Journal of Threatened Taxa

Building evidence for conservation globally

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

COMMUNICATION

THE BAT FAUNA (MAMMALIA: CHIROPTERA) OF THE UNITED ARAB EMIRATES: A REVIEW OF PUBLISHED RECORDS AND MUSEUM SPECIMENS WITH CONSERVATION NOTES

J. Judas, Gabor Csorba & Petr Benda

26 March 2018 | Vol. 10 | No. 3 | Pages: 11379-11390
10.11609/jott.3096.10.3.11379-11390

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 March 2018 | 10(3): 11379–11390

COMMUNICATION

The bat fauna (Mammalia: Chiroptera) of the United Arab Emirates: a review of published records and museum specimens with conservation notes

J. Judas [1], Gabor Csorba [2] & Petr Benda [3]

[1] EWS-WWF, P.O. Box 454891, Dubai, United Arab Emirates
[2] Hungarian Natural History Museum, H-1088 Budapest, Baross u. 13, Hungary
[3] Department of Zoology, National Museum (Natural History), Václavské nám. 68, 115 79 Praha 1 & Department of Zoology, Charles University, Viničná 7, 128 44 Praha 2, Czech Republic
[1] jjudas@ewswwf.ae (corresponding author), [2] csorba@nhmus.hu, [3] petr_benda@nm.cz

ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

Abstract: The bat fauna of United Arab Emirates (UAE) has so far received very little attention. This paper presents a review of published records and voucher specimens in museum collections. We reviewed 39 references and identified 116 records concerning nine species belonging to five families. Fifteen of these records mention 71 specimens of six species in collections. Distribution maps of known locations are provided for each species. Most records (70%) date back more than 10 years and two species have not been recorded for more than 40 years. Based on the bat fauna of Oman, a more thoroughly investigated neighbouring country, the presence of at least nine other, still unrecorded, species is expected. The status of bats in UAE and their conservation concerns are discussed. We encourage further field studies of the bat fauna of UAE.

Keywords: Distribution, literature review, museum specimens, UAE.

DOI: http://doi.org/10.11609/jott.3096.10.3.11379-11390 | **ZooBank:** urn:lsid:zoobank.org:pub:4394B1A0-3760-4577-A609-2C8636FBD8EA

Editor: Paul Racey, University of Exeter, UK. **Date of publication:** 26 March 2018 (online & print)

Manuscript details: Ms # 3096 | Received 18 October 2016 | Final received 02 February 2018 | Finally accepted 08 March 2018

Citation: Judas, J., G. Csorba & P. Benda (2018). The bat fauna (Mammalia: Chiroptera) of the United Arab Emirates: a review of published records and museum specimens with conservation notes. *Journal of Threatened Taxa* 10(3): 11379–11390; http://doi.org/10.11609/jott.3096.10.3.11379-11390

Funding: The Mohammed bin Zayed Species Conservation Fund (grant project 162513649)

Competing interests: The authors declare no competing interests.

Author Details: Jacky Judas, Manager & Scientific Advisor - Terrestrial Biodiversity , Emirates Wildlife Society - World Wide Fund for Nature (EWS-WWF), Dubai, UAE. Gabor Csorba, Deputy General Director, Hungarian Natural History Museum, Budapest, Hungary. Petr Benda, Research Curator, Department of Zoology, National Museum , Prague, Czech Republic.

Author Contribution: JJ: data collection, analysis, writing and mapping. GC: data collection, writing. PB: advices, reviews and corrections.

Acknowledgements: The authors are much grateful to the two anonymous reviewers for their valuable comments and to the Mohammed bin Zayed Species Conservation Fund, for providing funding that help initiating further bats research in the UAE.

INTRODUCTION

Rare are the reports of naturalists' observations and wildlife records in the United Arab Emirates before the 1950s. Only a few foreign early travellers took note of the most noticeable fauna and flora species or initiated some wildlife specimen collection (Thomas 1932; Thesiger 1959). Only in the mid 20th century, the fauna of the territory that would become the United Arab Emirates in 1971, began to receive attention from foreign expatriates or visitors. Bats were no exception, but even today, have still received very little attention, presumably in relation to their cryptic life, difficulties of field investigations, and the apparent low species diversity and abundance compared to other parts of the world. Most knowledge on bat species diversity comes from the surveys conducted by David Harrison in 1953–1955 and 1975 (Harrison & Bates 1991; Harrison 1955). Only few additional records have been published in the following decades and only the Particolored Bat *Vespertilio murinus* has been lately added to the species list of bat fauna established by Harrison (Monadjem et al. 2016).

Despite growing concern for environmental conservation in national institutions, the consequences of economic development on wildlife populations are still either not recognized or under-estimated. Field surveys data, well-designed long-term population monitoring programmes and a centralized biodiversity database at the country scale are still largely deficient. Given the data scarcity on the bat fauna of UAE, their population status and trends, how they are impacted by environmental changes is unknown. Bat species diversity might even be greater than currently assessed.

MATERIAL AND METHODS

We reviewed museum specimens and published records (including journals, articles, books and internet pages) to collect species occurrences, map distributions, highlight the gap in data, and stimulate further field investigations in order to better assess the conservation status of the species concerned. We considered as a record every mention of a species per site. Information on the sites and period of collection of museum specimens was also included in counts of record: a site of collection during the period of survey or study, as indicated in the literature, was counted as a single record for each species. All records were geo-referenced with as much precision as allowed by the information provided by authors. Species distributions were mapped, distinguishing locations already considered by Harrison & Bates (1991) from newer locations, collected in the last 25 years (Fig. 1.). The main natural history museums holding a bat collection have been approached to inquire about their possession of specimens from UAE. Voucher specimens collected from UAE are preserved or deposited in the Harrison Institute (HZM) - Sevenoaks, United Kingdom; Natural History Museum (BMNH) - London, United Kingdom; Zoologisches Forschungsmuseum Alexander Koenig (ZFMK) - Bonn, Germany; Hungarian Natural History Museum (HNHM) - Budapest, Hungary. References of museum specimens were obtained from literature (Harrison 1964; Harrison & Bates 1991; van Cakenberghe & de Vree 1994) or communicated by the HNHM.

The taxonomic nomenclature used follows Wilson & Reeder (2005) with the exception of *Rhyneptesicus nasutus* after the revision of Juste et al. (2012).

RESULTS

The review of published observations and specimens in collections allowed the identification of 116 records concerning nine species (Table 1). Of these, 60 (51%) were original records; all others being quotes or repetitions of previously published records. For example, six publications mentioning the presence of *Triaenops persicus* in UAE (Harrison & Bates 1991; Duckworth 1996; Aspinall et al. 2005; Drew et al. 2005; AGEDI 2008; Tourenq et al. 2009), cite the same single original record represented by eight voucher specimens (Harrison 1955). Among the 117 records, 15 referred to 71 specimens of six species that are kept in museum collections. Of the 60 original records, 42 (70%) dated more than 10 years back with an average of 7.5±6.7 records per 10 years (n=8) since the 1940s. This review brings an addition of 43 new records (Table 1) to the synthesis published by Harrison & Bates (1991).

List of species

Egyptian Rousette *Rousettus aegyptiacus* (E. Geoffroy, 1810)

A total of 13 original records of the Egyptian Fruit Bat (Image 1) in UAE have been published. Except for two sightings in Abu Dhabi City in 1998, all other records are from the broad border or in the Hajar Mountains on the eastern part of the country. In these locations, Egyptian Fruit Bats are recorded in gardens, orchards or other plantations, that they frequent for feeding, like in Al Ain,

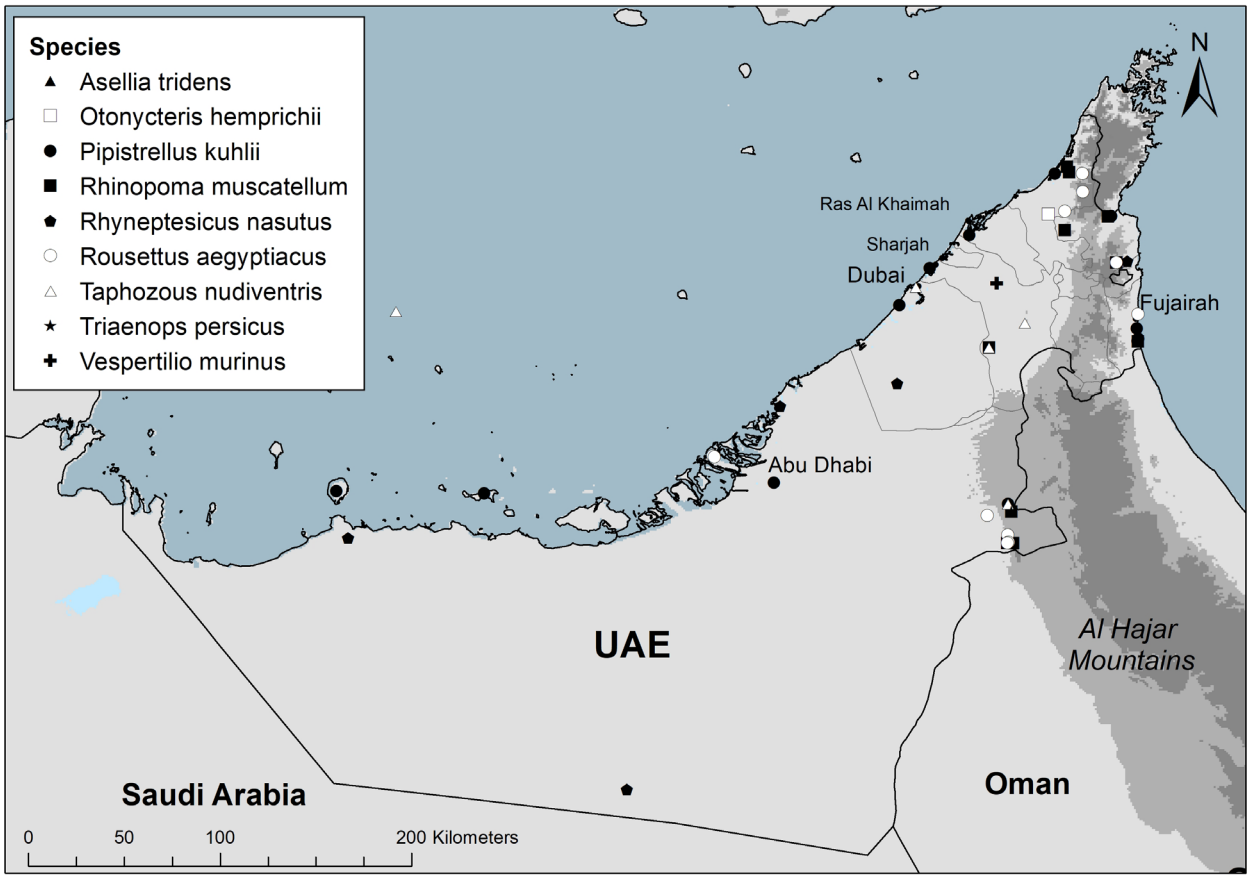

Figure 1. Distribution map of bats known from the United Arab Emirates

Table 1. Summary of number of literature records, locations and independent records per decades per species

Species	Literature records	Locations	Independent records				
			Before 1990	1990–1999	2000–2009	After 2010	All years
Rousettus aegyptiacus	14	13	1	6	4	2	13
Rhinopoma muscatellum	27	14	1	5	4	5	15
Asellia tridens	13	3	2			1	3
Triaenops persicus	6	1	1				1
Taphozous nudiventris	14	5	4		1		5
Vespertilio murinus	1	1				1	1
Rhyneptesicus nasutus	12	6	1	2	2	2	7
Pipistrellus kuhlii	25	13	4	3	5	2	14
Otonycteris hemprichii	4	1	1				1
	116	**57**					**60**

but benefit from the vicinity of the mountains, where they can shelter in caves or rock clefts.

Records: Abu Dhabi Emirate: Abu Dhabi, Manhal Palace Nursery, 20 November 1998: one individual observed, one individual found dead and collected (Hellyer 1999). Abu Dhabi, mango orchard in the city

Image 1. Egyptian Rousette *Rousettus aegyptiacus*

centre, November 1998: observation of two individuals (Aspinall et al. 2005). Al Ain, Faculty of Medicine and Health Sciences, Emirates University, 18 January 1999: one dead individual collected (Hellyer 1999). Al Ain, around town in gardens and orchards (Hellyer 1999; Aspinall et al. 2005; AGEDI 2008). Al Ain, Green Mubazarrah, March–April 2003: numerous specimen flying around date plantations (Drew & Al Dhaheri 2003) - Jebel Hafit, December 2003: one dead individual (Drew & Drew 2004; AGEDI 2008). Jebel Hafit, Ain Al Waal, 11 March 2015: one individual was photographed (Roberts 2015). Fujairah Emirate: Fujairah, present (Aspinall et al. 2005). Wadi Wurayah National Park, recorded twice between 2013 and 2015 (Judas 2016). Ras Al Khaimah Emirate: Khatt, 1991: one individual impaled on a barbed wire fence (Brown 1991). – Wadi Naqab, near Khatt, large limestone cave, 10 April 1992: observed a colony of 85–100 individuals (Hellyer 1992b). Ras al-Khaimah peninsula, 1972: a mummy (Harrison 1981); "M.D. Gallagher recovered a mummified specimen from a cave in the mountains of Ras al Khaimah" (Harrison & Bates 1991: 25). Ras' al-Khaimah: presence mentioned (Aspinall et al. 2005).

Small Mouse-tailed Bat *Rhinopoma muscatellum* (Thomas, 1903)

All 15 records of the Muscat Mouse-tailed Bat come from the Hajar Mountains, or isolated rocky outcrops, like in Qarn Nazwa, a newly established protected area in Dubai (Image 2), where the species roosts in caves or enlarged cracks in the rocks. They have been recorded in association with Egyptian Fruit Bat, and Naked-bellied Tomb Bat.

Records: Abu Dhabi Emirate: Al Ain, Buraimi Oasis, August to October 1953: collection of seven individuals: 31 August 1953: collected one female, one individual, 7 September 1953: collected one female, 8 September 1953: collected one female, 21 September 1953: collected one female, 3 October 1953: collected one male, one female, HZM (Harrison 1955, 1964, 1981; Harrison & Bates 1991; van Cakenberghe & de Vree 1994; Duckworth 1996); Jebel Hafit, Kahf Hamam, small cave, December 1997: observed one individual (Fogg et al. 2002); Jebel Hafit, 150 individuals observed roosting in a cave [photo] (Drew & Al Dhaheri 2003); Jebel Hafit, present on western and eastern flanks (Stuart & Stuart 1998, Drew & Drew 2004; Aspinall et al. 2005; Drew et al. 2005); Jebel Hafit, echolocation calls recorded by D. Gardner (Anonymous 2010), Jebel Hafit, Ain Al Waal, 23 March 2015: one individual was photographed; 22 April 2015: one individual was photographed (Roberts 2015); Dubai Emirate: Qarn Nazwa, present (Aspinall et al. 2005); Fujairah Emirate: Near Dibba, 2 April 1992: collected one male, one female (ZFMK 92.130, 92.131);

Image 2. Portrait of *Rhinopoma muscatellum* (Wadi Wurayah National Park, Fujairah Emirate), a typical inhabitant of the desert mountains of the region

Wadi Wurayah National Park: recorded during a EWS-WWF survey (Tourenq et al. 2009), present in a small number in a cave all year long (Judas 2016); 9 November 2015: collected one male, two females (HNHM 25488-25490); Ras Al Khaimah Emirate: Al Khatt, 10km south of, one individual collected, HZM (Harrison & Bates 1991, van Cakenberghe & De Vree 1994, Aspinall et al. 2005); 4km south of Rams, 12 individuals collected, HZM (van Cakenberghe & De Vree 1994); Ras al-Khaimah, present in caves (Harrison 1981); Ras Al Khaimah, two individuals collected, HZM (Harrison & Bates 1991, Van Cakenberghe & De Vree 1994, Aspinall et al. 2005); Sharjah Emirate: Khor Kalba, presence (Aspinall et al. 2005); UAE: most common (Gross 1987).

Geoffroy's Trident Leaf-nosed Bat *Asellia tridens* (E. Geoffroy, 1813)

Geoffroy's Trident Leaf-nosed Bat (Image 3) was recorded in important numbers, roosting in the 'falaj' (traditional irrigation system) of Al Ain oasis or in old buildings of Sharjah in the mid-fifties. The species remained unrecorded for nearly 50 years, until the discovery of a few individuals roosting in a cave at the bottom of Jebel Hafeet in 2015. One of the authors (JJ), found a dead individual, hit by a car along a tree-bordered avenue of Al Ain in 2005.

Records: Abu Dhabi Emirate: Al Ain, Al Ain oasis, water falaj tunnel, August to September 1953: observation of many hundreds of individuals, collection of eight: 31 August 1953: collected one male, 5 September 1953: collected one female, 8 September 1953: collected one female, 19 September 1953: collected two males, 8 June 1954: collected two males, one female, HZM (Harrison 1955, 1964; Harrison & Bates 1991; Duckworth 1996; Aspinall et al. 2005; Drew et al. 2005; AGEDI 2008); Jebel Hafit, Ain Al Waal, 16 March 2015: observed two individuals. [photo], 23 March 2015: observed one individual [photo], 20 April 2015: observed two individuals [photo], 29 April 2015: observed one individual [photo] (Roberts 2015); Sharjah Emirate: Sharjah, Trucial Oman, July 1954: "found in numbers… flighting out from Sharjah town at dusk across nearly a mile of barren desert to the vicinity of the airfield", collected three individuals: 9 July 1954: collected one female, 15 July 1954: collected two females, HZM (Harrison 1955, 1964; Harrison & Bates 1991; Aspinall et

Image 3. Geoffroy's Trident Leaf-nosed Bat *Asellia tridens*

Image 4. *Vespertilio murinus* - Budapest

al 2005); UAE: abundant, occurring wherever there are suitable habitats (Harrison 1981; Gross 1987).

Persian Leaf-nosed Bat *Triaenops persicus* (Dobson, 1871)

The Persian Leaf-nosed Bat is only known from a single record of few individuals by Harrison (1955) in the falaj of Al Ain, where it was observed in association with Geoffroy's Trident Leaf-nosed Bat, but in much lower numbers. The species has never been recorded again in UAE for more than 60 years.

Records: Abu Dhabi Emirate: Al Ain, Al Ain Oasis, water falai tunnel, 3–24 September 1953: collected eight individuals (Harrison 1955; Duckworth 1996; Harrison & Bates 1991; Aspinall et al. 2005; Drew et al. 2005; AGEDI 2008).

Naked-rumped Tomb Bat *Taphozous nudiventris* (Cretzschmar, 1830)

This might be more widely distributed in UAE, in the Hajar Mountains in particular, than suggested by the five published records. Only one permanent colony is definitely known in the Qarn Nazwa Protected Area of Dubai, where its presence is well known by UAE naturalists. The subspecies present in eastern UAE, was originally referred to *T. n. zayidi* Harrison, 1955 (Harrison & Bates, 1991), currently considered rather a synonym of *T. n. nudiventris* (Benda et al. 2006), while the specimen found on Das Island has been identified as *T. n. magnus*, known from Iraq, Iran, Syria and Turkey (Benda et al. 2006).

Records: Abu Dhabi Emirate: Al Ain, Buraimi Oasis, 30 August to 29 September 1953: collected eight individuals: 30 August 1953: collected one female, 9 September 1953: collected one male, one female, 16 September 1953: collected one male, one female, 23 September 1953: collected one male, 29 September 1953: one male, one female, HZM (Harrison 1955, 1964; Harrison & Bates 1991; Duckworth 1996; Aspinall et al. 2005); Al Ain, present (Stuart & Stuart 1998 in Drew et al 2005; AGEDI 2008); Das Island, Power Station, 21 December 1986: one individual found dead, HZM (Brown 1988; Hellyer 1988, 1989; Harrison & Bates 1991; Duckworth 1996; Aspinall et al. 2005; AGEDI 2008); Dubai Emirate: Dubai, Al Ghurair Centre, early 1987: one individual found dead (Brown 1988; Hellyer 1989); Qarn Nazwa, 18 April 2009: one individual was photographed (Gardner 2009; Anonymous 2010); Sharjah Emirate: Jebel Faiyah, Trucial Oman (Harrison 1977; Harrison & Bates 1991; Aspinall et al. 2005).

Particolored Bat *Vespertilio murinus* (Linnaeus, 1758)

The Particolored Bat is the most recent and only addition to the bat fauna of UAE, since the surveys of Harrison (1955). The dead specimen found in Sharjah was presumably a migrant (Image 4). This species has a large palearctic distribution and known as long distances migrant. The closest records from UAE are in the Zagros Mountains of Iran, attributed to migrating individuals (Benda et al. 2012).

Record: Sharjah Emirate: Breeding Centre for Endangered Arabian Wildlife, 13 May 2014: collected one individual (Monadjem et al. 2016).

Sind Bat *Rhyneptesicus nasutus* (Dobson, 1877)

The seven records of Sind Bat are spread all over UAE from the western region of Abu Dhabi to the Hajar Mountains on the eastern coast, and down to Liwa oasis at the border of the Rub-Al Khali Desert (Image 5). The occupied habitats are diverse, including desert oasis, coastal outcrops, artificial tree lines and mountain wadi.

Records: Abu Dhabi Emirate: inland from Ras Ghanadha, watering crevices in sandstone cliff, may 1993: observed ca. 20 individuals in a roost (Duckworth 1996; Aspinall et al. 2005; AGEDI 2008); Ruwais, 12 November 1991: collected one individual captured with mistnet (Hellyer 1992a; Duckworth 1996; Aspinall et al. 2005; AGEDI 2008), still regularly observed in subsequent years (Aspinall et al. 2005); Shah oilfield, in the deep sands south of the Liwa arc, March 2003 (Aspinall et al. 2005); Dubai Emirate: Bab Al Shams, March 2014: four individuals found under stones (Khan 2014); Fujairah Emirate: Wadi Wurayah National Park: 9 November 2015: collected one male (Judas 2016, HNHM 25491) Sharjah Emirate: Sharjah, Trucial Oman Coast, one juvenile (Sanborn 1956 [as *Eptesicus* sp., "[it] may represent *E. matschie*"]).

Kuhl's Pipistrelle *Pipistrellus kuhlii* (Kuhl, 1817)

Kuhl's Pipistrelle is presumably the most widespread species in UAE, and one of the most abundant. Most records were obtained in coastal areas of all emirates except Ajman, including islands (Image 6), but the species is also present inland as illustrated by the records in Al Ain.

Records: Abu Dhabi Emirate: Abu Dhabi, 19th Street, 25 March 2008: det. a foraging individual (Anonymous 2010); Al Ain Oasis, collected four individuals: 29 August 1953: collected one male, 24 September 1953: collected one female, HZM (Harrison 1955, 1964; Duckworth 1996; Aspinall et al. 2005; AGEDI 2008); Island of Marawah, Abu Dhabi (Aspinall et al. 2005); coastal areas

Image 5. *Rhyneptesicus nasutus* - UAE

Image 6. *Pipistrellus kuhlii* - UAE

(AGEDI 2008) - Jebel Hafeet, recorded during ENHG and ERWDA surveys (Drew & Al Dhaheri 2003, AGEDI 2008); Sir Bani Yas island, contacted with bat detector (Anonymous 2010); Dubai Emirate: recorded (Jongbloed et al. 2001; Aspinall et al. 2005); Jumeirah, 15 individuals in roof of veranda, six captured and released (Judas & Tourenq 2007); Fujairah Emirate: Dibba, Wamm Farms, 7 November 2015: coll three male (HNHM 25485-25487); Ras Al Khaimah Emirate: Ras Al Khaimah, no details, HZM (Harrison 1972); Sharjah Emirate: Kalba, 19 May 1946: two male, two females, BMNH (Harrison 1964; Harrison & Bates 1991; Aspinall et al. 2005); Sharjah, May to July 1954: observed many hundreds flighting individuals, collected eight individuals, 29 September 1953: collected one female, 8 April 1954: collected one male, 24 May 1954: collected two females, 4 June 1954: collected one male, HZM (Harrison 1955, 1964, Harrison & Bates 1991, Aspinall et al. 2005); Khor Kalba, 29 October 1993: collected one male (HNHM 97.33.9.); Khor Kalba, abandoned fish factory, 26 June 1997: collected three male (ZFMK 97.578–97.580); Umm Al Quwaim Emirate: 30 October 1993: collected one male (HNHM 97.33.8.); UAE: numerous localities (Harrison 1981).

Hemprich's Desert Bat *Otonycteris hemprichii* (Peters, 1859)

The species was recorded only once in UAE in Ras Al Khaimah, and identified from skulls collected in the pellets of a bird of prey.

Records: Ras Al Khaimah Emirate: Ras al Khaimah, Trucial Oman, April 1972: "two skulls […] found in the pellets of a raptor in a cave", HZM (Harrison 1977); Ras al-Khaimah, some skulls in the pellets of birds of prey (Harrison 1981; Harrison & Bates 1991; Hornby 1996; Cunningham 2004; Drew et al. 2005; Aspinall et al. 2005; AGEDI 2008).

DISCUSSION

Published records are not systematically well geo-referenced and the information provided by authors varied from very accurate description of the sites to mention only of the approximate area in which the species was recorded, limiting the accuracy of the location to more than 10km in some cases. An important part of the records from Harrison's collections in 1953 that initiated the characterization of the bat fauna of UAE, were referred to Buraimi - Al Ain oasis, which was at that time in Oman in its broader sense. Since this expedition, the area has seen profound environmental changes along with urban development, and with the establishment of the United Arab Emirates in 1971, was split between UAE and the Sultanate of Oman, which questions in which present country the records were obtained. Most recent authors have considered these records being from UAE, except van Cakenberghe and de Vree (1994), who placed them in Oman.

This review includes 116 records of nine species, of which 60 are original records, others being citations of previously published accounts. Three species are known from only one record: the records of Persian Leaf-nosed Bat *Triaenops persicus*, the Hemprich's Long-eared Bat *Otonycteris hemprichii* date back from 63 and 44 years respectively, whereas the Particolored Bat *Vespertilio murinus* was found only recently (Monadjem et al. 2016). Their actual presence in UAE cannot currently be ascertained.

This paper overviews the records collected over a period of 70 years, the first one from 1946, and highlights. the poor knowledge we still have on the bat fauna of UAE. Considering distribution data and occurrence in neighbouring countries (Nader 1990; Harrison & Bates 1991; Davis 2007; Benda et al. 2012), other species are expected to be present in UAE. Rhinolophids are likely to be found in Al Ain, since undated bones were discovered in a cave of Jebel Hafeet (Fogg et al. 2002), and an unconfirmed record of a Lesser Horseshoe Bat *Rhinolophus hipposideros* recently contacted with a bat detector was raised to our attention (J. Smithson, pers. comm. 2015). Geoffroy's Horseshoe Bat *Rhinolophus clivosus* is also known to occur in eastern Yemen and eastern Saudi Arabia. Blasius's Horseshoe Bat *Rhinolophus blasii*, the Egyptian Mouse-tailed Bat *Rhinopoma cystops*, the Egyptian Tomb Bat *Taphozous perforatus*, the Common Slit-faced Bat *Nycteris thebaica*, Botta's Serotine Bat *Eptesicus bottae*, Geoffroy's Myotis *Myotis emarginatus*, and the Egyptian Free-tailed Bat *Tadarida aegyptiaca* are all known from Oman in similar habitats found in UAE. The Arabian Pipistrelle *Hypsugo arabicus*, described in 1979 from specimens caught in wadis of northern Oman, initially considered as an endemic of the Hajar Mountains but subsequently recorded in Baluchistan, southern Iran (Benda et al. 2002) likely also occurs in the UAE.

All bats species recorded in UAE are listed as Least Concern at the international scale on the IUCN Red List of Threatened Species (IUCN 2017). Their status, however, distribution and trends at the regional scale stayed largely unknown and unassessed. In the first Red List of Mammals of UAE (Hornby 1996), all species

were listed as Data Deficient except the Egyptian Fruit Bat which was listed as Vulnerable. This list included the Arabian Pipistrelle *Hypsugo arabicus*, indicating that although lacking any confirmed record, its presence was suspected. In a further national Red List status assessment for the Emirate of Abu Dhabi, all species were still listed as Data Deficient, except Kuhl's Pipistrelle, which was listed as Least Concern (Drew & Tourenq 2005). Knowledge on bats' distribution and abundance has improved little since the publication of these national red lists, and in the absence of additional dedicated surveys, the status of all bat species in UAE should still be considered as Data Deficient.

In UAE, the wealth brought by oil revenues resulted in substantial development of infrastructures and agriculture, along with dramatic changes of life style and human population increase in just a few decades (Tourenq & Launay 2008). With the numerous threats and major direct impacts this fast pace of development brings to bear on the natural environment (habitat loss, fragmentation, over-grazing, occasional hunting, pollution, physical disturbance), bat populations of UAE are most probably threatened and decreasing. In relation with their ecological, behavioural and physiological characteristics, bats might be more sensitive than other taxa to climate changes and habitat loss and are generally in decline due to their sensitivity to environmental stress and slow reproductive rates (Sherwin et al. 2013). Bats are generally recognized as important component of terrestrial ecosystems, providing important ecological services. In UAE and Oman, except the frugivorous Egyptian Fruit Bats, all other species are insectivorous, contributing to regulation of insect populations. Due to their high position in the trophic chain, insectivorous bats are sensitive to accumulations of pesticides and other toxins, and their population might be affected by changes in arthropod preys availability. This makes bats excellent candidates to be used as bio-indicators of the ecosystems in which they live, by measuring their response to climate change and habitat loss (Jones et al. 2009). Bats might also raise economic or human health concerns that are worth investigating. The impact of the Egyptian Fruit Bat on orchards and date palm plantations has not been assessed in UAE, while there are strong suspicions that they are being poisoned in some places. Additionally, bats have been suspected to play a role in human infection by Middle East Respiratory Syndrome (MERS) coronavirus (Memish et al. 2013).

Despite an increasing number of records in the last five years, species distribution, status and trends still remain largely poorly understood. Much remains to be done about the bat fauna of UAE. We encourage and urge naturalists and field ecologists to conduct field surveys on the bat fauna of the United Arab Emirates, and to contribute in the characterization of the echolocation calls of UAE species. Accurate references of echolocation calls and acoustic identification methodology would facilitate the use of bat detectors in identifying species, which can substantially contribute in increasing the number of bats records and knowledge of their status. The efficient use of bat detectors will however be dependent on preliminary captures in order to confirm the species identification.

All bat records reviewed for this paper have been put into a database currently managed at the Emirates Wildlife Society, Dubai.

REFERENCES

AGEDI - Abu Dhabi Global Environmental Data Initiative (2008). Mammals, pp. 38–49. In: AGEDI (ed.): *Terrestrial Environments of Abu Dhabi Emirate*, *United Arab Emirates*. Environment Agency Abu Dhabi, Abu Dhabi, UAE xvii+112pp.

Anonymous (2010). It's a … It's a … It's Batman! *Gazelle.* Dubai, UAE, 25(2): 4–7.

Aspinall, S., P. Hellyer & C. Drew (2005). Terrestrial mammals, pp. 307–333. In: Hellyer, P. & S. Aspinall (eds.). *The Emirates Natural History*. Trident Press Limited, London, 428pp.

Benda, P., M. Andreas & A. Reiter (2002). Record of *Hypsugo arabicus* from Baluchistan, Iran, with remarks to its ecology and systematical status, p. 15. In: Anonymous (ed.): *IXth European Bat Research Symposium. 26–30 August 2002 – University of Le Havre. Abstracts*. Le Havre: University of Le Havre, France, x+59pp.

Benda, P., M. Andreas, D. Kock, R. Lučan, P. Munclinger, P. Nová, J. Obuch, K. Ochman, A. Reiter, M. Uhrin & D. Weinfurtová (2006). Bats (Mammalia: Chiroptera) of the eastern Mediterranean. Part 4. Bat fauna of Syria: distribution, systematics, ecology. *Acta Societatis Zoologicae Bohemicae* 70: 1–329.

Benda, P., K. Faizolahi, M. Andreas, J. Obuch, A. Reiter, M. Sevcik, M. Uhrin, P. Vallo & S. Ashrafi (2012). Bats (Mammalia: Chiroptera) of the eastern Mediterranean and Middle East. Part 10. Bat Fauna of Iran. *Acta Societatis Zoologicae Bohemicae* 76: 163–582.

Brown, B. (1988). Bats of the UAE. *Bulletin of the Abu Dhabi Natural History Group* 36: 14–15.

Brown, B. (1991). Mammals. In: Recorders' Reports for January–June 1991. *Tribulus* 1(2): 31–35.

Cunningham, P.L. (2004). Checklist and status of the terrestrial mammals from the United Arab Emirates. *Zoology in the Middle East* 33: 7–20.

Davis, L. (2007). *An Introduction to the Bats of the United Arab Emirates*. Echoes Ecology Ltd., Polmont, UK, 24pp.

Drew, C. & S. Al Dhaheri (2003). A Report on the Findings of a Preliminary Ecological and Environmental Survey of Jebel Hafit. Internal Report. Environmental Research & Wildlife Development Agency, Abu Dhabi, UAE, 39pp.

Drew, C., A. Al Hemeri, P. Soorae & S. Khan (2003). A Report on a Survey of Terrestrial Mammals and Reptiles of Arzanah. Internal report, Environmental Research & Wildlife Development Agency, Abu Dhabi, UAE, 10pp.

Drew, C. & L. Drew (2004). The Mammals of Jebel Hafit, pp. 169–186. In: Aspinall, S. & P. Hellyer (eds.). *Jebel Hafit*, *A Natural History*. Emirates Natural History Group, Abu Dhabi, UAE, 220pp.

Drew, C.R., S. Al Dhaheri, I. Barcelo & C. Tourenq (2005). The Terrestrial

Mammals, Reptiles and Amphibians of the UAE - Species List and Status Report. Environmental Research & Wildlife Development Agency, Abu Dhabi, UAE, 23pp.

Drew, C. & C. Tourenq (2005). The Red List of Terrestrial Mammalian Species of the Abu Dhabi Emirate. Environmental Research & Wildlife Development Agency, Abu Dhabi, UAE, 28pp.

Duckworth, W. (1996). Land mammals of Abu Dhabi, pp. 148–171. In: Osborne, P.E. (ed.). *Desert Ecology of Abu Dhabi*. Pisces Publications, Newbury, UK, 236pp.

Fogg, T., P. Fogg & T. Waltham (2002). Magharet Qasir Hafit, a significant cave in the United Arab Emirates. *Tribulus* 12(1): 5–14.

Gardner, D. (2009). A naked-bellied tomb bat, *Taphozous nudiventris*, photographed at Qarn Nazwa, Sharjah on 18 April 2009. *Tribulus* 18: cover page

Gross, C. (1987). *Mammals of the Southern Gulf*. Motivate Publishing, Dubai, UAE, 80pp.

Harrison, D.L. (1955). On a collection of mammals from Oman, Arabia, with the description of two new bats. *Annals and Magazine of Natural History*, *Twelfth Series* 8: 897–910.

Harrison, D.L. (1964). *The Mammals of Arabia. Volume I. Introduction, Insectivora, Chiroptera, Primates*. Ernest Benn Limited, London, UK, xx+192pp.

Harrison, D.L. (1972). *The Mammals of Arabia. Volume III. Lagomorpha, Rodentia*. Ernest Benn Limited, London, UK, xvii+288pp.

Harrison, D.L. (1977). Mammals obtained by the Expedition with a checklist of the mammals of the Sultanate of Oman. *Journal of Oman Studies*, *Special Report* [*The Scientific Results of The Oman Flora and Fauna Survey*] 1975: 13–26.

Harrison, D.L. (1981). *Mammals of the Arabian Gulf*. George Allen & Unwin, London, UK, 92pp.

Harrison, D.L. & P.J.J. Bates (1991). *The Mammals of Arabia. Second Edition*. Harrison Zoological Museum, Sevenoaks, UK, 354pp.

Hellyer, P. (1988). Mammal Recorder's Report, 1987. *Bulletin of the Abu Dhabi Natural History Group* 34: 11–12.

Hellyer, P. (1989). Mammal Recorder's Report, 1988. *Bulletin of the Abu Dhabi Natural History Group* 37: 3–6.

Hellyer, P. (1992a). Mammals. In: Recorders' Reports for July–December 1991. *Tribulus* 2(1): 27–30.

Hellyer, P. (1992b). Mammals. In: Recorders' Reports for January–June 1992. *Tribulus* 2(2): 41–45.

Hellyer, P. (1994). Mammals. In: Recorders' Reports. *Tribulus* 4(1): 25–29.

Hellyer, P. (1999). Recorders' Reports: mammals and miscellaneous. *Tribulus* 9(1): 31.

Hornby, R. (1996). A red list of mammals for the United Arab Emirates. *Tribulus* 6(1): 13–14.

IUCN (2017). *The IUCN Red List of Threatened Species. Version 2017-2*. <www.iucnredlist.org>. Downloaded on 31 October 2017.

Jones, G., D.S. Jacobs, T.H. Kunz, M.R. Willig & P.A. Racey (2009). Carpe noctem: the importance of bats as bioindicators. *Endangered Species Research* 8: 93–115.

Jones, G. (2012). What bioindicators are and why they are important, pp. 18–19. In: Flaquer, C. & X. Pulg-Montserrat (eds.). Proceedings of the International Symposium on the importance of bats as Bioindicators. Museum of Natural Sciences Editions, Granollers.

Jongbloed, M., R. Llewellyn-Smith & M. Sawaf (2001). *Wild About Mammals*. Arabian Leopard Trust & Zodiac Publishing, Sharjah, UAE, 70pp.

Judas, J. (2016). Wadi Wurayah National Park - Scientific Research report 2013–2015. EWS-WWF Report. Abu Dhabi, UAE, 115pp.

Juste, J., P. Benda, J.L. Garcia-Murrada & C. Ibanez (2013). Phylogeny and systematics of Old World serotine bats (genus Eptesicus, Vespertilionidae, Chiroptera): an integrative approach. *Zoologica Scripta* 42(5): 441–457.

Kalka, M.B., A.R. Smith & E.K.V. Kalko (2008). Bats limit arthropods and herbivory in a tropical forest. *Science* 320: 71.

Khan, R. (2014). Not a bird but a tiny bat ID needed. http://www.uaebirding.com/forum accessed 5 December 2015.

Kunz, T.H., E. Braun de Torrez, D. Bauer, T. Lobova & T.H. Fleming (2011). Ecosystem services provided by bats. *Annals New York Academy of Science,* 1223: 1–38.

Memish, Z.A., N. Mishra, K.J. Olival, S.F. Fagbo, V. Kapoor, J.H. Epstein, R. Alhakeem, A. Durosinloun, M. Al Asmari, A. Islam, A. Kapoor, T. Briese, P. Daszak, A.A. Al Rabeeah & W.I. Lipkin (2013). Middle east respiratory syndrome coronavirus in bats, Saudi Arabia. *Emerging Infectious Diseases* [Internet]. 2013 Nov [03 june 2016]; http://doi.org/10.3201/eid1911.131172

Monadjem, A., C. Joubert, L. Richards, I. B. Nielsen, M. Nielsen, K.R.. Kjartansdóttir, K. Bohmann, T. Mourier & A.J. Hansen (2016). First record of *Vespertilio murinus* from the Arabian Peninsula. *Vespertilio* 18: 79–89.

Nader, I.A. (1990). Checklist of the mammals of Arabia. *Fauna of Saudi Arabia* 11: 239–381.

Roberts, H. (2015). [series of annotated photos]. http://www.pbase.com/wildlifeuae accessed 7 December 2015.

Sanborn, C.C. (1956). Appendix C: Bats collected by the expedition. In: Field H. (ed.): An Anthropological Reconnaissance in the Near East, 1950. *Papers of the Peabody Museum*, *Hardvard, UK* 48(2): 77.

Sherwin, H.A., W.I. Montgomery & M.G. Lundy (2013). The impact and implications of climate change for bats. *Mammal Review* 43: 171–182.

Stuart, C. & T. Stuart (1998). The mammal fauna of Jebel Hafit. In: Hornby, R. (ed.): The Natural History, Geology and Archaelogy of Jebel Hafeet. Emirates Natural History Group, Abu Dhabi, UK.

Tourenq, C., A. Khassim, M. Sawaf, M. K. Shuriqi, E. Smart, M. Ziolkowksi, M. Brook, R. Selwan & L. Perry (2009). Characterisation of the Wadi Wurayah catchment basin, the first mountain protected area in the United Arab Emirates. *International Journal of Ecology and Environmental Sciences* 35: 289–311.

Thesiger, W. (1959). *Arabian Sands*. Reprinted 1996. Motivate Publishing, Dubai, UAE, 306pp.

Thomas, B. (1932). *Arabia Felix: across the Empty Quarter of Arabia*. Jonathan Cape Publication, 304pp.

Tourenq, C. & F. Launay (2008). Challenges facing biodiversity in the United Arab Emirates. *Management Environment Quality* 19(3): 283-304.

van Cakenberghe, V. & F. de Vree (1994). A revision of the Rhinopomatidae Dobson, 1872, with the description of a new subspecies (Mammalia: Chiroptera). *Senckenbergiana Biologica* 73: 1–24.

Wilson, D.E. & D.A.M. Reeder (eds.) (2005). ***Mammal Species of the World. A Taxonomic and Geographic Reference (3rd Edition).*** Johns Hopkins University Press, 2, 142pp. http://www.departments.bucknell.edu/biology/resources/msw3/ Accessed 24 March 2017

Appendix 1. Geographical gazetteer

Sites	Emirates	Latitude*	Longitude*
19th street, Abu Dhabi	Abu Dhabi	24.35	54.65
Abu Dhabi city	Abu Dhabi	24.47	54.37
Ain Al Waal, Al Ain	Abu Dhabi	24.07	55.75
Al Ain city	Abu Dhabi	24.22	54.77
Al Ain Oasis	Abu Dhabi	24.21	55.77
Al Ghurair Centre	Dubai	25.27	55.32
Bab al Shams	Dubai	24.81	55.23
Breeding Center for Endangered Arabian Wildlife	Sharjah	25.29	55.70
Buraimi Oasis	Abu Dhabi	24.25	55.75
Das Island	Abu Dhabi	25.15	52.88
Dibba	Fujairah	25.59	56.26
Faculty of Medicine and Health Sciences, Emirate University, Al Ain	Abu Dhabi	24.20	55.65
Green Mubazzarah, Al Ain	Abu Dhabi	24.11	55.75
Jebel Fayah	Sharjah	25.10	55.83
Jebel Hafit, Al Ain	Abu Dhabi	24.07	55.75
Jumeirah	Dubai	25.20	55.25
Kahf Hamam, Jebel Hafit	Abu Dhabi	24.07	55.78
Kalba	Sharjah	25.07	56.36
Khatt	Ras Al Khaimah	25.62	56.02
Khor Kalba	Sharjah	25.03	56.36
Liwa	Abu Dhabi	23.13	53.79
Manhal Palace Nursery	Abu Dhabi	24.48	54.36
Marawah Island	Abu Dhabi	24.30	53.29
Qarn Nazwa	Dubai	24.98	55.66
Rams	Ras Al Khaimah	25.83	56.03
Ras Al Khaimah city	Ras Al Khaimah	25.81	56.04
Ras Ghanada	Abu Dhabi	24.71	54.68
Ruwais	Abu Dhabi	24.03	52.76
Safa park	Dubai	25.18	55.24
Shah oilfield	Abu Dhabi	22.91	53.96
Sharjah	Sharjah	25.36	55.38
Sir Bani Yas Island	Abu Dhabi	24.31	52.60
Wadi Naqab	Ras Al Khaimah	25.72	56.10
Wadi Wurayah National Park	Fujairah	25.39	56.31
Wamm farms	Fujairah	25.60	56.23

* Latitudes and longitudes in decimal degrees

Journal of Threatened Taxa

www.threatenedtaxa.org

ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

March 2018 | Vol. 10 | No. 3 | Pages: 11361–11494
Date of Publication: 26 March 2018 (Online & Print)
DOI: 10.11609/jott.2018.10.3.11361-11494