

**Final Report
Operation Wallacea
Sinai 2005**

Bats



by
Christian Dietz
University of Tuebingen, Germany.
email: ChristianDietzHorb@web.de

Preface

The report consists of two parts. In part 1 the data collected during the Operation Wallacea 2005 Sinai expedition are given and discussed. Some suggestions for further scientific studies are outlined as well. In part 2 ideas how to induce scientific bat research projects are given.



Rhinolophus hipposideros



Barbastella leucomelas

Contents

1. Bats of the St.-Katherine-Protectorate, Sinai	4
1.1 Abstract.....	4
1.2 Introduction	4
1.3 Methods.....	4
1.4 Results	5
1.5 Species records and species discussion.....	6
1.5.1 <i>Rousettus aegyptiacus</i>	6
1.5.2 <i>Rhinolophus clivosus</i>	6
1.5.3 <i>Rhinolophus hipposideros</i>	6
1.5.4 <i>Asellia tridens</i>	7
1.5.5 <i>Nycteris thebaica</i>	7
1.5.6 <i>Hypsugo ariel</i>	7
1.5.7 <i>Hypsugo bodenheimeri</i>	7
1.5.8 <i>Eptesicus bottae innesi</i>	8
1.5.9 <i>Plecotus christii</i>	8
1.5.10 <i>Barbastella leucomelas</i>	9
1.5.11 <i>Tadarida teniotis</i>	9
1.5.12 unidentified Molossidae.....	9
1.5.13 <i>Rhinopoma hardwickii</i>	10
1.5.14 <i>Taphozous perforatus</i>	10
1.6 General discussion	10
1.7 Suggestions for studies in the St. Katherine Protectorate	11
1.7.1 searching for roosts.....	11
1.7.2 mist-netting	11
1.7.3 bat-detectors	11
1.7.4 training of rangers and staff of the protectorate	12
1.8 Suggestions for studies during Operation Wallacea Expeditions....	12
1.9 Prospect	13
1.10 Acknowledgements	13
1.11 Attachments	13
2. Bat research in Egypt	14
2.1 Introduction	14
2.2. List of possible activities to start bat research in Egypt	14
2.2.1 Training course.....	14
2.2.2 Identification key	15
2.2.3 Species List.....	15
2.2.4 Data base	15
2.2.5 Echolocation behaviour	16
2.2.6 Distribution	16
2.2.7 Ecological data	16
2.2.8 Species monitoring.....	16
2.2.9 Taxonomy.....	17
2.2.10 Protection	17
Appendix I: List of material necessary to provide a small team with all equipment necessary for successful research.	18
Appendix II: Possible additional costs for bat research.	23

1. Bats of the St.-Katherine-Protectorate, Sinai

by Christian Dietz, University of Tuebingen, Germany

1.1 Abstract

Data on the distribution and echolocation of bats were gathered during the Operation Wallacea 2005 Sinai expedition between 29th of July 2005 and 19th of August 2005. Bats were captured by mist-nets in foraging areas or at drinking sites and their echolocation calls were recorded. By comparing release-calls of individuals of known species with recordings from various sites in the St.-Katherine-Protectorate and the capture data a species list of bats could be established. Out of the 7 species that have been found in the Sinai before, at least 6 species could be confirmed. In addition at least 5 more species were found for the first time in the Sinai. The confirmation of the historical records of *Barbastella leucomelas* and *Rhinolophus hipposideros* by recent captures and sound-recordings show the importance of the protectorate for bats. Both species are only found in Egypt in Sinai.

1.2 Introduction

The bat fauna of Egypt is poorly known. The most recent summary of all bat data was done by M.B. Qumsiyeh in 1985 (Qumsiyeh, M.B. 1985. The bats of Egypt. Special Publications of the Texas Tech University No. 23, 102 pp.). This comprehensive work shows that most data on the distribution of bats come from the lower Nile valley. For the Sinai only 7 out of the 22 species found in Egypt are reported. Of most species only single records are known. On the other hand, two species, the barbastelle (*Barbastella leucomelas*) and the lesser horseshoe bat (*Rhinolophus hipposideros*) are known in Egypt from the Sinai only, both species with single individuals. The barbastelle (*Barbastella leucomelas*) has been found by Rüppell in 1822 in the Sinai and described by Cretzschmar in 1826 as a species on its own. The lesser horseshoe bat (*Rhinolophus hipposideros*) was found in 1953 by Hoogstraal. Both species have been never found since in Egypt. Aim of the study has been to evaluate the status of distribution of these two species, to search for further species, to produce a species list and to provide data on their echolocation behaviour which will enable a sound library to be established.

1.3 Methods

Between the 29th of July and the 19th of August 2005 bats were captured using mist-nets in foraging habitats and at drinking sites. Mist-nets are specially designed nets that are used to catch birds and bats. They are strung between poles (we used fishing poles) within suitable foraging areas or at places where the bats come to drink. Captured bats were removed as soon as possible and kept individually in cloth bags. Standard measurements of forearm-length and lengths of fifth and third finger and body mass were taken for all individuals. Photographs were taken of all species and echolocation calls recorded when the bats were released.

Echolocation calls were recorded with the custom-built recording system PCTape (© University of Tuebingen, Germany). The system consists of an ultrasound-microphone, an interface with ring-memory and recording software on a laptop. Each file consists of a 6 second long recording and a comment file, both stored in wav-format. The recordings were analysed using the custom-built analysis-software SELENA (© University of Tuebingen, Germany). Standard sound parameters like start-frequency, best-frequency, end-frequency, sound-duration and pulse-interval were measured to analyse the sounds. The recordings were compared with an existing sound-library at the University of Tuebingen and with recordings of known species. Some recordings that could not be assigned to a certain species were sent to colleagues at the Universities of Jerusalem and Tel-Aviv to compare with their sound-libraries.

1.4 Results

Ninety-three bats belonging to 8 species were captured by mist-nets. More than 500 sound files contain recordings of at least 11 species, including several ones that have not been recorded so far from the Sinai. The following species list (Tab. 1) summarises published and new results.

Table 1: Records of bats from the Sinai including the data of the 2005 season.

Species	records given by Qumsiyeh 1985	mist-netting # of individuals	sound-recordings	photographs
<i>Rousettus aegyptiacus</i>	-	60	+	+
<i>Rhinolophus clivosus</i>	+	1	+	+
<i>Rhinolophus hipposideros</i>	+	2	+	+
<i>Asellia tridens</i>	+	-	+	-
<i>Nycterus thebaica</i>	+	-	+?	-
<i>Hypsugo ariel</i>	-	1	+	+
<i>Hypsugo bodenheimeri</i>	+	2	+	+
<i>Eptesicus bottae innesi</i>	-	1	+	+
<i>Plecotus christii</i>	+	22	+	+
<i>Barbastella leucomelas</i>	+	2	+	+
<i>Tadarida teniotis</i>	-	-	+	-
<i>Molossidae spp.</i>	-	-	+?	-
<i>Rhinopoma hardwickii</i>	-	-	+?	-
<i>Taphozous perforatus</i>	-	-	+	-
# of species:	7	8	11 + 3?	8

1.5 Species records and species discussion

1.5.1 *Rousettus aegyptiacus*

The Egyptian fruit-bat is common in the Nile Valley but has not been found in the Sinai before. We captured a single individual of the species at Ein Hodra and observed a foraging one in St. Katherine. More than 60 individuals were captured in a garden in Wadi Feiran. The high number of captured individuals suggests that the species forms a maternity colony in this wadi. Colonies are usually found in caves or underground structures like mines or galleries.

New records:

1 ind. (f ad) captured at a well in the Oasis Ein Hodra, Wadi Hodra on 04.08.2005 (mist-net). 5 ind. in the Oasis Ein Hodra, Wadi Hodra on 04.08.2005 (visual obs). 1 ind. at the village of St. Katherine patrolling the trees along the road on 09.08.2005 (obs, rec). 66 (8 f ad, 6 f sbad, 17 m ad, 5 m sbad, 30 released without sexing or ageing) captured in Wadi Feiran, Feiran Oasis, garden el Braga on 10.08.2005 (mist-net). 3 ind. in Wadi Feiran, Feiran Oasis, garden el Braga on 11.08.2005 (visual obs). 3-5 ind. in Wadi Feiran, Feiran Oasis, garden el Braga on 12.08.2005 (visual obs).

Published records:

No published records from Sinai (Qumsiyeh 1985).

1.5.2 *Rhinolophus clivosus*

The Arabian horseshoe bat has been found earlier in the Sinai. We captured a single specimen in Wadi Feiran and took sound recordings of several more individuals. The species roosts in underground galleries like mines and caves.

New records:

3 ind. (1 f sbad, 2 f ad) captured at Wadi Feiran, Feiran Oasis, garden el Braga on 10.08.2005 (mist-net). 1 ind. at Wadi Feiran, Feiran Oasis, garden el Braga on 11.08.2005 (obs, rec). 2 ind. at Wadi Feiran, Feiran Oasis, garden el Braga on 12.08.2005 (obs, rec).

Published records:

3 ind. Al Arish (Hoogstraal 1962, Qumsiyeh 1985). 9 ind. Feiran Oasis (Hoogstraal 1962, Qumsiyeh 1985). Wadi Talaah near Saint Katherine Monastery (Wassif & Hoogstraal 1954).

1.5.3 *Rhinolophus hipposideros*

The lesser horseshoe bat has been found with a single specimen only once before in Egypt in Wadi Feiran. We got sound recordings from this Wadi, observed one individual at Farsh el-Romana and captured two individuals at the Ecolodge al-Karm. Our new records confirm the occurrence of the species in Egypt at the edge of the species' distribution.

New records:

1 ind. at Farsh el-Romana in the garden Abu Hamat on 08.08.2005 (obs, rec). 1 ind. at Wadi Feiran, Feiran Oasis, garden el Braga on 12.08.2005 (obs, rec). 1 ind. at Farsh el-Romana in the garden Abu Hamat on 15.08.2005 (obs, rec). 2 ind. (1 f sbad, 1 m sbad) captured at the Ecolodge Al-Karm, Wadi Shiekh awad on 17.08.2005. 1 ind. at the Ecolodge Al-Karm, Wadi Shiekh awad on 17.08.2005 and 18.08.2005 (obs, rec).

Published records:

1 ind. Feiran Oasis (FMNH 74476) (Hoogstraal 1962).

1.5.4 *Asellia tridens*

The trident leaf-nosed bat has been found in the Sinai before as well. We got sound recordings from Wadi Feiran. The species is known to roost in underground shelters.

New records:

1 ind. at Wadi Feiran, Feiran Oasis, garden el Braga on 11.08.2005 (obs, rec).

Published records:

El Arish (Hoogstraal 1962). Tor (Anderson 1902).

1.5.5 *Nycteris thebaica*

The Egyptian slit-faced bat has been recorded from the Sinai. We got a sound recording from Wadi Feiran that might be assigned to the species, but unfortunately the quality is quite low.

New records:

Sound recordings of 1 ind. at Wadi Feiran, Feiran Oasis, garden el Braga on 11.08.2005 might belong to this species, but are too bad in quality to assure correct species identification.

Published records:

2 ind. "Mt. Sinai" (BMNH) (Qumsiyeh 1985).

1.5.6 *Hypsugo ariel*

The Egyptian desert pipistrelle is a very rare bat, known only from a very few specimen from Sudan, Egypt, Israel and Saudi Arabia. It has not been recorded from Sinai before. We captured a specimen by mist-net in Wadi Arbain and it was identified by several morphological characters. Species identification was confirmed later on by several skull and teeth characters. The taxonomy of the Arabian species of the genus *Hypsugo* is poorly understood, it is well possible that *Hypsugo ariel* and *Hypsugo bodenheimeri* belong to the same species, in this case the name *Ariel* would have priority over *bodenheimeri*. The echolocation calls of the specimen from Wadi Arbain did not differ from those of *Pipistrellus bodenheimeri* from Ein Hodra.

New records:

1 ind. (m ad) captured in a garden in the Wadi Arbain (Ramadan's garden) on 01.08.2005 (mist-net).

Published records:

No published records from Sinai (Qumsiyeh 1985).

1.5.7 *Hypsugo bodenheimeri*

Bodenheimer's pipistrelle is a rare species known only from the Arabian Peninsula and the Sinai, where it has been found in St. Katherine before. We captured two individuals in the oasis Ein Hodra.

New records:

2 ind. (1 f sbad, 1 m ad) captured in the oasis Ein Hodra, Wadi Hodra on 05.08.2005 (mist-net).

Published records:

2 ind. at Saint Katherine Monastery (HUJ) (Qumsiyeh 1985).

The two pipistrelle species *Hypsugo ariel* and *Hypsugo bodenheimeri* did not differ in their echolocation calls, so the sound recordings could not be assigned to one of the two species. Pipistrelles (*Hypsugo* spec.) were recorded regularly around St. Katherine, Ein Hodra, Wadi Feiran and at

the Ecolodge Al-Karm. Pipistrelles belong to one of the most common and widely distributed of all the bat species in the Sinai.

New records:

2 ind. at the Research Centre Saint Katherine in Wadi Arbain on 30.07.2005 (obs, rec). 4 ind. in the oasis Ein Hodra, Wadi Hodra on 04.08.2005 (obs, rec). 8 ind. in the oasis Ein Hodra, Wadi Hodra on 05.08.2005 (obs, rec). 1 ind. centre of the village Saint Katherine on 09.08.2005 (obs, rec). 1 ind. at the entrance to the monastery of Saint Katherine on 09.08.2005 (obs, rec). 2 ind. at the Research Centre Saint Katherine in Wadi Arbain on 09.08.2005 (obs, rec). 3 ind. at Wadi Feiran, Feiran Oasis, garden el Braga on 11.08.2005 (obs, rec). 1 ind. at Wadi Feiran, Feiran Oasis, garden el Braga on 12.08.2005 (obs, rec). 15-20 ind. foraging close to the Ecolodge Al-Karm, Wadi Shiekh awad on 17.08.2005 (obs, rec). 6 ind. foraging close to the Ecolodge Al-Karm, Wadi Shiekh awad on 17.08.2005 (obs, rec). 2 ind. at Sharm el-Sheikh airport on 24.08.2005 (rec).

1.5.8 *Eptesicus bottae innesi*

Botta's serotine has been recorded rarely in Egypt in the Nile valley, no records have been made in the Sinai. We captured a single individual in Wadi Feiran. By comparing sound recordings of this individual with other recordings we could identify most of the mystery calls as belonging to this species. Recordings were made at St. Katherine, Ein Hodra, Wadi Feiran and at the Ecolodge Al-Karm. It seems to be a widely distributed species in the Sinai.

New records:

2 ind. around the Research Centre Saint Katherine in Wadi Arbain on 30.07.2005 (obs, rec). 4 ind. foraging around the Research Centre Saint Katherine in Wadi Arbain on 02.08.2005 (obs, rec). 1-3 ind. in the Oasis Ein Hodra, Wadi Hodra on 05.08.2005 (obs, rec). 1 ind. (m ad) captured in Wadi Feiran, Feiran Oasis, garden el Braga on 10.08.2005 (mist-net). 4 ind. in Wadi Feiran, Feiran Oasis, garden el Braga on 11.08.2005 (obs, rec). 2-4 ind. in Wadi Feiran, Feiran Oasis, garden el Braga on 12.08.2005 (obs, rec).

Published records:

No published records from Sinai (Qumsiyeh 1985).

1.5.9 *Plecotus christii*

The desert long-eared bat has been regarded as belonging to the Grey long-eared bat, *Plecotus austriacus*, for many years. Recent genetic studies have shown, that *christii* is a separate species. Long-eared bats have been known from the Sinai as well. We captured 22 individuals at many sites, a fact that is easy to explain, long-eared bats in general are easy to catch with mist-nets.

New records:

1 ind. in a garden in the Wadi Arbain (Ramadan's garden) on 01.08.2005 (obs, rec). 1 ind. (m ad) captured in the Oasis Ein Hodra, Wadi Hodra on 04.08.2005 (mist-net). 4 ind. (2 m ad, 1 m sbad, 1 f ad) captured in the Oasis Ein Hodra, Wadi Hodra on 05.08.2005 (mist-net). 2 ind. (2 f ad) captured in a garden in Wadi Gebal (Hussein's garden) on 07.08.2005 (mist-net). 3 ind. (3 m ad.) Captured in Wadi Feiran, Feiran Oasis, garden el Braga on 10.08.2005 (mist-net). 6 ind. (5 m ad., 1 m sbad) captured in Wadi Feiran, Feiran Oasis, garden el Braga on 11.08.2005 (mist-net). 1 ind. (m ad) captured at the Ecolodge Al-Karm, Wadi Shiekh awad on 17.08.2005 (mist-net). 1 ind. (m ad) captured at the Ecolodge Al-Karm, Wadi Shiekh awad on 18.08.2005 (mist-net).

Published records: 5 ind. Jabal El' Ajmah (HUJ). 1 ind. St. Katherine Monastery (HUJ). 1 ind. Tor (BMNH). 1 ind. Um Hashiba (TAU) (Qumsiyeh 1985).

1.5.10 *Barbastella leucomelas*

The Sinai barbastelle has been found only once in Egypt in the Sinai. Most probably the isolated population of the barbastelle from the Sinai Peninsula forms a distinct species even though it has been traditionally united with the Asian barbastelle. We captured two individuals at St. Katherine and many sound recordings were taken here as well. The only other place where the bat was found was around the Ecolodge Al-Karm. If the separate species status of the Sinai-barbastelle could be confirmed, it will be an endemic species to the Sinai Peninsula and might require special conservation.

New records:

5 ind. at the Research Centre Saint Katherine in Wadi Arbain on 29.07.2005 (obs, rec). 2 ind. (f ad) captured the Research Centre Saint Katherine in Wadi Arbain on 30.07.2005 (mist-net). About 20 ind. at the Research Centre Saint Katherine and its surroundings in Wadi Arbain on 30.07.2005 (obs, rec). About 20 ind. at the Research Centre Saint Katherine and its surroundings in Wadi Arbain on 02.08.2005 (obs, rec). About 10 ind. at the Research Centre Saint Katherine and its surroundings in Wadi Arbain on 09.08.2005 (obs, rec). 1-2 ind. at the Ecolodge Al-Karm, Wadi Shiekh awad on 17.08.2005 (rec).

Published records: 2 ind. Sinai, Egypt 1822 (labelled Arabia Petraea) (SMF 4343, SMF 12393) (Mertens 1925, Kock 1969, Qumsiyeh 1985, Harrison and Makin 1988, Harrison & Bates 1991).

1.5.11 *Tadarida teniotis*

The European free-tailed bat has not been recorded from the Sinai before. We got many sound recordings of the species from St. Katherine, Wadi Arbain and the Ecolodge Al-Karm.

New records:

1-5 ind. foraging every night around the Research Centre Saint Katherine in Wadi Arbain between 29.07.2005 and 20.08.2005 (obs, rec). 2 ind. foraging in the oasis Ein Hodra, Wadi Hodra on 05.08.2005 (obs, rec). 1 ind. at the Ecolodge Al-Karm, Wadi Shiekh awad on 17.08.2005 (rec).

Published records:

No published records from Sinai (Qumsiyeh 1985).

1.5.12 unidentified Molossidae

We also got sound recordings of a molossid bat (Molossidae) that are higher in their frequency than those of *Tadarida teniotis* but are otherwise quite similar. Most probably they belong to an other species of free-tailed bat, but unfortunately no reference calls are available. The only other free-tailed bat known from Egypt is *Tadarida aegyptiaca*, but the species emits echolocation calls much higher than those recorded (but reference sound recordings are only available from South Africa!). It might be possible that the recorded sounds belong to one of the *Chaerephon* species. None of those species has been found in Egypt until now, but they are known from Sudan and from the Arabian Peninsula. All these species are very strong fliers and it is not hard to imagine that the high flying bats have not been captured before.

New records:

1-2 ind. foraging around the Research Centre Saint Katherine in Wadi Arbain on 30.07.2005 (rec). 1 ind. foraging at a garden in the Wadi Arbain (Ramadan's garden) on 01.08.2005 (rec). 2 ind. foraging around the Research Centre Saint

Katherine in Wadi Arbain on 02.08.2005 (rec). 1 ind. foraging close to the bus parking of the Monastery Saint Katherine in Wadi Sheikh on 09.08.2005 (rec).

Published records:

There are no published records of any molossid bat from Sinai (Qumsiyeh 1985).

1.5.13 *Rhinopoma hardwickii*

The lesser mouse-tailed bat is a common bat of the Nile valley but has not been reported from the Sinai. We got a sound recording in Wadi Feiran that might belong to the species. Unfortunately the foraging situation of the individual was atypical in a much cluttered background situation, so the calls are not well comparable to reference calls and species identification remains doubtful.

New records:

Maybe 1 ind. foraging in Wadi Feiran, Feiran Oasis, garden el Braga on 12.08.2005 (rec). Species identity not well supported.

Published records:

No published records from Sinai (Qumsiyeh 1985).

1.5.14 *Taphozous perforatus*

The tomb bat is known from the Nile valley, but has not been reported from the Sinai. Sound recordings from Wadi Feiran are identically with reference recordings from Wadi Degla and from Israel, so the species could be confirmed for the first time from the Sinai.

New records:

At least 2 ind. foraging in Wadi Feiran, Feiran Oasis, garden el Braga on 11.08.2005 (obs, rec). At least 1 ind. foraging in Wadi Feiran, Feiran Oasis, garden el Braga on 12.08.2005 (rec).

Published records:

No published records from Sinai (Qumsiyeh 1985).

1.6 General discussion

Together records of 12 positively identified bat species are now available from the Sinai, representing more than 50 % of the 22 species reported until now from Egypt. In addition sound recordings of maybe two more species were taken. Certainly some more species could be found in further surveys, but the number of reported species already highlights the importance of the St. Katherine-Protectorate for the conservation of bats in Egypt. Two species that have been found previously in Egypt only within the protectorate, the barbastelle (*Barbastella leucomelas*) and the lesser horseshoe bat (*Rhinolophus hipposideros*), were found during the recent survey again. It is a very good result of the 2005 Sinai expedition to find the barbastelle for the first time since 1822 at its type-locality again. The Sinai-barbastelle is one of the rarest bats in the western Palaearctic, it has been found only at a few other sites in Israel and only in low numbers. Most probably *Barbastella leucomelas* forms a distinct species completely isolated from the two other species of the genus, the European barbastelle (*Barbastella barbastellus*) and the Asian barbastelle (*Barbastella darjelingensis*). The species could be found with at least 20 individuals at the Research Centre in St. Katherine, a hint that the species forms a well established population within the Protectorate. Some more individuals were found foraging around the Ecolodge Al-Karm. The lesser

horseshoe bat *Rhinolophus hipposideros* has only been reported in Egypt in 1953 from a single specimen collected in Wadi Feiran. During our expedition we found the species at three localities within the Protectorate and two captured individuals were young born in the year, so the species certainly reproduces in Egypt as well.

1.7 Suggestions for studies in the St. Katherine Protectorate

The assessment of bats in a certain area has to be a combination of several methods. Usually roosts can be found only with the help of locals. The knowledge about roost gives the necessary prerequisite to study the ecology of species and populations in more detail. In only sparsely vegetated areas it is quite difficult to assess bat species by mist-netting and the use of sound recording systems gives only limited information about the ecology of a species (no reproductive data can be assessed by this method). It is also important to study bats at different times of the year, as bats react in a very fast and complex way to changes in prey availability and temperature. It might be well possible that further species occur within the protectorate in winter, spring or autumn. I would like to emphasize that all bat work should only be carried out by trained and well educated bat specialists to avoid negative impacts on the very rare bat species of the Protectorate. Some basic suggestions for further studies are given here:

1.7.1 searching for roosts

During the 2005 expedition no roosts of bats could be surveyed. Especially the many mines in the Wadi Feiran which seem to be suitable roosts for bats of many species should be surveyed. In the past bats have been found in underground galleries there by Hoogstraal. The high number of captured fruit-bats in 2005 makes it highly probable that an underground roost of this species exists somewhere in the Wadi Feiran. It would be very helpful for the protection of bats and the estimation of their population size to find some of their roosts. In addition new species not found in the Sinai before might be found in underground site of the Wadi Feiran like *Rhinopoma hardwickii* or *Taphozous perforatus*.

1.7.2 mist-netting

Further scientific studies should include mist-netting in other oases and at further drinking sites. Especially wadis with "dense" vegetation like Wadi Tebeg should be studied concerning their bat fauna. If roosts are found captures within or at these roosts to asses the species and their reproductive condition should be carried out.

1.7.3 bat-detectors

It might be also possible to perform transect-work with bat-detectors, but all people doing this transect work must be advised in detail about the possibilities and especially about the problems of species identification with normal bat-detectors, to avoid the

collection of pseudo-scientific data. To use sound recording for transect work requires expensive equipment (time-expansion-detector with sound recording device) and analysis software. It seems wise to provide such equipment to the Protectorate that could also be used during Operation Wallacea Egypt expeditions.

1.7.4 training of rangers and staff of the protectorate

Rangers and staff of the protectorate should be trained in how to identify bats found in houses or roosts and how to search for bat roosts.

1.8 Suggestions for studies during Operation Wallacea Expeditions

As outlined above the relative rareness of bats in arid regions, especially in the Sinai Mountains, makes regular bat projects difficult. Scientific projects about the desert bats require many skills and techniques that do not allow doing them in group work with untrained students (e.g. telemetry). On the other hand nearly nothing is known about most of the species and all kind of data on the rare and most probably endangered species are welcome.

I suggest including some bat work in a general mammals project and to do one or two nights per week surveys or transect work on bats. As the bat density was found to be highest around St Katherine, it might be best to do parts of the bat work there. I suggest to do repeated transect work on fixed transects with bat-detectors to get data on the spatial and temporal distribution of the species. Further projects could include faunistic assessments in further oasis. Because all activities like bat catching or searching for roosts require well trained bat workers to avoid disturbance to the bats, sound recording and analysis might be the best methods as well.

If a bat scientist will be there to give advice it might be most promising to check further oasis and valleys for the presence of bats and to search especially Wadi Feiran for roosts and foraging grounds.

1.9 Prospect

The photographs and data collected during the Sinai 2005 expedition will be used to create and illustrated identification key of the bats of Sinai by the external characteristics and their echolocation calls. This ID-key will be available from the Internet. The data collected during the field trip will be published in a scientific article to make them accessible to the scientific community.

1.10 Acknowledgements

I would like to express my gratitude to the many people that helped to make the bat-survey a success: Operation Wallacea, especially Tim Coles for giving me the possibility to work in the Sinai, the staff, especially Kathy Meakin, Rebecca Guenther and Steve Oliver for their permanent help in many respects, Francis Gilbert, Samy Zalat and the whole BioMAP Egypt-team for their help and many discussions, the staff of the protectorate for their help and for given the permission for field-work, the staff of the Camp for providing such a perfect base camp, the Bedouin guides for their help in finding good capture places and the students and volunteers for their presence. I am especially grateful to Kathy Meakin for her friendship, the perfect advice and her enthusiasm to spend the nights with bat work in addition to her many other duties.

1.11 Attachments

- Excel file containing all species records
- Powerpoint file containing sonograms of echolocation calls
- JPEG files with pictures of all species captured

2. Bat research in Egypt

by Christian Dietz –University of Tuebingen, Germany

2.1 Introduction

Due to its size, geographical location and habitat richness, Egypt is expected to have a high bat species richness. But research on the bat fauna in Egypt is currently undeveloped. The most comprehensive work is "The bats of Egypt" by M.B. Qumsiyeh, published in 1985. To date there are only 22 recorded bat species in Egypt. This number of species is relatively low and the true number is believed to be much higher. For the known species there is very little knowledge of their ecology and behaviour. We aim to improve basic knowledge of the distribution and systematics of the bats of Egypt, to serve as a basis for further scientific studies and conservation planning.

As in many faunistic groups, bat research and protection require skilled and educated staff. For proper species identification and monitoring with the use of sophisticated technical equipment such as bat detectors, good training is essential to avoid misidentifications, misuse of the equipment, or even worse, injury to the bats. I suggest the establishment of training courses for interested people. These training sessions will last for about one week, and will cover all aspects of bat biology, systematics and research methods.

All activities in bat research should be part of a coherent research programme studying, for example, species distribution, habitat selection and the climatic niche. It is preferable that such research should be part of a national programme of research on vertebrates.

General methods of bat research and many valuable ideas and comments can be found in the Bat Workers Manual available for downloading at: www.jncc.gov.uk/Publications/bat_workers

2.2. List of possible activities to start bat research in Egypt

2.2.1 Training course

As outlined above, a training course for people interested in bat-work is a necessary prerequisite to guarantee successful and scientifically satisfactory studies. During these training courses, new data on the bats of different areas can be collected, and while doing this, the necessary skills will be taught.

The first training courses should be given by International bat researchers in cooperation with naturalists from Egypt. In most European countries there are regular training courses in many aspects of bat research; some of the methods will have to be adapted for the Egyptian situation, but in general the same methods can be used.

Later on training courses can be arranged by Egyptian bat workers and be held at regular intervals to increase the number of people working with bats.

A basic training course should last for one week and include a variety of methods with field practice:

- Bat biology and ecology
- Conservation in general and bat conservation
- Identification of bats
- How to find bats: roosts – foraging habitats – seasonal activities and assessment methods
- Working with bat detectors: equipment, methods, species identification
- roosts: finding of roosts, possibilities of data collection at roosts and conservation of roosts
- foraging habitats: methods of catching bats.
- Advanced scientific methods: telemetry, marking, faecal analysis.....
- Data collection, analysis and mapping programs, link to BioMAP

2.2.2 Identification key

Correct species identification is the basis for all scientific studies on bats. An illustrated identification key to the bats of Egypt is in progress at the moment (author Christian Dietz), with a draft version already available. The ID-key will soon be available on the Internet, accessible to the public. This identification key will include additional species likely to be found in the future.

2.2.3 Species List

The 22 bats species recorded so far are not necessarily the full number of species inhabiting the territory of Egypt. In Libya three more species (*Nyctalus lasiopterus*, *Plecotus gaisleri* and *Pipistrellus hanaki*) are known. In Israel and Palestine a total of 33 species is known and on the Western Arabian Peninsula 28 species.

As we mentioned earlier, we believe that there are additional species in the country. The true number of species will only be known after different habitats have been surveyed using a variety of methods. Systematic research over a large geographical region covering many different habitats will need a huge amount of skilled manpower.

2.2.4 Data base

All data available from the Internet, mainly from the major publications on bats, should be included in a national database available to researchers, preferably accessible via the Internet. It would worth contacting scientists who have been collecting data on the bats of Egypt in the past, such as M. B. Qumsiyeh, in order to get more detailed data.

2.2.5 Echolocation behaviour

Bats use of ultrasound can be a big advantage to bat surveyors. The use of ultrasonic detectors is a common method for bat surveys all over the world. To identify the recorded species, a sound library with a good identification key for the sounds is necessary. The best data for comparison can be obtained from release calls of captured bats.

From the data collected during the Opwall 2005 bat excursion, a preliminary echolocation-call repertoire of the bats of Egypt is currently available. However, data are still lacking for 10 of the 22 species reported in Egypt.

In order to use echolocation calls for bat surveys, and to record calls for a sound library, sound recording equipment consisting of a bat detector, a recording system and analysing software is necessary. A further possibility could be the use of an automatic monitoring system such as ANABAT.

2.2.6 Distribution

Data on the distribution of bats is available from several publications, but some of the records are old and only a small part of the country has been searched for bats. Most available data concern bat species roosting in underground sites such as caves or caverns. Many new data can be collected during bat surveys. After looking at the available data, special focus can be given to regions where there is a lack of knowledge.

2.2.7 Ecological data

There are hardly any ecological data about bats of Egypt available. During any kind of bat research, many types of ecological data can be assessed. It is very important to collect the information within a coherent research question. Important data could be type of roost, temperature of roost, numbers of individuals and species per roost, the seasonal timing of births, etc.

2.2.8 Species monitoring

In most bat species there is little knowledge regarding changes in population size. Monitoring of population size is a necessary prerequisite for bat conservation.

Possible projects arising from the data collected in 2005 are:

- counting of bats inhabiting caves of the Wadi Degla National Park in the course of a year: regular counting of emerging bats at 10-day intervals to assess changes in species abundance.
- Transect work around St Katherine: Transects can show annual fluctuations in species composition and abundance. These transects can be done with bat detectors.

2.2.9 Taxonomy

In some species taxonomic questions are unresolved. Most of these questions can only be resolved with genetic methods comparing samples from most of the species distribution. Many such studies are being carried out in European countries. It would be very helpful if genetic samples of bats could be collected during fieldwork in Egypt, and some material provided to scientists working on bat systematics. Species assignment is most problematic in *Pipistrellus ariel* / *Pipistrellus bodenheimeri*, *Pipistrellus kuhlii* / *Pipistrellus deserti*, *Rhinolophus hipposideros*, *Barbastella leucomelas*.

2.2.10 Protection

Some bat species may be very rare in Egypt, others may be vulnerable due to specialisation to uncommon roosting sites, such as big caves. An increase in the use of caves for tourists might destroy such roosts and some species might become extinct locally. Data on the occurrence of very large roosts, and assessment of possible threats, are necessary to develop adequate conservation plans.

Appendix I: List of material necessary to provide a small team with all equipment necessary for successful research.

Equipment	Number	Available at	Specification
Torch	One for each person	(www.alanaecology.com)	A strong light to search for bats in large caves or to light at foraging bats. Best with rechargeable batteries. Spotlights or torches are available in many versions.
Headlamp	One for each person	(www.alanaecology.com)	A head lamp is essential to work at a mist net to take bats out or to climb in a cave to reach a bat roost. The lamp is usually needed only within a limited range but for a long time, so the LED lamps that use only little energy are very useful. Five LED bulbs per lamp are suitable, three bulbs are OK as well. Best with rechargeable batteries.
Tally Counters (15 Pounds)	1	www.alanaecology.com : ca 22 €	Useful to count bats when emerging from a roost.
Mist-net	1x 3m, 2x 6m, 2x 12m	www.alanaecology.com (3m: 60 €, 6m: 80 €, 12m: 120 €). www.ecotone.pl	Mist-nets are the best method to catch bats in flight. They are available in several lengths. To catch in front of cave entrances lengths of 3 or 6 m are suitable; in foraging habitats or around water pools, 6- and 12-m nets are better. The height of nets should be around 3 meters especially in the longer nets.
Poles (fishing poles)	2 per mist-net	Fishing-shop	Poles are needed to set the mist-nets. Two poles per net are necessary. For easy transport and variable use, telescopic fishing poles are very suitable. For mist-netting 6-8 meter fishing poles are suitable; the thin telescopic parts can be removed.

Ropes	6 per mist-net	-	Strong ropes are necessary to fix the poles. Usually three to four ropes per pole with a length of at least 4 m each are necessary. Some thin ropes can be used to close the capture bags and to hang them.
Crushable Insect-net 30 cm (20 Pounds)	1	www.alanaecology.com	Insect nets or butterfly nets can be fixed at a telescopic pole and are of good use to catch bats inside roosts. A small net is useful to catch only a few bats out of a large colony
Crushable Insect-net 60 cm (30 Pounds)	1	www.alanaecology.com	A large net is suitable to catch single roosting bats.
Telescopic pole for Insect net	1		Telescopic poles are useful to fix butterfly nets to reach roosts in caves or buildings. A length of two meters is useful, for some caves longer poles are necessary.
Capture bags	At least 100 bags	Home made (www.alanaecology.com): 7 € per bag)	Capture bags have to be suitable to keep single bats for some time. The best material is soft cotton cloth. Bags should be at least 25x20 cm in size, the larger the better: especially for fruit-bats, bags should be at least 30x40 cm. It is important that no loose strings are inside the bag for the bats to get entangled. Unfortunately no really good bags are available, so you must sew your own.

Gloves	A pair for everybody		Gloves are important to take the sometimes very angry bats out of nets. They have to be soft and flexible to be able to take bats out of the net. Soft cotton gloves or very soft thin leather gloves are very useful. For fruit-bats, stronger leather gloves are suitable as well.
Dial Caliper (30 Pounds)	1 per person	www.alanaecology.com : 45 €	Callipers are needed to take exact measurements of the bats. Mechanical or dial caliper with a precision of 0.1 mm are suitable.
Balance (50 Pounds)	1	(www.alanaecology.com) about 70 €	A digital balance is very useful, precision has to be 0.1 g and the surface to place the bat in a bag has to be large enough (about 10x10 cm).
Biopsy punch	20	www.xx-trade.de (80 €) www.medi-scot.co.uk www.biopsypunch.com	Biopsy punches are used to take small tissue samples from the wing membrane of bats. The samples can be used to extract DNA for studies on taxonomy or population genetics. 5 mm punches are suitable.
Eppendorf cups and alcohol	500		Eppendorf cups are used to store tissue samples. They will be filled with 80% ethanol.
Id-key	1	Internet	An ID-key is necessary to identify captured bats.
Form to fill data in	1	-	A form to fill in all necessary data (date, locality, coordinates, observer, species, sex, measurements, sample and recording numbers.....) is very useful to avoid gaps in data.

Rabies vaccination	For each person handling bats	Hospital	A rabies vaccination is highly recommended for all people taking bats in hand. Some species can transfer rabies by biting. Be aware that full protection is only given after the third injection about a year after the first one.
Bat-detector for normal work Pettersson D-100 Pettersson D-200 Batbox III	1-2 either Batbox III or Pettersson D-200 recommended	www.batsound.com (D100: 180 €; D-200: 270 €). www.alanaecology.com (D100: 285 €; D-200: 345 €; Batbox III: 210 €).	Many detector types are available for normal fieldwork. The use of very cheap ones is very limited, I recommend either the Pettersson D-200 or the Batbox III.
Bat-detector for sound recording Pettersson D-240x	1	www.batsound.com (1150 €) www.alanaecology.com (1700 €)	Bat detectors are used to make the sounds of bats audible or in the more sophisticated ones to record the echolocation calls. The best detector in quality and price is the Pettersson D240x.
Recording equipment DAT Recorder or Mini Disc recorder with intensity control	1	(www.batsound.com : DAT: 800 €) Mini Disc recorder with manual intensity control: about 500 €	To store echolocation calls either DAT-recorders or Mini Disc Recorders are suitable. The most important thing is that they have an intensity control to avoid the recording of too-loud sounds that can not be analysed later. Automatic intensity control is not suitable! Some cables and in the Pettersson 240x a small interface are necessary. DAT recorders are very good but expensive and the DAT cassettes are sometimes hard to get and expensive. MD recorders and MD discs are cheaper and also suitable (there is some data compression but it works perfectly).

Analysing software	1	www.batsound.com (430 €) www.alanaecology.com (400 €)	To analyse the recorded sounds, special analysis software is necessary. The best commercial program is BatSound.
(ANABAT automatic registration unit)	(1)	www.titley.com check price at titley@nor.com.au	To record bat activity automatically. A robust system for monitoring, well suitable in rough conditions like deserts or mountains, easy to use.
Camera	1	-	A camera is very useful to take pictures of rare bats to prove species identification or to illustrate capture sites.

Appendix II: Possible additional costs for bat research.

Type	costs
Travel and car expenses	
Salary for candidates	
Costs for training courses	
Costs for adding published data to database	