold for insects to survive (Kurta and Baker, 1990; Gannon et al., 2005). In the tropics, there is no evidence of hibernation, but

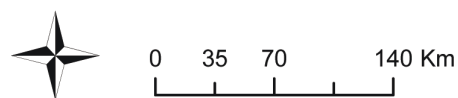


Figure 7. Presence/absence map of *Eptesicus fuscus* in The Bahamas. The Bahamas are indicated in gray. See Figure 1 for geographic reference. The islands on which *E. fuscus* is found are indicated with black fill. Photograph of *E. fuscus* by J. A. Soto-Centeno.

these bats may become torpid if temperatures drop below 20° C rather than leaving the roost to hunt (Silva-Taboada, 1979).

Females give birth once a year to twins and occasionally single pups (Gannon et al., 2005). Gestation occurs from March to May in Cuba and this seems to be true for populations in The Bahamas based on limited sampling (Silva-Taboada, 1979; Timm and Genoways, 2003). While giving birth, females roost with their heads up and use their tail membrane to catch pups as they are born (Gannon et al., 2005). Lactation occurs in June (Silva-Taboada, 1979) and juveniles begin to fly at 18–35 days old (Kurta and Baker, 1990). The female does not carry her offspring while hunting at night (Silva-Taboada, 1979). More research is necessary on populations in the West Indies to understand social structure.

Eptesicus fuscus is indicated as of “least concern” by IUCN (2014), because of its wide distribution, high population size, occurrence in protected habitats, and resilience against some degree of habitat modification. *E. fuscus* has not suffered any local extinctions in The Bahamas, suggesting that populations have persisted through past climate and habitat change. As this bat has the propensity to roost in buildings and is commonly found in urban areas, it may be at risk from improper removal or extermination when found in man-made structures. Instructions for excluding bats from buildings can be found at Bat Conservation International (<http://www.batcon.org/resources/for-specific-issues/bats-in-buildings>). We recommend future work to investigate the genetics and ecology of the two proposed subspecies of *E. fuscus* occurring in The Bahamas.

LASIURUS MINOR (MILLER, 1931)

Common Name.—Minor Red Bat

Type Locality.—“Trouin Voute L’Eglise,” Haiti (Miller, 1931)

Conservation Status.—“vulnerable” (IUCN, 2014)

The validity for the use of the species name *Lasiurus minor* for red bats in The Bahamas is uncertain. Some authors consider red bats a single species (*Lasiurus borealis*) that expanded across

North America and the Greater Antilles, including The Bahamas and Turks and Caicos (Koopman, 1993). However, bats found on Hispaniola and Puerto Rico are smaller and probably belong to a different species (i.e., *L. minor*; Miller, 1931). Allen (1905) examined a single specimen from Nassau, New Providence, which he considered “indistinguishable in color and proportions” of the body and skull from *L. borealis* in Florida, USA. Allen and Sanborn (1937) examined a single specimen from Cat Island, which they assigned to *L. minor*. This specimen was not an adult, yet they still considered it different than *L. borealis*. Given the paucity of the specimens examined, Koopman et al. (1957) suggested the use of *L. borealis minor* for the populations on The Bahamas, Hispaniola, and Puerto Rico. Until further evidence is uncovered and to avoid confusion with its mainland congeners, we adopt the name *L. minor* to refer to the small species of insular red bat that occurs on The Bahamas, Hispaniola, Puerto Rico, and Turks and Caicos (Miller, 1931; Simmons, 2005).

Lasiurus minor is a small bat (ca. 6–11 g) with short rounded ears and a small rostrum (Fig. 8; Miller, 1931; Gannon et al., 2005; Rodríguez-Durán and Christenson, 2012). This bat has dense fur that extends from the body onto to the large wing membrane, which appears visibly furred. Perhaps the most striking characteristic of *L. minor* is its distinctive reddish or yellow-orange pelage, which in some individuals show small patches of white hair giving it a frosted appearance (Allen and Sanborn, 1937; Gannon et al., 2005). The dark brown wings of *L. minor* show a marked contrast with the reddish coloration of the fur. The coloration and densely furred tail membrane make this bat easy to distinguish among other Bahamian bats. However, this species is infrequently seen or captured probably because of its solitary nature and preference for foliage and tree roosts.

Information on *L. minor* in The Bahamas is limited and is based on about 15 specimens. These records are from Cat Island, Great Inagua, Long Island, and New Providence (Table 1; Fig. 8; Allen, 1905, 1911; Allen and Sanborn, 1937; Koopman et al., 1957). Two road kill specimens collected from



0 35 70 140 Km



Figure 8. Presence/absence map of *Lasiurus minor* in The Bahamas. The Bahamas are indicated in gray. See Figure 1 for geographic reference. The islands on which *L. minor* is found are indicated with black fill. Photograph of *L. borealis*, which looks very similar to *L. minor*, by Merlin D. Tuttle, Bat Conservation International, www.batcon.org.

Great Abaco, have been tentatively identified as *L. minor* at the Florida Museum of Natural History. Fossils of *L. minor* have been identified from Great Abaco (Soto-Centeno and Steadman, 2015) Cuba, and Hispaniola (Morgan, 2001). Because *L. minor* is considered rare across its distribution and in some instances could be identified as *L. borealis*, the number of specimens preserved in natural history museum collections is difficult to determine.

Almost nothing is known of the life history of *L. minor* in The Bahamas, because of the lack of field observations and paucity of specimens. *L. borealis* in the southeastern United States are solitary mammals that roost primarily in the foliage of trees, making them rare to document. They often hang by one foot and their coloration gives them the appearance of dead leaves (Harvey et al., 2011). No roost trees of *L. minor* have been observed on the islands, but on the mainland, red bats roost in trees with dense foliage and broad leaves (Gannon et al., 2005).

Lasiurus minor, like its congeners, is insectivorous and probably feeds on beetles (Coleoptera), flies (Diptera), leafhoppers (Homoptera), termites (Isoptera), and moths (Lepidoptera) as evidenced from data of one individual from Puerto Rico (Rodríguez-Durán, 1999). Wings of *L. minor* are elongated and narrow, which give this species a swift but not very maneuverable flight. Therefore, *L. minor* can typically be found foraging in open areas above the tree canopy or along forest edges. Hickey and Fenton (1990) reported *L. borealis* foraging around streetlights where concentration of insects was higher. A red bat (likely *L. minor*) was observed foraging around a streetlight in Conch Bar, Turks and Caicos (Soto-Centeno, pers. obs.). Therefore, it is possible that island populations of *L. minor* also takes advantage of streetlights as foraging habitat.

Reproduction of *L. minor* on islands is not well known. Female *L. borealis* give birth to three pups on average and carry their pups with them while flying (Harvey et al., 2011). *L. minor* from Puerto Rico seem also to be able to give birth to multiple pups, where most species of bats in the West Indies give birth to one pup per year.

Rodríguez-Durán (1999) documented the capture of a single lactating female carrying three pups on Puerto Rico during the month of June. Based on the appearance of the pups, he speculated that they were likely born around late May. Silva-Taboada (1979) examined embryos in February, April, and May and identified the earliest date of birth as late May.

Lasiurus minor is considered “vulnerable” by the IUCN (2014) due to population decline and restricted geographic range. The solitary nature and high reliance on densely foliated trees for roosting makes *L. minor* susceptible to habitat changes, such as deforestation. Population surveys using multiple sampling techniques are required to formally assess the status of *L. minor* in The Bahamas and would greatly increase the available knowledge on the natural history of this species.

CONCLUSIONS

While most species of bat in The Bahamas are classified as “least concern” by the IUCN (2014), this may not be a good indicator of the local health of bat populations. The IUCN aims to prevent the global extinction of species and does not specifically assess local extinction risks (www.iucnredlist.org). Global extinction risk may not accurately reflect the conservation needs of regional populations. For example, *T. brasiliensis* is widespread in the Americas and is classified as a species of “least concern” (IUCN, 2014), but this classification may not reflect risk to populations in The Bahamas. IUCN classifications are more reflective of local conservation needs in the case of endemic species, like *C. tumidifrons*, which is limited to The Bahamas and is classified as “near threatened” (IUCN, 2014). Bat populations in The Bahamas may be at a greater risk than throughout the rest of their range, especially given the widespread distribution and abundance of some species on larger islands and the mainland. Bats represent two-thirds of the mammals in The Bahamas (excluding domesticated species; Buden, 1986). Local extinction of just one or two species will result in a significant loss of mammalian biodiversity on these islands.

Islands of the Great Bahama Bank support

more bat species (7 of 10 species) than islands of the Little Bahama Bank (6 of 10), Crooked and Acklins (5 of 10), Inagua (5 of 10), Mayaguana (3 of 10), and San Salvador (3 of 10; Table 1). Species richness does not seem to correlate with island area, but may reflect the effects of Pleistocene glacial-interglacial cycles on island area and habitat (Morgan, 1989). For example, the Abacos and Long Island are each inhabited by 6 of 10 bat species, while larger islands by area, like Andros and Inagua, are inhabited by 3 and 5 bat species, respectively. In the case of Inagua, it may be that there has not yet been enough sampling conducted on the island to categorize all of the bat diversity there. Habitat may also influence bat species diversity (Pregill & Olson, 1981). The Abacos and Grand Bahama in the north receive the highest rainfall, with the lowest mean annual rainfall recorded in southern islands of Crooked and Acklins, Mayaguana, and Inagua (Buchan, 2000). The habitat of southern islands is dominated by coppice and scrub vegetation, but lacks the pine woodlands and palmetto understory common in the northern Bahamas (Pregill and Olson, 1981). However, Grand Bahama has considerably fewer bat species (2 of 10) than Great Abaco (6 of 10), despite having similar habitat and rainfall. Perhaps distribution and availability of roosting habitat corresponds more closely with bat species diversity. Comprehensive information on locality of caves and use by bats is not known, but N. A. Albury in conjunction with other Bahamian collaborators is working to accumulate these data.

Sixteen species of fossil bats have been identified from cave deposits in Great Abaco, Andros, Cat Island, the Exumas, and New Providence (Morgan, 2001:table 1). Of these, only four (*Eptesicus fuscus*, *Erophylla sezekorni*, *Lasiurus minor* and *Macrotus waterhousii*) inhabit all of the Bahamian islands where they have been documented in the fossil record (Morgan, 2001; Soto-Centeno and Steadman, 2015). However, fossils of *L. minor* have only been documented from one locality on Great Abaco, so its historic range is unknown. *L. minor* is a tree-roosting species, so the paucity of data from the fossil record is not

surprising given all bat fossils collected in The Bahamas to date have come from caves and blue holes, which are inundated caves. Four species of bat (*Chilonatalus tumidifrons*, *Monophyllus redmani*, *Nyctiellus lepidus*, and *Tadarida brasiliensis*) were once more widespread in The Bahamas than they are today (Morgan, 2001:table 1). *M. redmani* is not found on any of the islands where fossils of this species have been documented and *C. tumidifrons* is found on one of the four islands it previously inhabited. There is no fossil evidence of *Artibeus jamaicensis* and *Noctilio leporinus*, which are currently only found on Inagua and Mayaguana. Fossil deposits have not been documented from these islands and it is possible that *A. jamaicensis* and *N. leporinus* have occupied these islands historically without colonizing other Bahamian islands. However, *A. jamaicensis* is documented from fossil and extant collections on Cuba, Jamaica, Hispaniola, and Puerto Rico (Morgan, 2001:table 1) and it is more likely that it recently colonized Inagua and Mayaguana. *N. leporinus* is known from fossil deposits on Cuba and Puerto Rico and is extant on these islands, as well as Jamaica and Hispaniola. As it has only been collected from a single locality in The Bahamas, but is widespread across the Greater Antilles, *N. leporinus* is likely also a recent colonizer.

Comparing the fossil record to current presence/absence data, the Bahamas lost more bat species than other islands of the West Indies (Morgan, 2001). Pleistocene glacial-interglacial cycles significantly altered the available habitat for terrestrial organisms in The Bahamas and these changes may have led to bat extinctions (Dávalos and Russell, 2012). However, recent evidence indicates human colonization of the West Indies played a driving role in bat extinctions (Soto-Centeno and Steadman, 2015). In the past, humans have been linked to other major extinctions in the West Indies (Steadman et al., 2005), and currently the effects of land development and habitat loss in The Bahamas are threatening the local extinction of several others. The Bahamian hutia (*Geocapromys ingrahami*, Order Rodentia) was once widespread and abundant across The Bahamas, but hunting by

native peoples likely caused their local extinction (Morgan, 1989). Extant populations are now limited to East Plana Cay (near Acklins Island) and introduced populations in the Exuma Land and Sea Park on Little Wax Cay and Warderick Wells Cay (Morgan, 1989). Increasing human populations and lack of habitat protection have also influenced the once widespread Bahamas Parrot (Order Psittaciformes: *Amazona leucocephala bahamensis*; Williams and Steadman, 2001; Russello et al., 2010). Where The Bahamas Parrot has been documented through fossils on Crooked and Acklins, New Providence, Long Island, Fortune Cay, and Grand Turk, it is currently limited to populations on Inagua and Great Abaco (Williams and Steadman 2001). As preservation of Bahamian terrestrial mammals, specifically bats, is dependent on minimizing human effects, engaging the public is key to successful conservation efforts.

Education and outreach have been used effectively in the past in The Bahamas to increase public awareness of and concern for pertinent conservation issues. One locally famous example is the “Size Matters” campaign implemented by Friends of the Environment and Rare Planet on Great Abaco (<http://www.friendsoftheenvironment.org/page-1/marine-resources/size-matters>). This program aimed to prevent further decline of the local spiny lobster (*Panulirus argus*) population by educating fishermen, restaurant owners, and the public on the negative effects of harvesting undersized lobsters. The insinuating logo, “Size Matters,” was printed on rulers that were handed out to fishermen, an educational song by a local musician (titled “Size Matters”) was played on the radio, and workshops were held to educate community members. Data on the health of the spiny lobster population is insufficient, but follow-up polling of community members indicates increased awareness of the problem. Outreach to increase public awareness has also been employed to aid conservation of mangroves (My Island, My Mangrove) and conch (Community Conch, www.communityconch.org). Presentations that we have conducted on Great Abaco, Grand Bahama, Eleuthera, Long Island, and New Providence have

focused on educating school children, providing information for employees of museums and nature centers, and updating community members on our research. J. A. Soto-Centeno has also created an informational brochure on the “Common Bats of the Bahamas,” which can be found online at the Friends of the Environment website (<http://www.friendsoftheenvironment.org/wp-content/uploads/2012/08/Bat-brochure.pdf>) and has been distributed to nature centers and museums on several islands. These efforts are motivated by our desire to change negative public perception of bats in The Bahamas through education and outreach designed to encourage public participation in conservation efforts.

Beyond the importance of public support, conservation of caves and coppice and evergreen forest habitat will protect roosting and foraging grounds used by all 10 species of Bahamian bats. National parks have been established for the purpose of maintaining these habitats in The Bahamas, but most parks are focused on Grand Bahama, the Abacos, New Providence and the Exuma Islands (excluding wetland parks). As each island is unique in terms of species composition, not all of the bat species in The Bahamas are protected by these national parks. The majority of the bat species diversity occurs south of the Little Bahama Bank (Grand Bahama and the Abacos; Table 1) and additional protected areas on the Great Bahama Bank, Crooked and Acklins, San Salvador, Inagua, and Mayaguana are necessary for preservation of the complete diversity of bats in this archipelago. Decreasing disturbance of cave ecosystems is also important to preservation of bat populations. It is common to find trash and graffiti in caves, indicating destructive human use of these ecosystems. In the past, most accessible caves were mined for guano as a commercial export and agricultural fertilizer. Unfortunately, guano was not sifted and much of the fossil record of The Bahamas was lost due to removal of sediments (Mylroie and Mylroie and, 2013). While guano mining is not currently a commercial venture in The Bahamas, guano continues to be harvested from caves on a small scale and can force bats

to abandon cave roosts. However, guano mining can be performed sustainably by minimizing the disturbance of bat roosting colonies (information available through IUCN, <http://www.batcon.org/pdfs/GuanoGuidelinesVersion1.pdf>). Human impact on bat habitat may be minimal on islands with fewer inhabitants, but human effects are likely to increase over time. By preserving roosting and foraging habitat used by bats, we can maintain the health of these populations in The Bahamas.

Few of the studies reviewed for this publication were conducted specifically on bat populations in The Bahamas. Given the unique climate, environmental pressures, and geologic history of these islands in comparison to other islands in the West Indies, it is necessary to conduct studies focused on bats in The Bahamas. Our current knowledge of Bahamian bat populations is based on observational information, and there have not been thorough examinations of the natural history, ecology, and genetic diversity of bats on these islands. The information reviewed in this publication can serve as a foundation from which future research can build. Minimal available data prevents accurate assessment of the health and trends of bat populations, making it difficult to develop specific conservation solutions. By consolidating, updating, and verifying all known locality and natural history information on bats in The Bahamas, areas of missing information are identified and can be targeted in future research. Through this research we will better our understanding of Bahamian fauna and increase public engagement in a shared initiative to preserve the natural biodiversity of these islands.

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Table 1. All Bahamian localities where bats have been collected, including museum where specimens are curated, collector, date collected, island, and latitude and longitude to two decimal places. Localities were taken from VertNet and consolidated where possible based on expert local knowledge and collector field notes. "Notes" column indicates all consolidated localities and provides additional information when available. We only show localities where the island is known. Latitude and longitude are only provided to two decimal places to preserve culturally sensitive locations. Museum abbreviations are: American Museum of Natural History (AMNH); Cornell Museum of Vertebrates (CUMV); Field Museum of Natural History (FMNH); Florida Museum of Natural History (FLMNH); University of Kansas Natural History Museum (KU); Louisiana State University Museum of Zoology (LSUMZ); Museum of Comparative Zoology (MCZ); Michigan State University Museum (MSU); Royal Ontario Museum (ROM); and United States National Museum, Smithsonian Institution (USNM).

Abaco Islands

Species present (6): *Chilonatalus tumidifrons*, *Eptesicus fuscus*, *Erophylla sezekorni*, *Lasiurus minor*, *Macrotus waterhousii*, and *Tadarida brasiliensis*

Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
Bahi		<i>Chilonatalus tumidifrons</i>				FMNH	G. M. Allen (1904)	Likely Israel's Point Cave
Casuarina	near Marsh Harbour	<i>Tadarida brasiliensis</i>	26.29	-77.09	WGS84	FLMNH, USNM	G. S. Morgan (1989)	Consolidated locality, abandoned building, coordinates are approximate
Cave 0.5 mi N of Hard Bargain, Mores Island		<i>Erophylla sezekorni</i>	26.32	-77.56	WGS84	AMNH	R. G. Van Gelder (1966)	Likely Sonny's Cave, but may also be Prophet's Cave, coordinates given for Sonny's Cave
Eight Mile Cave	0.5 km W of Flint Bay, 13 km N of Hole in the Wall; Abaco National Park	<i>Chilonatalus tumidifrons</i> , <i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i>	25.98	-77.20	WGS84	FLMNH, USNM	G. S. Morgan (1989), J. A. Soto-Centeno et al. (2009, 2011)	Sometimes confused with Hole in the Wall Cave
Golden Cave		<i>Chilonatalus tumidifrons</i>				FLMNH	I. Bethel (1985)	Likely Eight mile Cave and the collectors are probably I. Lothain and D. Bethel
Great Abaco		<i>Erophylla sezekorni</i>				KU, MCZ	G. M. Allen (1904)	Either Little Harbour Cave or Israel's Point Cave (Allen 1905)

Table 1. Continued

Abaco Islands (continued)								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
Green Turtle Cay, Normans Castle		<i>Erophylla sezekorni</i>	26.72	-77.45	WGS84	AMNH	R. G. Van Gelder (1966)	Likely refers to Norman's Castle, an abandoned settlement. Green Turtle Cay, now Treasure Cay, is the closest active settlement. Coordinates are provided for Norman's Castle.
Hole in the Wall Cave	3 mi W of imperial Lighthouse; Imperial Lighthouse Cave	<i>Chilonatalus tumidifrons</i> , <i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i>	25.86	-77.19	WGS84	AMNH, FLMNH	R. G. Van Gelder (1966), D. L. Reed et al. (2009), J. A. Soto-Centeno et al. (2009)	Sometimes confused with Eight Mile Cave, these are commonly used names for the same cave
Island Homes Cave	Long Bay Cave, 2 km N of Crossing Rocks, Island Homes Development	<i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i>	26.14	-77.19	WGS84	FLMNH, USNM	G. S. Morgan (1989), D. L. Reed et al. (2009), J. A. Soto-Centeno et al. (2009, 2011), Speer and Soto-Centeno (2013)	Consolidated locality
Israel's Point	Cave 7 mi from Marsh Harbour, Central Abaco; Great Abaco	<i>Chilonatalus tumidifrons</i> , <i>Erophylla sezekorni</i>	26.58	-77.15	WGS84	AMNH, MCZ	G. M. Allen et al. (1904)	Consolidated locality, see Allen (1905)
Little Abaco		<i>Tadarida brasiliensis</i>				MCZ	G. M. Allen et al. (1904)	Collected from a building on Little Abaco, settlement unknown (Allen 1905)
Little Harbour Cave	Cave at Hurricane Hole; Sitting Duck Cave; Central Abaco	<i>Erophylla sezekorni</i>	26.32	-77.00	WGS84	FLMNH, MCZ	G. M. Allen (1904), Speer et al. (2013)	Consolidated locality

Table 1. Continued

Abaco Islands (continued)								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
Lubber's Quarters		<i>Lasiurus minor</i>	26.49	-77.00	WGS84	FLMNH	N. A. Albury (2009)	
Marsh Harbour		<i>Tadarida brasiliensis</i>	26.54	-77.06	WGS84	MCZ	G. M. Allen (1904)	Collected from buildings in Marsh Harbour (Allen, 1905), coordinates provided for the settlement
near Marsh Harbour, Central Abaco		<i>Erophylla sezekorni</i>				MCZ	G. M. Allen et al. (1904)	Likely refers to Israel's Point Cave (Allen 1905)
Old Sugar Mill	Owens-Illinois Sugar Cane Processing Plant, Abandoned Building	<i>Eptesicus fuscus</i> , <i>Tadarida brasiliensis</i>	26.34	-77.09	WGS84	FLMNH, USNM	G. S. Morgan (1989), J. A. Soto-Centeno et al. (2011), Speer and Soto-Centeno (2013)	Consolidated locality
RBOR, the Ferry Parking Lot		<i>Lasiurus minor</i>	26.55	-77.04	WGS84	FLMNH	B. Sweeting and N. A. Albury (2011)	
		<i>Chilonatalus tumidifrons</i>				FMNH	Unknown	
Acklins Island								
Species present (5): <i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i> , <i>Monophyllus redmani</i> , and <i>Tadarida brasiliensis</i>								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
Atwood Harbour Cave	Cave near Atwood Harbour	<i>Tadarida brasiliensis</i>	22.72	-73.89	WGS84	LSUMZ	D. W. Buden (1972)	Consolidated locality
Duncan Pond Cave	SW Delectable Bay	<i>Erophylla sezekorni</i> , <i>Monophyllus redmani</i> , <i>Tadarida brasiliensis</i>	22.41	-73.99	WGS84	LSUMZ	D. W. Buden (1973)	

Table 1. Continued

Acklins Island (continued)						
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum Collector Notes
East Plana Cay, in cave		<i>Macrotus waterhousii</i>				LSUMZ G. Clough (1973)
Jamaica Bay, Salt Point		<i>Macrotus waterhousii</i>				USNM P. Bartsch (1930) Likely refers to a series of 3 caves in the region. Salina Point Cave or Nibbles Cave is the central and largest of these three caves.
Jumbie Hole	Cave between Snug Corner and Spring Point	<i>Eptesicus fuscus</i> , <i>Macrotus waterhousii</i> , <i>Monophyllus redmani</i> , <i>Tadarida brasiliensis</i>	22.49	-73.89	WGS84	LSUMZ D. W. Buden (1973) Consolidated locality
Andros						
Species present (3): <i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , and <i>Macrotus waterhousii</i>						
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum Collector Notes
2.5 mi S of Airstrip, Man-grove Cay		<i>Erophylla sezekorni</i>				KU A. Schwartz et al. (1968) Specimens collected from a cave (Timm and Genoways, 2003)
Ashton Cave, near surface		<i>Erophylla sezekorni</i>				FLMNH M. Langworthy (1981)
King's Cave #1	Morgan's Bluff Cave, Pleasant Harbour, Pleasant Island; Bat cave, .4 mi SSE of "New" Morgan's Bluff Road on "Old" Morgan's Bluff Road	<i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i>	25.15	-78.01	WGS84	FLMNH, MSU F. W. King (1964), J. D. Hall et al. (1974), R. Franz (1981) Consolidated locality, J. D. Hall collection may have been made in 1994

Table 1. Continued

		Andros (continued)				
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Notes
		<i>Macrotus waterhousii</i>				Likely collected from King's Cave #1 or nearby, see Northrop (1910)
Cat Island						
Species present (4): <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i> , <i>Nyctiellus lepidus</i> , and <i>Lasiurus minor</i>						
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Notes
3 km SE of Smith Bay		<i>Erophylla sezekorni</i>				MCZ
3 mi NE of Cutlass Bay, Cave		<i>Macrotus waterhousii</i>				Likely Stepwell Cave, 4 mi NE of Cutlass Bay
Brackenwell Cave	Bain's Town, E end of Cutlass Bay	<i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i>	24.15	-75.38	WGS84	Consolidated locality, see Timm and Genoways (2003) for cave description
Dumfries	Crown Cave	<i>Erophylla sezekorni</i>	24.61	-75.64	WGS84	Consolidated locality, coordinates are approximate
Industrious Hill Cave	4.1 mi N of Tea Bay, Cave	<i>Macrotus waterhousii</i>	24.46	-75.55	WGS84	Consolidated locality
James Cystern Cave		<i>Erophylla sezekorni</i> , <i>Nyctiellus lepidus</i>	24.67	-75.71	WGS84	Sometimes confused with Sheep Hill Cave, coordinates are approximate.
Man O'War Rock Caves, Orange Creek		<i>Erophylla sezekorni</i>	24.67	-75.76	WGS84	MCZ
Orange Creek		<i>Lasiurus minor</i> , <i>Macrotus waterhousii</i>				May be different from Man O'War Rock Caves

Table 1. Continued

Cat Island (continued)						
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Collector
seaside cave at Port Howe		<i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i>				D. W. Buden (1986)
Sheep Hill Cave, N side of Griffinland	Griffin Cave	<i>Erophylla sezekorni</i> , <i>Nyctiellus lepidus</i>	24.67	-75.71	WGS84	W. J. Clench et al. (1935)
		<i>Nyctiellus lepidus</i>			AMNH	L. M. Dávalos (2004)
Crooked Island						
Species present (5): <i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i> , <i>Monophyllus redmani</i> , and <i>Tadarida brasiliensis</i>						
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Collector
Cave between McCay's Bluff and Major's Cay		<i>Erophylla sezekorni</i>	22.75	-74.17	NAD27BAH	D. W. Buden (1972)
cave on north shore		<i>Erophylla sezekorni</i>			MCZ	T. Barbour and J. C. Greenway (1932)
Fortune Island, Albert Town, in church		<i>Tadarida brasiliensis</i>	22.60	-74.34	WGS84	D. W. Buden (1972)
Jingle Hill Cave	Cave between Turtle Sound and Cripple Hill	<i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i> , <i>Monophyllus redmani</i> , <i>Tadarida brasiliensis</i>	22.78	-74.25	WGS84	D. W. Buden (1972)
					LSUMZ	Long Cay was formally Fortune Island, coordinates are provided for the church that was in the center of the settlement
					LSUMZ	Consolidated locality

Table 1. Continued

Crooked Island (continued)								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
McKays Bluff Cave	Cave at McKay's Bluff	<i>Tadarida brasiliensis</i>	22.75	-74.17	NAD27BAH	LSUMZ	D. W. Buden (1972)	Consolidated locality
		<i>Tadarida brasiliensis</i>				LSUMZ	D. W. Buden (1972)	
Eleuthera								
Species present (4): <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i> , <i>Nyctiellus lepidus</i> , and <i>Tadarida brasiliensis</i>								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
Butter Hole Cave	2.1 mi SSE of Bannerman Town	<i>Erophylla sezekorni</i>	24.64	-76.17	NAD27BAH	FLMNH	D. L. Reed et al. (2011)	
Crigley Hill Cave	near Bannerman Town	<i>Macrotus waterhousii</i>	24.62	-76.16	NAD27BAH	FLMNH	D. L. Reed et al. (2011)	
Gregorytown		<i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i>	25.39	-76.56	WGS84	USNM	J. Riley (1903)	Coordinates provided for settlement, which is near many caves
Hatchet Bay Cave	Hatchet Bay Plantation; 7.25 mi S of Glass Window Bridge on Queen's HWY	<i>Erophylla sezekorni</i> , <i>Nyctiellus lepidus</i>	25.37	-76.52	NAD27BAH	FLMNH, KU	A. Schwartz and R. F. Klinikowski (1961), J. A. Soto-Centeno et al. (2010), D. L. Reed et al. (2011)	
Hector's Cave		<i>Erophylla sezekorni</i>	25.55	-76.60	WGS84	FLMNH	K. A. Speer and N. A. Albury (2013)	
Rock Sound Cave	0.6 mi S of Ocean Hole on Queens HWY, across from Rock Sound AME Church	<i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i>	24.85	-75.16	WGS84	FLMNH	J. A. Soto-Centeno et al. (2010)	

Table 1. Continued

Eleuthera (continued)								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
S Eleuthera, Wemyss Bight, John Miller's Town		<i>Nyctiellus lepidus</i>				MCZ	J. C. Greenway (1934)	Likely Thompson's Cave, coordinates unknown
Ten Bay Cave	3.3 mi S of Sea View Drive on Queens HWY	<i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i> , <i>Tadarida brasiliensis</i>	25.13	-76.15	WGS84	FLMNH	J. A. Soto-Centeno (2010), D. L. Reed et al. (2011), K. A. Speer and N. A. Albury (2013)	
Valentine Cave		<i>Erophylla sezekorni</i> <i>Macrotus waterhousii</i>	25.55	-76.71	WGS84	FLMNH USNM	K. A. Speer and N. A. Albury (2013) S. H. Derickson (1903)	
Exuma Islands								
Species present (5): <i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i> , <i>Nyctiellus lepidus</i> , and <i>Tadarida brasiliensis</i>								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
1 mi SW of Forest		<i>Eptesicus fuscus</i>				KU	A. Schwartz and J. R. Thomas (1966)	Likely Nursery Caves
3 mi W of Williams Town		<i>Eptesicus fuscus</i> , <i>Tadarida brasiliensis</i>				AMNH	K. F. Koopman and M. K. Hecht (1953)	Koopman et al. (1957) indicates this cave is near Williamstown
Cave 1 mi SSW of Forest Settlement		<i>Macrotus waterhousii</i>				KU	A. Schwartz and J. R. Thomas (1966)	Likely Nursery Caves
Darby Island, dry cave on SW side, Exuma Cays		<i>Macrotus waterhousii</i>	23.82	-76.19	WGS84	AMNH	G. B. Rabb and E. B. Hayden (1953)	Coordinates are approximate
Drydock Cave		<i>Tadarida brasiliensis</i>	23.47	-75.72	WGS84	FLMNH	K. A. Speer et al. (2014)	

Table 1. Continued

Exuma Islands (continued)								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
Forest Settlement	Nursery Caves	<i>Eptesicus fuscus</i>	23.57	-75.91	NAD27BAH	AMNH	K. F. Koopman and M. K. Hecht (1953)	Consolidated locality
Georgetown		<i>Eptesicus fuscus</i> , <i>Macrotus waterhousii</i>				AMNH	K. F. Koopman and M. K. Hecht (1953)	
Hog Pen Cave	2 mi E of the ferry	<i>Eptesicus fuscus</i> , <i>Tadarida brasiliensis</i>				AMNH	K. F. Koopman and M. K. Hecht (1953)	Consolidated locality, see Koopman et al. (1957)
Isaac's Cay	Isaac's Bay Cave	<i>Eptesicus fuscus</i> , <i>Macrotus waterhousii</i>	23.65	-75.95	WGS84	AMNH	K. F. Koopman and M. K. Hecht (1953)	Consolidated locality
Little Exuma, Christian Farm Cave; 1 mi S of Ferry		<i>Tadarida brasiliensis</i>				KU	A. Schwartz and J. R. Thomas (1966)	May be Pasture Cave, Boatyard Cave, or Drydock Cave, which are all very close to the old ferry
Pasture Cave	3 mi E of the ferry	<i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Nyctiellus lepidus</i>	23.46	-75.64	WGS84	AMNH, FLMNH	K. F. Koopman and M. K. Hecht (1953), Speer et al. (2014)	Consolidated locality, see Koopman et al. (1957)
Pigeon Cay	Turnaround Bay Cave	<i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i> , <i>Tadarida brasiliensis</i>	23.55	-75.88	NAD27BAH	AMNH, FLMNH	K. F. Koopman and M. K. Hecht (1953), K. A. Speer et al. (2014)	Consolidated locality
Robeson Cave	Little Exuma, SE of Forbes Hill; Forbes Hill Cave	<i>Eptesicus fuscus</i>				AMNH, KU	K. F. Koopman and M. K. Hecht (1953), A. Schwartz and J. R. Thomas (1966)	Consolidated locality

Table 1. Continued

Exuma Islands (continued)								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
Rolletown		<i>Eptesicus fuscus</i> ,				AMNH	K. F. Koopman and M. K. Hecht (1953)	Koopman et al. (1957) indicates this locality is a cave
		<i>Tadarida brasiliensis</i>						
Rolleville		<i>Tadarida brasiliensis</i>	23.67	-75.98	WGS84	AMNH	K. F. Koopman and M. K. Hecht (1953)	Collected from an old school house (Koopman et al., 1957), coordinates provided for Settlement of Rolleville
Grand Bahama Island								
Species present (2): <i>Erophylla sezekorni</i> and <i>Tadarida brasiliensis</i>								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
Arawak Hotel	7 mi E of Freeport, Abandoned Hotel, Royal Oasis Hotel	<i>Tadarida brasiliensis</i>	26.56	-78.56	WGS84	FLMNH	D. L. Reed et al. (2011), K. A. Speer et al. (2014)	
Ben's Cave, Lucayan National Park		<i>Erophylla sezekorni</i>	26.61	-78.40	NAD27BAH	FLMNH	K. A. Speer and J. A. Soto Centeno (2013)	Connected by passages to Burial Mound Cave
Burial Mound Cave, Lucayan National Park		<i>Erophylla sezekorni</i>	26.61	-78.40	WGS84	FLMNH	D. L. Reed et al. (2011)	Connected by passages to Ben's Cave
Shannon Golf Course	Garden of the Groves	<i>Erophylla sezekorni</i>	26.55	-78.57	WGS84	FLMNH	D. L. Reed et al. (2010), K. A. Speer et al. (2014)	Abandoned building

Table 1. Continued

Inagua						
Species present (5): <i>Artibeus jamaicensis</i> , <i>Erophylla sezekorni</i> , <i>Lasiurus minor</i> , <i>Macrotus waterhousii</i> , and <i>Noctilio leporinus</i>						
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum
2 mi N of Matthew Town		<i>Artibeus jamaicensis</i>				KU
						Collector: A. Schwartz and J. R. Thomas (1967) Notes: Specimens collected from a cave (Timm and Genoways, 2003)
7 mi NE of Matthew Town		<i>Macrotus waterhousii</i>				KU
						Collector: A. Schwartz and D. C. Leber (1960) Notes: Likely either Salt Pond Hill Cave or Maroon Hill Cave
8 mi N of Matthew Town, Windsor Lake		<i>Macrotus waterhousii</i>	21.05	-73.65	WGS84	KU
						Collector: A. Schwartz and J. R. Thomas (1967) Notes: Specimens collected from abandoned kiln building (Timm and Genoways, 2003)
Great Inagua		<i>Artibeus jamaicensis</i>				USNM
						Collector: P. Bartsch (1930)
Great Inagua		<i>Artibeus jamaicensis</i>				USNM
						Collector: G. C. Klingel (1938)
Great Inagua		<i>Erophylla sezekorni</i>				MCZ
						Collector: R. McLean and B. Shreve (1938)
In cave at Jackline, 12 miles east of Matthew Town		<i>Erophylla sezekorni</i>				MCZ
						Collector: R. McLean and B. Shreve (1938)
Little Inagua, sink hole, ca. 2 mi inland from NW point	Undercut solution hole inland from NW Point	<i>Artibeus jamaicensis</i>				LSUMZ
						Collector: D. W. Buden (1975, 1977) Notes: Consolidated locality, coordinates are approximate
Magnasite Barn	Abandoned building located in Matthew Town	<i>Macrotus waterhousii</i>	20.95	-73.68	WGS84	CUMV, FLNMH
						Collector: J. Wing (1962) Notes: Matthew Town
Maroon Hill Cave		<i>Macrotus waterhousii</i>	20.97	-73.58	WGS84	AMNH
						Collector: G. B. Rabb (1953)
Matthew Town		<i>Macrotus waterhousii</i> , <i>Lasiurus minor</i>				MCZ
						Collector: R. McLean and B. Shreve (1938)

Table 1. Continued

Inagua (continued)						
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum Collector Notes
Salt Pond Hill Cave	Cave 5.5 mi E of Mattew Town, near Salt Pond Hill; 89 km NNE of Cape Maisi (E Cuba); Matthew Town collected in cave	<i>Artibeus jamaicensis</i> , <i>Macrotus waterhousii</i> , <i>Noctilio leporinus</i>	20.95	-73.58	WGS84	AMNH, KU, LSUMZ, MCZ G. C. Klingel and W. Coleman (1931), R. McLean and B. Shreve (1938), G. B. Rabb and E. B. Hayden (1953), A. Schwartz and J. R. Thomas (1967), D. W. Buden (1972) Consolidated locality
		<i>Artibeus jamaicensis</i>				MCZ T. Barbour and J. C. Greenway (1933)
		<i>Artibeus jamaicensis</i>				USNM I. Dunbar (1963)
		<i>Lasiurus minor</i>				FMNH C. B. Cory (1901)
Long Island						
Species present (6): <i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Lasiurus minor</i> , <i>Macrotus waterhousii</i> , <i>Nyctiellus lepidus</i> , and <i>Tadarida brasiliensis</i>						
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum Collector Notes
Adderley's		<i>Macrotus waterhousii</i>				FMNH J. Pearson (1937)
Burnt Ground, N End		<i>Tadarida brasiliensis</i>				FMNH J. Pearson (1937)
Carlton's Hill Cave		<i>Macrotus waterhousii</i> , <i>Tadarida brasiliensis</i>				FMNH J. Pearson (1936)
Cave 2.25 mi SW of Clarendtown		<i>Tadarida brasiliensis</i>				MCZ W. J. Clench et al. (1935)
Cave at Tatmails		<i>Tadarida brasiliensis</i>				FMNH L. A. Hodsdon (1935)

Table 1. Continued

Long Island (continued)						
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum
Clarencetown		<i>Eptesicus fuscus</i>				MCZ
Fox's Cave, ca. 26 mi NW of Clarencetown		<i>Macrotus waterhousii</i>				FMNH, KU
Great Lakes Cave	Mortimer's, S end, 15 mi SE of Clarencetown; near Mortimer's; S Point	<i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i> , <i>Nyctiellus lepidus</i> , <i>Tadarida brasiliensis</i>	22.92	-74.86	WGS84	FLMNH, FMNH, KU, MCZ
Hamilton's Cave	Cartwright's Cave, 10 mi NW of Clarence Town; 14 mi NW of Clarence Town	<i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i> , <i>Nyctiellus lepidus</i> , <i>Tadarida brasiliensis</i>	23.12	-75.05	NAD27BAH	FLMNH, FMNH, KU, MCZ, USNM
Hillside Grocery Cave		<i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i> , <i>Tadarida brasiliensis</i>	23.35	-75.13	NAD27BAH	FLMNH
McKinnon's Cave	ca. 28 mi NW of Clarencetown; Whalehead	<i>Eptesicus fuscus</i> , <i>Tadarida brasiliensis</i>	23.40	-75.21	WGS84	FMNH, KU
Miller's Cave, ca. 30 mi NW of Clarencetown		<i>Nyctiellus lepidus</i>				FMNH, KU
Millerton		<i>Lasiurus minor</i>				FMNH

Notes

W. J. Clench et al. (1936)

J. Pearson (1936)
May be Salt Pond Cave

T. Barbour and J. C. Greenway (1934), J. Pearson (1936), D. L. Reed et al. (2012)

J. Riley (1903), L. A. Hodson (1935), W. J. Clench et al. (1936), J. Pearson (1936), D. L. Reed et al. (2010), K. A. Speer et al. (2014)

Consolidated locality

J. Pearson (1936)

Consolidated locality

J. Pearson (1936)

J. Pearson (1937)

Table 1. Continued

Long Island (continued)						
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum
Morris' Cave	ca. 32 mi NW of Clarencetown; Banana Hole	<i>Macrotus waterhousii</i>				FMNH, KU
Pinder's Hill, ca. 24 mi NW of Clarencetown		<i>Macrotus waterhousii</i> , <i>Nyctiellus lepidus</i> , <i>Tadarida brasiliensis</i>				FMNH, KU
Pinder's Settlement, ca. 24 mi NW of Clarencetown		<i>Macrotus waterhousii</i> , <i>Nyctiellus lepidus</i>				FLMNH, KU, UMMZ
Salt Pond Cave	Grotto Bay	<i>Tadarida brasiliensis</i>	23.34	-75.12	NAD27BAH	FLMNH
Salt Pond Cave, ca. 26 mi NW of Clarencetown		<i>Tadarida brasiliensis</i>				FLMNH
Simm's Church, Episcopal		<i>Eptesicus fuscus</i> , <i>Lasiurus minor</i>	23.48	-75.24	WGS84	FMNH
Stella Maris Cave		<i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i>	23.59	-75.27	WGS84	FLMNH
Valet Cave	Mimms Cave, near Dunmore; 4.9 mi SE of Clarencetown; Milley Cave	<i>Eptesicus fuscus</i> , <i>Macrotus waterhousii</i>	23.06	-74.92	WGS84	FLMNH
		<i>Erophylla sezekorni</i>				MCZ
		<i>Macrotus waterhousii</i>				MCZ

Notes

Consolidated locality

Consolidated locality

Specimens collected from a cave (Timm and Genoways, 2003)

There are two salt pond caves in close vicinity

Collected from one of the two Salt Pond Caves in close vicinity

Coordinates provided for Simms Settlement, St. Peter's Anglican Church

Consolidated locality

Table 1. Continued

Locality	Additional Descriptions	Long Island (continued)				Museum	Collector	Notes
		Species	Latitude	Longitude	Datum			
		<i>Macrotus waterhousii</i>				USNM	J. Riley (1903)	Miller (1905) says this locality is "a cave back of Clarence Harbor" Later in the same publication, he says Clarence Harbor is a town, so perhaps he means Clarencetown
		<i>Nyctiellus lepidus</i>				MCZ	J. V. Malone (1938)	
		<i>Tadarida brasiliensis</i>				MCZ	T. Barbour (1934)	
		<i>Tadarida brasiliensis</i>				USNM	J. Riley (1903)	Miller (1905) says "Mr. Riley procured sixty-one skins near Clarence harbor, Long Island... This species was found in a rather light cave about a mile and half back of Clarence Harbor, Long Island, and in the Hamilton cave, about five mi from the same town."
		<i>Tadarida brasiliensis</i>				USNM	Unknown (1903)	Collector is likely J. Riley
Christmas Hill Cave	Near site of former military base (in cave)	<i>Lasiurus minor</i>	22.35	-73.07	WGS84	LSUMZ	D. W. Buden (1972)	Consolidated locality

Table 1. Continued

Mayaguana

Species present (3): *Artibeus jamaicensis*, *Erophylla sezekorni*, and *Lasiurus minor*

Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
Low Point Hill Cave	Abraham's Hill Cave; cave E of Abraham's Bay; cave on top of Abraham's Hill	<i>Artibeus jamaicensis</i> , <i>Erophylla sezekorni</i>	22.39	-72.95	WGS84	AMNH, FMNH, LSUMZ, MCZ, USNM	P. Bartsch (1930), N. J. Clench et al. (1936), G. B. Rabb and E. B. Hayden (1953), D. W. Buden (1972)	Consolidated locality

New Providence

Species present (4): *Eptesicus fuscus*, *Erophylla sezekorni*, *Lasiurus minor*, and *Macrotus waterhousii*

Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
4 mi W of Nassau		<i>Erophylla sezekorni</i>				ROM	J. C. Barlow (1971)	Likely Hunt's Cave
Adelaide		<i>Erophylla sezekorni</i>				UMMZ	J. Van Tyne (1949)	
Caves Point Cave	Sea caves, W of Nassau; Cave Junction, Nassau	<i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i>	25.07	-77.45	WGS84	AMNH, KU	C. J. Maynard (1884), S. H. Hamilton (1902), A. Schwartz and J. R. Thomas (1966)	Consolidated locality, see Miller (1905)
Fort Charlotte	Nassau; in dungeon of Fort Charlotte (<i>Eptesicus fuscus</i>); in out-building (<i>Erophylla sezekorni</i>)	<i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , <i>Macrotus waterhousii</i>	25.08	-77.36	WGS84	AMNH, FLMNH, FMNH, KU, MCZ, USNM	C. Maynard (1894), S. H. Hamilton (1902), J. Riley (1903), G. M. Allen (1904), L. A. Hodsdon (1935), J. C. Dickinson (1958), A. Schwartz and R. Porter (1950)	Consolidated locality; see Allen (1905, 1937) and Miller (1905)

Table 1. Continued

New Providence (continued)								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
Hunt's Cave	0.5 mi S of Harold Pond; near Fort Charlotte	<i>Eptesicus fuscus</i> ,	25.03	-77.38	WGS84	AMNH,	H. Kennedy (1900),	Consolidated locality, this cave was leveled for quarry rock.
		<i>Erophylla sezekorni</i>				FMNH,	W. J. Clench et al. (1935), G. B. Rabb and E. B. Hayden (1953), J. C. Dickinson and M. Dickinson (1958)	
						FLMNH,		
						MCZ, USNM		
Nassau		<i>Eptesicus fuscus</i>				FMNH	C. B. Cory (1879)	
Nassau		<i>Eptesicus fuscus</i>				FLMNH, UMMZ	R. Porter (1950)	Likely Fort Charlotte or Caves Point Cave
Nassau		<i>Eptesicus fuscus</i>				USNM	Unknown (1886)	Likely collected by J. Benedict
Nassau		<i>Eptesicus fuscus</i>				USNM	Unknown (1886)	Likely collected by J. Benedict
Nassau		<i>Erophylla sezekorni</i>				AMNH, USNM	H. Kennedy (1900)	
Nassau		<i>Erophylla sezekorni</i>				FMNH, USNM	J. Benedict (1886)	Miller (1905) says "cave practically unexplored and not very long known, several miles back from Nassau" different from a "much better known cave somewhere back of Nassau" that likely refers to Cave Point Cave
Nassau		<i>Erophylla sezekorni</i>				USNM	Unknown (1886)	Likely collected by J. Benedict

Table 1. Continued

New Providence (continued)								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
Nassau		<i>Lasiurus seminolus</i>				MCZ	O. F. Bryant (1904)	This bat was caught after it flew inside a building (Allen 1905), coordinates given for Nassau; likely <i>L. minor</i> , not <i>L. seminolus</i>
Nassau		<i>Macrotus waterhousii</i>				FMNH	C. B. Cory (1879)	
Nassau		<i>Macrotus waterhousii</i>				USNM	C. K. Brace	accessioned at USNM in 1882
near Nassau		<i>Erophylla sezekorni</i>				FMNH	W. J. Clench (1935)	
West end		<i>Eptesicus fuscus</i>				AMNH	R. M. West (1971)	
Winton		<i>Macrotus waterhousii</i>	25.04	-77.26	WGS84	AMNH	S. H. Hamilton (1902)	-
San Salvador								
Species present (4): <i>Chilonatalus tumidifrons</i> , <i>Eptesicus fuscus</i> , <i>Erophylla sezekorni</i> , and <i>Macrotus waterhousii</i>								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
0.5 km S of Graham's Harbour		<i>Erophylla sezekorni</i>				USNM	S. L. Olson et al. (1981)	Specimens were mist-netted between Graham's Harbour and Reckley Hill Settlement; coordinates are approximate
4.2 mi N of Cockburn Town		<i>Erophylla sezekorni</i>				KU	A. Schwartz and J. R. Thomas (1966)	Timm and Genoways (2003) says specimens were "netted in a formal garden."

Table 1. Continued

San Salvador (continued)								
Locality	Additional Descriptions	Species	Latitude	Longitude	Datum	Museum	Collector	Notes
6.9 mi NE of Cockburn Town		<i>Erophylla sezekorni</i>				KU	A. Schwartz and J. R. Thomas (1966)	Timm and Genoways (2003) says specimens were "netted in a formal garden."
9 mi S of Cockburn Town		<i>Eptesicus fuscus</i>	23.95	-74.52	WGS84	KU	A. Schwartz and J. R. Thomas (1966)	Coordinates provided for abandoned church, see Timm and Genoways (2003)
Alter Cave	Sandy Point, Watling's Island	<i>Chilonatalus tumidifrons</i> , <i>Erophylla sezekorni</i>	23.95	-74.56	WGS84	FLMNH, USNM	J. Riley (1903), S. Olson et al. (1981), D. L. Reed et al. (2012)	Consolidated locality, see Miller (1905)
Cockburntown		<i>Eptesicus fuscus</i>	24.05	-74.53	WGS84	MCZ	T. Barbour (1934)	T. Barbour took <i>E. fuscus</i> from an old church in February 1934 (Olson et al. 1990), coordinates are provided for the oldest church in Cockburntown
Lighthouse Cave		<i>Chilonatalus tumidifrons</i>	24.10	-74.45	WGS84	FLMNH	D. L. Reed et al. (2012)	
Major's Cave at Hoy Cay		<i>Erophylla sezekorni</i>	24.07	-74.52	WGS84	FLMNH	D. L. Reed et al. (2012)	
North Victoria Hill	Garden Cave	<i>Chilonatalus tumidifrons</i>	24.11	-74.46	WGS84	USNM	P. Bartsch (1923)	Unable to identify locality, coordinates provided for Victoria Hill settlement
		<i>Chilonatalus tumidifrons</i>				USNM	S. Derickson (1903)	Likely collected from Alter Cave
	Likely collected by J. Riley and S. Derickson	<i>Macrotus waterhousii</i>				USNM	Unknown (1903)	

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