

ANNALS of CARNEGIE MUSEUM

CARNEGIE MUSEUM OF NATURAL HISTORY

4400 FORBES AVENUE • PITTSBURGH, PENNSYLVANIA 15213

VOLUME 51

3 DECEMBER 1982

ARTICLE 19

THE BAT FAUNA OF JABAL AL AKHDAR, NORTHEAST LIBYA

MAZIN B. QUMSIYEH¹

DUANE A. SCHLITTER

Associate Curator, Section of Mammals

ABSTRACT

Fifty nine specimens of bats representing eight species in three families are reported from the region of Jabal Al Akhdar in northeastern Libya. *Nyctalus lasiopterus* is reported for the first time from Africa, while *Pipistrellus pipistrellus*, *Miniopterus schreibersii* and *Tadarida teniotis* are new additions to the fauna of Libya. *Rhinolophus clivus*, *R. mehelyi*, *Pipistrellus kuhlii*, and *Plecotus austriacus* are additional distributional records from Libya. Taxonomic comments are given. Although distinctive, the bat fauna of Jabal Al Akhdar is considered of Mediterranean origin and includes taxa seemingly closely associated with those from southcentral Europe rather than the Eastern Mediterranean and Maghreb regions.

INTRODUCTION

There are few reports on the bat fauna of Libya (De Beaux, 1932, 1938; Festa, 1921; Hufnagel, 1972; Klaptocz, 1909; Setzer, 1957; Toschi, 1954; Zavattari, 1934). Almost no collecting of bats has been done in the Jabal Al Akhdar (=the green mountain) in northeastern Libya (previously referred to as "Cyrenaica" or the Cyrenaica Plateau). The Jabal Al Akhdar region is characterized by a Mediterranean Maquis type vegetation (Zohary, 1973) and is unique in this part of northern Africa.

Through the courtesy of the Kuf National Park administration in

¹ Address: Biological Sciences Group, U-43, University of Connecticut, Storrs, CT 06268. Present Address: Department of Biology and The Museum, Texas Tech University, Lubbock, TX 79409.

Submitted 23 February 1982.

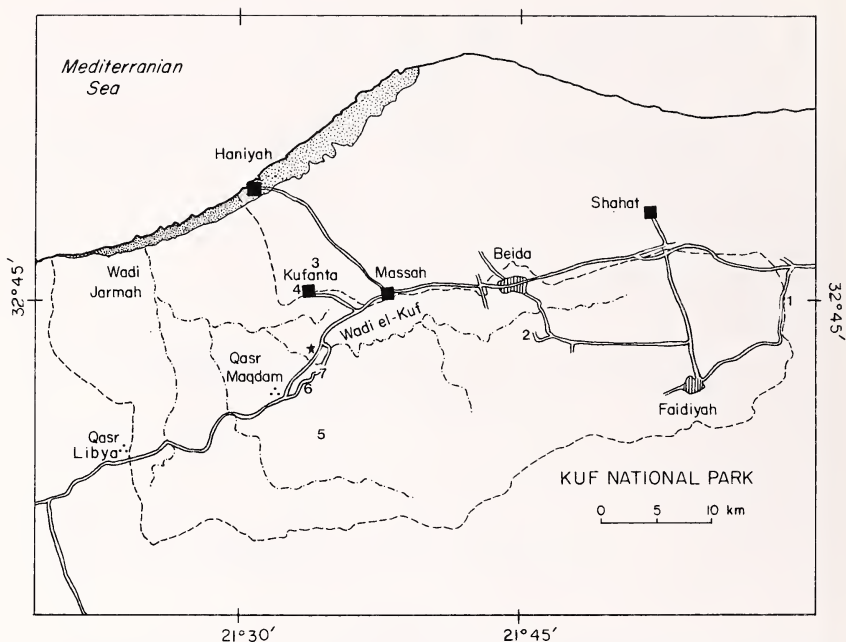


Fig. 1.—Map of the Kuf National Park and environs of Jabal Al Akhdar illustrating collecting localities mentioned in the text (numerals).

Libya, an inventory of small mammals, especially bats, was made in the park from 8 March through 9 April 1981. During that interval, 58 specimens of bats, representing eight species in three families, were collected. Many of these specimens represent taxonomically and zoogeographically important records for this region of Africa and are reported in this paper.

MATERIALS AND METHODS

The collecting localities mentioned in the accounts of species and their coordinates are listed below (numbers correspond to Fig. 1):

- 1) Al Abraqa, 5 km SW—32°45'N, 21°58'E.
- 2) Baida, 4 km S—32°44'N, 21°43'E.
- 3) Haniya, 8 km SSE—32°46'N, 21°27'E.
- 4) Kufanta—32°46'N, 21°34'E.
- 5) Qasr Maqdam, Ruins 6 km SE—32°38'N, 21°36'E.
- 6) Wadi Al Kuf, unnamed cave—32°41'N, 21°33'E.
- 7) Wadi Al Kuf, mistnetting site—32°42'N, 21°35'E.

Unless otherwise indicated in the specimens examined, all specimens were prepared as conventional museum specimen skins and skulls and were collected by the senior



Fig. 2.—Mistnetting site at edge of water pool in Wadi Al Kuf. Habitat of *Pipistrellus kuhlii*, *P. pipistrellus*, *Nyctalus lasiopterus*, *Plecotus austriacus*, and *Tadarida teniotis*.

author in 1981. In some instances, the field numbers, indicated by the prefix MQ, are given for specimens not yet catalogued. Specimens will be divided with most deposited in Carnegie Museum of Natural History, Pittsburgh, and some will be deposited in the Kuf National Park Museum, Beida, Libya. One specimen of *Pipistrellus pipistrellus* from 5 km SW of Al Abra q was examined in the National Museum of Natural History, Washington (USNM). External measurements were taken from the field tags and forearm and cranial measurements were taken with dial calipers. All measurements are given in millimeters. Selected external and cranial measurements of the eight species are given in Tables 1 and 2.

In the species accounts, families and genera are listed as they appear in Corbet (1978) but the species are listed alphabetically.

JABAL AL AKHDAR

The Jabal Al Akhdar is a mountainous region of northeastern Libya, mainly south of the city of Beida. The Wadi Al Kuf, with its tributaries Wadi Beit Saleh and Wadi Sudan, provides the main watershed of the Jabal Al Akhdar (Figs. 1, 2). The watershed consists of wadis cut through the limestone rock, forming many high and narrow valleys. Some valleys are 200 m in depth. Numerous karstic caves and cracks of different sizes occur in the region. Altitude ranges from sea level to 878 m.

Table 1.—External measurements of samples of eight species of bats from Jabal Al Akhdar and some comparative material. Means and ranges of measurements enclosed in parentheses are given for some samples.

Locality, sample, and sex	Total length	Length of tail	Length of hindfoot	Length of ear	Length of forearm
<i>Rhinolophus civicus</i>					
6 km SE Oasr Maqdam (♂)	76	29	10.5	19	50
Roman aqueduct, Kufanta (♂)	78, 76	26, 30	10, 10	18, 21	47, 49
<i>Rhinolophus mehelyi</i>					
Wadi Al Kuf (6 ♂♂)	72.5 (70-77)	24.2 (22-26)	9.8 (8.5-11)	20.0 (19-21.5)	47.3 (46-48)
Wadi Al Kuf (4 ♀♀)	72.8 (70-75)	26.3 (22-29)	9.8 (8-11)	20.4 (19-21)	47.3 (46-49)
<i>Pipistrellus kuhlii</i>					
Wadi Al Kuf (2 ♂♂)	81, 85	38, 41	7, 7	13, 12.5	34, 34
<i>Pipistrellus pipistrellus</i>					
Wadi Al Kuf (10 ♂♂)	71.6 (67-78)	31.2 (28-33)	6.1 (4-8)	10.2 (8-11)	31.2 (30-32)
Wadi Al Kuf (6 ♀♀)	74.5 (71-82)	32.0 (30-34)	6.5 (6-7)	10.4 (10-11)	31.5 (29.7-32.5)
<i>Nyctalus lasiopterus</i>					
Wadi Al Kuf (2 ♂♂)	143, 150	53, 53	14.5, 13	21, 22	62.5, 61
Wadi Al Kuf (4 ♀♀)	144.5 (138-152)	56.3 (48-62)	14.4 (12.5-16)	20.8 (19-23)	61.3 (59-64)
<i>Plecotus austriacus</i>					
Wadi Al Kuf (♀)	98	42	9	36	40
6 km SE Qasr Maqdam (♂)	95	45	8.5	34.5	38

Table 1.—Continued.

Locality, sample, and sex	Total length	Length of tail	Length of hindfoot	Length of ear	Length of forearm
Egypt: Dandara Temple (2 ♀♀)	95, 93	48, 46	8, 8.5	38, 35	38.5, 39
Egypt: Dandara Temple (1 ♂)	96	45	8	37	37
<i>Miniopterus schreibersii</i>					
Wadi Al Kuf (3 ♀♀)	107.7 (106–111)	49.3 (48–50)	8.8 (8.5–9)	8.3 (8–8.5)	43.5 (43–44)
<i>Tadarida teniotis</i>					
Wadi Al Kuf (8 ♂♂)	126.3 (119–132)	41.4 (37–48)	11.4 (10–12.5)	29.5 (25–31)	58.9 (56–61)
Wadi Al Kuf (4 ♀♀)	130.8 (120–136)	46.8 (46–48)	11.9 (11.2–12.3)	29.3 (26–31)	61.0 (59–63)

Table 2.—Selected cranial measurements of specimens listed in Table 1. Means and ranges of measurements as in Table 1.

Locality, sample, and sex	Greatest length of the skull	Zygomatic breadth	Length of maxillary tooththrow	Length of mandibular tooththrow
<i>Rhinolophus clivosus</i>				
6 km SE Qasr Maqdam (♂)	20.6	11.1	7.6	8.6
Roman aqueduct, Kufanta (♂, ♀)	20.3, 20.4	10.9, 11.0	7.5, 7.5	13.4 13.2, 13.2
<i>Rhinolophus mehelyi</i>				
Wadi Al Kuf (6 ♂♂)	19.5 (19.3–19.8)	10.2 (9.9–10.6)	6.8 (6.7–6.9)	7.5 (7.4–7.7)
Wadi Al Kuf (4 ♀♀)	19.5 (19.4–19.5)	10.4 (10.2–10.5)	6.7 (6.6–6.8)	7.5 (7.3–7.7)
<i>Pipistrellus kuhlii</i>				
Wadi Al Kuf (2 ♂♂)	13.4, 13.8	8.4, 9.0	4.7, 4.9	9.4, 9.3 5.3, 5.5
<i>Pipistrellus pipistrellus</i>				
Wadi Al Kuf (10 ♂♂)	12.5 (12.2–12.7)	7.6 (7.4–7.9)	4.3 (4.2–4.4)	8.2 (8.0–8.4)
Wadi Al Kuf (6 ♀♀)	12.4 (11.5–12.7)	7.7 (7.0–8.0)	4.3 (4.0–4.4)	8.1 (7.4–8.5)
<i>Nyctalus lasiopterus</i>				
Wadi Al Kuf (2 ♂♂)	22.7, 22.1	15.7, 15.4	9.0, 8.6	16.8, 16.3
Wadi Al Kuf (4 ♀♀)	22.4 (22.2–22.7)	15.5 (15.1–16.0)	8.8 (8.7–8.9)	16.5 (16.3–16.7)
<i>Plecotus austriacus</i>				
Wadi Al Kuf (♀)	17.7	9.0	5.7	11.0
6 km SE Qasr Maqdam (♂)	17.6	9.1	5.2	10.6
Egypt: Dandara Temple (2 ♀♀)	16.8, 16.8	8.5, 8.6	5.3, 5.4	9.9, 10.1
Egypt: Dandara Temple (1 ♂)	17.0	8.6	5.5	10.1

Table 2.—Continued.

Locality, sample, and sex	Greatest length of the skull	Zygomatic breadth	Length of maxillary toothrow	Length of mandible	Length of mandibular toothrow
Wadi Al Kuf (2 ♀♀)	14.7, 14.8	8.1, 8.2	5.6, 5.7	10.0, 10.4	6.4, 6.5
		<i>Miniopterus schreibersii</i>			
Wadi Al Kuf (8 ♂♂)	23.9 (23.3–24.8)	14.0 (13.5–15.1)	8.7 (8.5–9.0)	16.3 (15.8–17.0)	9.8 (9.6–10.2)
		<i>Tadarida teniotis</i>			
Wadi Al Kuf (4 ♀♀)	23.5 (23.2–23.8)	13.4 (13.1–13.7)	8.6 (8.5–8.6)	16.3 (15.9–16.7)	9.7 (9.5–9.8)

The climate of the area is mild Mediterranean. The rainfall ranges between 300 and 600 mm per year, with most of the precipitation occurring during the winter months of November through February. Temperatures range from highs of 35°C in July and August to below freezing during January. Fog occurs extensively during winter months.

The vegetation of the Jabal Al Akhdar is a Maquis type. Groves of *Cupressus sempervirans* occur in protected areas but the main tree species are *Juniperus phoenicea*, *Pistacia lentiscus*, *Arbutus pavarii*, *Cistus salviaefolius*, *Ceratonia siliqua*, *Zizyphus lotus*, *Sparteum funceum*, *Olea europea*, *Myrtus communis* and *Quercus coccifera*.

ACCOUNT OF SPECIES

Family Rhinolophidae

Rhinolophus clivosus Cretzschmar, 1828

Specimens examined (5).—Roman aquaduct, Kufanta (2 ♂♂, 1 ♀ in alcohol); Ruins, 6 km SE Qasr Maqdam (1 ♂, 1 ♀ in alcohol).

Remarks.—*Rhinolophus clivosus* was previously recorded from Fezzan by Toschi (1954) as *R. c. schwarzi* Heim de Balsac, originally described from the Algerian Sahara. Hayman and Hill (1971:23) list Algerian Sahara and Libya as the range of *R. c. schwarzi*. The specimens from Jabal Al Akhdar are larger than those examined from the Algerian Sahara (*R. c. schwarzi*) and Egypt (*R. c. brachygnathus*).

The female was not pregnant and the adult males showed no enlarged testes.

Rhinolophus mehelyi Matschi, 1901

Specimens examined.—Unnamed cave in Wadi Al Kuf (6 ♂♂, 4 ♀♀).

Remarks.—*Rhinolophus mehelyi* was listed from "Cyrenaica" by Corbet (1978) based on specimens in the British Museum. The taper of the lancet in our specimens is abrupt and the connecting process of the sella is short and slightly blunt. These characters and the relatively large cranial measurements (Table 2) clearly refer the Jabal Al Akhdar specimens to *Rhinolophus mehelyi* rather than *R. euryale*. However, specimens of the former species originating from eastern Libya and Egypt are small in many cranial and external measurements when compared to those of the Eastern Mediterranean region and northwestern Africa (Algeria, Morocco, Tunisia). This difference may help explain why various authors have identified some Egyptian material as *R. euryale* (see DeBlase, 1972, for a review of this species group in Egypt and Southwest Asia).

The range of measurements of testes of five of the adult males collected was 2.0 to 2.1 in length and 1.0 to 1.6 in width.

Family Vespertilionidae
Pipistrellus kuhlii (Natterer, 1817)

Specimens examined (2).—Wadi Al Kuf, mistnetting site (2 ♂♂).

Remarks.—While *Pipistrellus kuhlii* is common in most of the southwestern Palearctic, including Libya and southwestern Asia (De Beaux, 1932, 1938; Harrison, 1964), it seems to be less common in forested areas where it is outnumbered by the smaller species *Pipistrellus pipistrellus*. This was the case in Jabal Al Akhdar where only two specimens of *P. kuhlii* were caught compared to 18 of *P. pipistrellus*.

The Jabal Al Akhdar specimens are referred to the nominate subspecies. They are indistinguishable in size from specimens of *P. kuhlii kuhlii* from northwestern Africa and southern Europe; measurements of specimens from Crete given by Pohle (1953) agree with those of the Jabal Al Akhdar specimens.

An adult male collected on 9 April had testes measuring 3.5 by 2.0.

Pipistrellus pipistrellus (Schreber, 1774)

Specimens examined (19).—Wadi Al Kuf (8 ♂♂, 3 ♀♀; 2 ♂♂, 2 ♀♀ in alcohol); 4 km S Beida (2 ♂♂); 8 km SSE Haniya (1 ♀); 5 km SW Al Abraç (1 ♂, USNM).

Remarks.—These are the first specimens of *Pipistrellus pipistrellus* reported from Libya. The species is known to occur in the Maghreb, the Eastern Mediterranean region, and in southern Europe (Atallah, 1977; Corbet, 1978; and Harrison, 1964). There seems to be little geographic variation in this species in this part of its continuous range. The populations around the Mediterranean are tentatively all considered to belong to the nominate subspecies.

The range of measurements of testes of seven adult males collected was 1.5 to 3.5 in length and 1.2 to 2.5 in width.

Nyctalus lasiopterus (Schreber, 1780)

Specimens examined (6).—Wadi Al Kuf (2 ♂♂, 4 ♀♀).

Remarks.—These are the first records of *Nyctalus lasiopterus* from Africa, although *Nyctalus noctula* had been reported from Rabat, Morocco (Laurent, 1937), Algiers, Algeria (Dobson, 1878:213; specimen examined in B.M.), and as far south as Lebanon (Lewis and Harrison, 1962) and Oman (Harrison and Jennings, 1980) in southwestern Asia. Another record of *Nyctalus noctula* exists from Mozambique (Peters, 1852). This record was doubted, but in view of the widespread records of the genus in Africa and southwestern Asia and the long migrations known for *N. noctula* in Europe (Roer, 1960), individuals of this genus should be expected elsewhere in northern and eastern Africa.

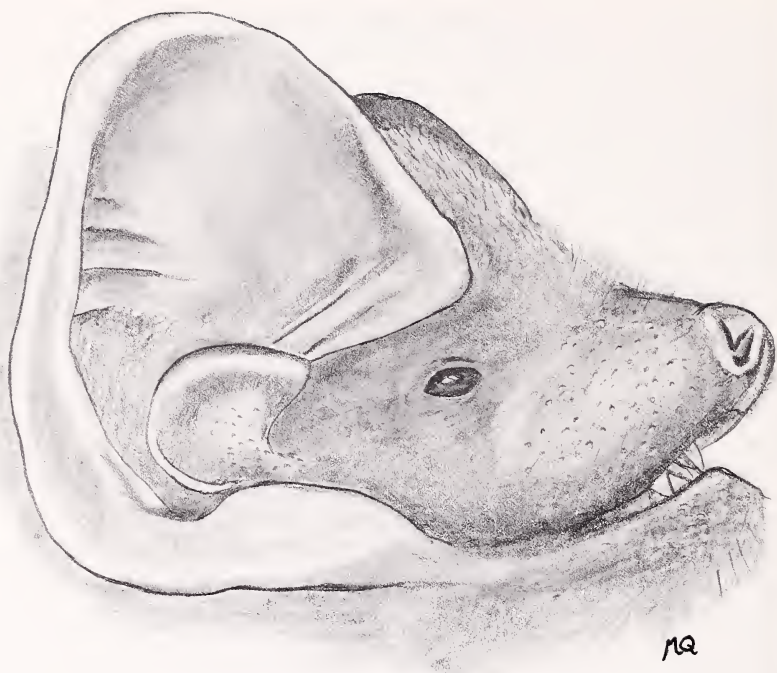


Fig. 3.—Lateral view of head of a male specimen of *Nyctalus lasiopterus* from Wadi Al Kuf to illustrate ear pinna and tragus shape. Drawn from Kodachrome slide of live specimen.

The cranial measurements of the Libyan specimens are slightly smaller than those of European specimens of *N. lasiopterus*. The external measurements of the Libyan specimens are smaller than are those of European specimens and correspond more closely with those of *N. aviator* (= *N. lasiopterus aviator*) of the Far East. The shape of the ear (Fig. 3) also indicates that the Libyan specimens are referable to *N. lasiopterus*, being thicker and wider at the base than those of *N. noctula*.

The baculum of *N. lasiopterus* closely resembles that of *N. noctula* in shape but is significantly larger in size (Lanza, 1959). The os penes of the two male specimens from Libya measured 7.7 and 8.1 mm in length and 1.15 and 1.18 mm in width at the proximal end. The corresponding measurements for *N. noctula* given by Topal (1958) were 5.51 and 6.22 (mean 5.83) in length and 0.84 to 1.09 (mean 0.94) in width.

An adult male collected on 15 March had testes measuring 2.1 by 1.8.

Six individuals of this species were taken in mist nets in Wadi Al Kuf (Fig. 2). Three females and a single male were netted on 15 March and a single female and male were taken on 28 March and 29 March, respectively.

Plecotus austriacus (Fischer, 1829)

Specimens examined (2).—Wadi Al Kuf, mistnetted (1 ♀); Ruins, 6 km SE Qasr Maqdam (1 ♂).

Remarks.—The two specimens listed above and a third individual collected at Gharian, Libya, agree with specimens of *Plecotus austriacus* from Europe in external and cranial measurements, color of pelage, and shape of bacula. However, they are darker in color and larger in size than the holotype of *P. austriacus christie*, and specimens from Egypt and Giarabub Oasis in Libya referred to this subspecies by Lanza (1960), Harrison (1964), and Hanak (1966). The determination of the subspecific status of the Libyan specimens requires more comparative study.

Miniopterus schreibersii schreibersii (Kuhl, 1819)

Specimens examined (3).—Unnamed cave, Wadi Al Kuf (3 ♀♀).

Remarks.—This is the first record of *Miniopterus schreibersii* from Libya. This widespread species occurs from South Africa across Africa to Morocco and then across Europe as far as Australasia. External and cranial measurements and color of pelage of the three specimens agree with those of specimens from Europe and northeast Africa (the nominate subspecies) rather than with those of the Eastern Mediterranean region referable to *M. s. pallidus*.

Family Molossidae

Tadarida teniotis (Rafinesque, 1814)

Specimens examined (12).—Wadi Al Kuf, mistnetted (8 ♂♂, 4 ♀♀).

Remarks.—These are the first specimens of *Tadarida teniotis* recorded from Libya. They are referred, on geographic reasons, to *T. teniotis rueppellii* Temminck, the subspecies found in Morocco, Algeria, Egypt, and elsewhere in the Middle East.

One adult male with descended testes had testes measurements of 6.0 by 4.0. The range of measurements of testes of five other males was 2.0 to 3.0 in length and 1.1 to 2.0 in width.

DISCUSSION

The eight species of bats recorded from Jabal Al Akhdar fall into two general groups based on their zoogeographic distribution—Palearctic species or species with primarily Eurasian distributions but which also occur in North Africa to varying degrees and Cosmopolitan species or species with broad Eurasian and African distributions. The Palearctic species are *Rhinolophus mehelyi*, *Pipistrellus pipistrellus*, *Nyctalus lasiopterus*, *Plecotus austriacus*, and *Tadarida teniotis*. The Cosmopolitan species include *Rhinolophus clivosus*, *Pipistrellus kuhlii*, and *Miniopterus schreibersii*. The specimens of *Nyctalus lasiopterus* are the first records for the species for the African continent. *Plecotus austriacus* is known from as far south as Ethiopia in the East and Senegal and Cape Verde Islands in the West (Hayman and Hill, 1971).

In spite of the close proximity of the Jabal Al Akhdar to Egypt, only the specimens of *Rhinolophus mehelyi* and *Tadarida teniotis* show a close relationship with Egyptian populations. In the case of *Pipistrellus pipistrellus*, there seems to be little variation in external and cranial size and color of pelage around the whole of the Mediterranean. The *Nyctalus lasiopterus* of northeastern Libya seem to be closely related to populations of southcentral Europe. The *Rhinolophus clivosus* of northeastern Libya are larger than populations from neighboring North African countries. *Miniopterus schreibersii* and *Pipistrellus kuhlii* are similar to those from northwestern Africa and southern Europe.

The distributions and morphological attributes of the bats studied, and the characteristic Mediterranean Maquis type vegetation (Zohary, 1973:85), suggest that the bats of Jabal Al Akhdar are related to those of southcentral Europe and some probably reached this part of Libya by spreading across the islands of the central Mediterranean sea or are relicts of the more temperate climate (Hey, 1963) of the late Pleistocene/early Holocene in Cyrenaica.

ACKNOWLEDGMENTS

We are indebted to John Kirsch, Museum of Comparative Zoology, Harvard University; Charles O. Handley, Jr., National Museum of Natural History, Washington, D.C.; and John E. Hill, British Museum (Natural History), London, for allowing us to examine holotypes and comparative material in their respective collections. Field work in North Africa was supported by funds received from the Richard King Mellon Acquisition fund of Carnegie Museum of Natural History, Explorer's Club of New York, and Society of Sigma Xi. Permission to do field work in Kuf National Park was received from the Arab Center for the Studies of Arid Zones and Dry Lands, and the administration of the Kuf National Park project. We are grateful to the officials of the Libyan government, Ministry of Agriculture, A.C.S.A.D., and Kuf National Park for this permission. We want to thank H. John Herbert for logistical help while the senior author worked in the Kuf National Park. The senior author is indebted to Dr. Ralph M. Wetzel for continuous help and encouragement.

LITERATURE CITED

- ATALLAH, S. I. 1977. The mammals of the Eastern Mediterranean region: their ecology, systematics and zoogeographical relationship. *Saugetierk. Mitt.*, 25:241-320.
- CORBET, G. B. 1978. The mammals of the Palearctic region: a taxonomic review. Trustees of the British Museum (Nat. Hist.), London, 314 pp.
- DE BEAUX, O. 1932. "Mammiferi" in *Spedizione Scientifica all'Oasi di Cufra*. *Ann. Mus. Civ. Stor. Nat. Genova*, 60:374-394.
- . 1938. "Mammiferi" in *Missione zoologica del Dott. E. Festa in Cirenaica*. *Boll. Musei Zool. Anat. Comp. Torino*, 46(86):359-379.
- DEBLASE, A. F. 1972. *Rhinolophus euryale* and *R. mehelyi* (Chiroptera: Rhinolophidae) in Egypt and South West Asia. *Israel J. Zool.*, 21:1-12.
- DOBSON, G. E. 1878. Catalogue of the Chiroptera in the collection of the British Museum. London, xlii + 576 pp.
- FESTA, E. 1921. *Missione zoologique del Dott. E. Festa in Cirenaica*. *Boll. Musei Zool. Anat. Comp. Torino*, 46(86):359-379.
- HANAK, V. 1966. Zur Systematik und Verbreitung der Gattung *Plecotus*, Geoffroy, 1818 (Mammalia, Chiroptera). *Lynx*, 6:57-66.
- HARRISON, D. L. 1964. The mammals of Arabia. Vol. I. Introduction, Insectivora, Chiroptera, Primates. Ernst Ben Ltd., London, xx + 192 pp.
- HARRISON, D. L., AND M. C. JENNINGS. 1980. Occurrence of the noctule, *Nyctalus noctula* Schreber, 1774 (Chiroptera: Vespertilionidae) in Oman, Arabia. *Mammalia*, 44:409-410.
- HAYMAN, R. W., AND J. E. HILL. 1971. Order Chiroptera. Part 2: Pp. 1-73, in *The Mammals of Africa: an identification manual* (J. Meester and H. W. Setzer, eds.), Smithsonian Institution Press, Washington, D.C.
- HEY, R. W. 1963. Pleistocene screes in Cyrenaica. *Eiszeitaltar und Gegenwart*, 14: 77-84.
- HUFNAGEL, E. (with A. Craig-Bennet, O. Brogan, R. J. G. Savage and Ed. van Weerd. 1972. *Libyan mammals*. The Oleander Press, 85 pp.
- KLAPOTCZ, B. 1909. Beitrage zur Kenntnis der Sauger von Tripolis und Barka. *Zool. Jahrb.*, 27:237-272.
- LANZA, B. 1959. Notizie sull'osso peniale dei Chiroterri Europei e su alcuni casi di Paralletismo morfologico. *Monit. Zool. Italiana*, 67:3-14.
- . 1960. Su due specie criptiche di Orecchione: "Plecotus auritus" (L.) e "P. wardi" Thomas ("Mamm.; Chiroptera"). *Monit. Zool. Italiana*, 68:7-23.
- LAURENT, P. 1937. Une chauve-souris nouvelle pour le Maroc: la noctule *Nyctalus noctula* Schreber a Rabat. *Bull. Soc. Sci. Nat. Maroc*, 17:14-20.
- LEWIS, R., AND D. L. HARRISON. 1962. Notes on the bats from the Republic of Lebanon. *Proc. Zool. Soc. London*, 138:473-486.
- PETERS, W. C. H. 1852. *Naturwissenschaftliche Reise nach Mozambique*. Zoologie I: Saugethiere. G. Reiner, Berlin, 202 pp.
- POHLE, H. 1953. Ueber die Fledertiere von Kreta. *Zeitschr. Saugetierk.*, 17:14-20.
- ROER, H. 1960. *Verläufige Ergebnisse der Fledermause-Beringung und Literaturübersicht*. *Bonner Zool. Beitr.*, 11:234-256.
- SETZER, H. W. 1957. A review of Libyan mammals. *J. Egyptian Publ. Health Assoc.*, 32:41-82.
- TOPAL, G. 1958. Morphological studies on the os penis of bats in the Carpathian Basin. *Ann. Hist.-Nat. Mus. Nat. Hungary*, 50:331-342.
- TOSCHI, A. 1954. Elceno preliminare dei mammiferi della Libia. *Suppl. Ric. Zool. Appl. Caccia, Bologna*, 2:241-275.
- ZAVATTARI, E. 1934. *Prodomo della fauna della Libia*. Tipografia gia Cooperativa, Pavia, viii+1234 pp.
- ZOHARY, M. 1973. *Geobotanical foundations of the Middle East*. Verlag, Stuttgart, 2 vols., xi + 739 pp.