A behavioural study of the Silhouette sheath-tailed bat (*Coleura seychellensis*)

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Abstract.— The behaviour of the Seychelles sheath-tailed bat *Coleura seychellensis* was studied in the largest known roost of the species at La Passe, Silhouette island. The population of bats using the roost numbered 32, the highest count recorded for the species. The roost comprises two small interconnected caves in a boulder field. The preferred roost was relatively dark and cool. Individuals appeared to show preferences for positions within the roost. A harem structure has been speculated to exist in this species, observations from the present study may support this but are inconclusive.

Keywords.— Seychelles, Chiroptera, Emabllonuidae

INTRODUCTION

The Seychelles islands support one Critically Endangered species of mammal; the Seychelles sheath-tailed bat *Coleura seychellensis* PETERS, 1868. This species was described as "very common in the neighbourhood of the town of Port Victoria" (WRIGHT 1868) but is now rarely observed. A small number of roost sites have been located for this species but by 2003 all have been reported to be abandoned with the exception of two interconnected caves on Silhouette island occupied by 10-15 bats. The causes of this decline are not known, human disturbance, predation by barn owls and habitat destruction have been suggested (NICOLL & SUTTIE 1982; RACEY & NICOLL 1984; GERLACH 1997). Pesticide contamination does not appear to be a significant threat. The existing Silhouette roost is secure from human disturbance but invasive creepers threaten to smother the entrance. There is a need to eliminate this threat and determine the ecological requirements for the species. Very little is know of the Seychelles sheath-tailed bat and there have been few published studies of its behaviour (NICOLL & SUTTIE 1982; MATYOT 1995; JOUBERT 2004), in addition to this a brief study was made of the La Passe roost on Silhouette in 2001 (see Appendix I). The present study is the first in depth study of behaviour in the roost on Silhouette

METHODS

Observations at the roost were made on each of the 4 days of the investigation (31st March - 1st April 2003) for ½-2 hours up to 3 times a day. The observation timetable covered as many different times of the day as possible; previous studies indicated the need for more observations to be made at dusk and dawn so studies concentrated around 6am when it was just starting to get light and 6pm when the light began to fade; latest observations started at 9pm. Two observers were divided between the 2 roosts. While

approaching the roost a bat detector was used to determine whether or not the bats were present.

Light intensity (in Lux), temperature and relatively humidity were recorded inside and outside the roots using a light meter and a whirling hygrometer. The temperature, humidity and light level recording point in roost A was directly beneath the main roosting point, consequently it was sometimes not possible to record climatic data due to the presence of roosting bats. In roost B bats were always present and data were recorded in the cave entrance.

Observations involved viewing the bats, recording all behaviour and numbers in the groups. The time of the behaviour was also recorded. At cave A this was done by viewing the bats through the openings into the cave on the left and right side. Observations into cave B proved more difficult as the entrance to the cave was covered by a boulder 1.7m in height which had to be scaled to gain a good viewing position. During dark periods of observation a torch was used. However, this was kept to a low level as it aggravated the bats and so caused unnatural behaviour.

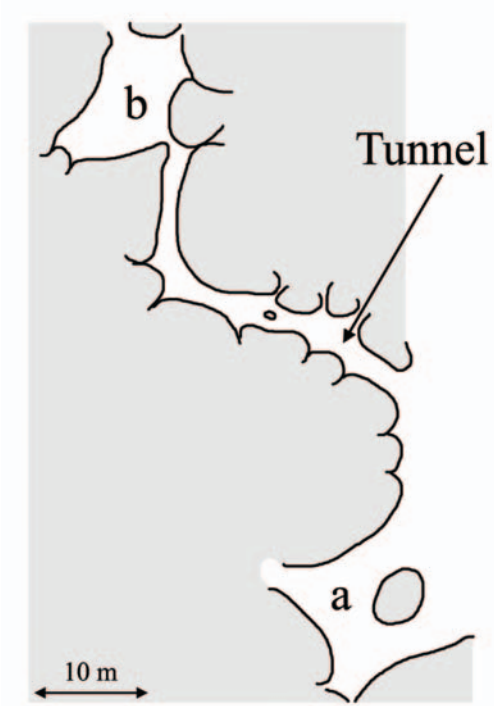

Fig. 1 Tunnel between roosts

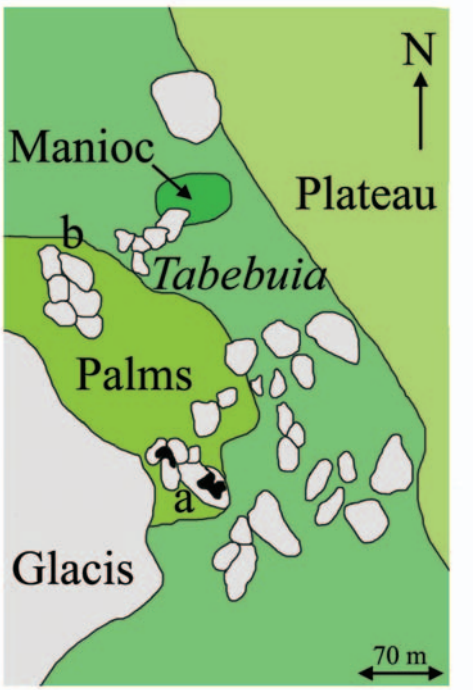

Fig. 2 Map of the La Passe roost

RESULTS

Roost characterization

The caves are in a boulder field of eroded granite boulders, situated in a forest of mixed native and introduced palms with cinnamon trees also present. These trees provide

a medium density vegetation cover (60% cover) directly outside the entrance to the caves. It is reached by a steep path over large granite boulders, to an altitude of 44m (±24m, GPS reading). The beginning of the path is well concealed. The roost system is comprised of two caves: cave A is seen first in a small clearing at the top of the path and cave B is only accessed through a small tunnel, formed by granite boulders (Figs. 1 & 2).

Cave A is separated into two parts by a central boulder. At the far left-side there is a side exit to an enclosed arrangement of boulders.

Table 1. Measurements (m) of the La Passe roosts, data for roost B are estimated

	Roost A		**Roost B**
	left	right	
Height at entrance	3.1	1.8	3.5
Width of entrance	2.1	3.8	2.0
Maximum depth	9.7		5.0
Roosting position on ceiling to floor	1.4	2.5	3.5
Entrance of cave to roosting position	2.1	3.8	3.0

Numbers

On the second day of observations a count of 32 bats was made in cave B from a viewing position of about 1.5m away. This was followed the next day by another count of 31 bats (Fig. 3).

Fig. 3 Bats in roost B

Vocalisations

Ultrasounds of 24-26KHz were detected at different times of the day in both cave A and B. While bats flew in and out of the entrance to cave A on two separate occasions (29th March 6:05am and 31st March 6:00am) they produced ultrasounds of higher frequencies, 28 and 29kHz respectively (Table 2).

Table 2. Vocalizations in the La Passe roosts

Date	time	Cave	Frequency (kHz)	observations
29th March	06:05am	A	28	Very active, 4-8 circling in and out of entrance
	06:35am	B	25	
	10:52am	B	25	Single bat vocalizing
	17:00pm	A	26	
30th March	09:30am	A	26	Little vocalization
	09:54am	B	26	
	18:39pm	B	25	All bats in a settled, roosting group
31st March	06:00am	A	29	Very active, 2-3 circling in and out of entrance
	15:35pm	B	24	
1st April	09:30am	B	24	All bats roosting in a group
	18:15pm	a	25	

Behaviour

A total of just over 11 hours were spent observing the bats. A number of behavioural patterns were observed:

Circling in and out of cave A entrance.— This occurred on 3 occasions; twice at dawn (about 06:00hrs) and once at around 18:00hrs. On all occasions the bats were very active but remained relatively quiet.

Solitary Bat in cave A.— This occurred on four occasions, always during the day; mainly in the afternoon. The bat would be found at the beginning of an observation session alone in the cave or would remain after others had left the cave due to disturbance. This bat would sometimes be joined by a small number (4-5) other bats flying in from cave B

Movement from cave A to cave B through tunnel or into tunnel and then back to cave— This occurred at all times of the day and on all of the days of observation. At periods of dusk and dawn the bats would be found flying between the two caves via the tunnel. Movement through the tunnel to observation points proved that the bats were going right through to the other cave and not just turning around half way through the tunnel making it appear like new bats were returning to the cave. A number of bats would leave one cave

and fly to the other cave and on occasions a similar number of bats (not the same bats) would fly back to the cave from the other cave soon after. During the day this movement of bats between caves was less frequent. The bats use more than just one route to travel between both caves. On numerous occasions, they were seen flying out of the entrance to cave A and up over the trees before turning in the direction of cave B. There are also at least two other alternative routes within the tunnel itself. On both arrivals at dawn, the bats were at their most active. At 6am, when it was just starting to get light, a number of bats would be roosting in cave A and cave B with many more flying to and fro between the two caves using mainly the tunnel. It would take at least an hour for the bats to settle in either cave and by light the activity was greatly reduced. At the end of the dusk observation period on 30th March (19:10hrs), no bats were roosting in either of the two caves.

Distribution within roost.— During the observations the majority of bats stayed in cave B where during the day they would usually formed one large, tightly packed group (attached by all four limbs) towards the back of the cave and another group made up of 3-4 bats slightly spread out (hanging mainly by two limbs) towards the front of the cave and the tunnel. The group at the front would contain a single bat that would constantly vocalize even when no other bats would reply. This bat would also take to flight around the cave from time to time sometimes landing amongst the main group of bats. Loud and agitated vocalisations would be given off by other members of the group when this occurred. They would also sometimes return vocalisations. The bats in the group closest to entrance in cave B appeared to be substantially rounder then those in the main group.

Fighting for position on the roost.— On a number of occasions the bats in cave B would take to flight around the cave for periods of between 20secs and 5mins around the cave. On landing the group would be spread across the ceiling. A period would then follow when the bats would move closer to each other and begin to pull each other closer using their front limbs. Vocalisation would also accompany this periods with bats sometimes taking to flight before landing again at nearly the same point the ceiling. This jostling for position was a common theme amongst the bats.

Fig. 4 A single Seychelles sheath-tailed bat

Roosting.— During the day the majority of bats would roost by all four limbs. In the majority of cases they preferred to roost with company and to be in contact with them. This is similar to observations made by NICOLL & SUTTIE (1982). They tended not to roost upside down, but instead pressed their underside against the cave ceiling while hanging on by all fours with their wings outstretched (Figs. 3 & 4). Occasionally, they would roost on top of each other in clusters.

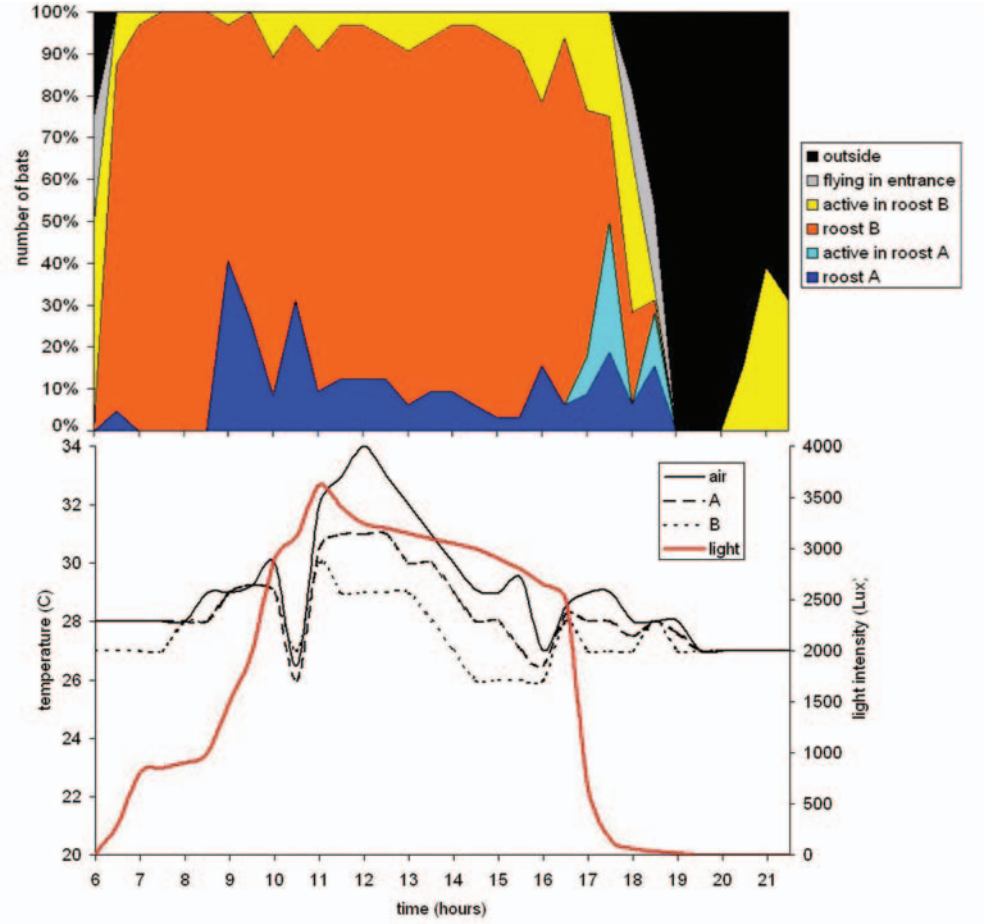

Fig. 5 Behavioural patterns and climatic data

Climate

Cave A receives more light and is warmer than cave B (Fig. 5) and the bats tended to spend most of their time in cave B. For example, readings taken on 29th March at 10am outside the caves showed cave B to be 2°C cooler than cave A and a light reading 2400 Lux lower. Four observational periods coincided with heavy rainfall, cloud and an increase in wind speed. On 3 out of 4 occasions activity of at least some bats was increased.

DISCUSSION

Cave A and B were linked by a tunnel which was used by the bats to get between the two caves. Prospecting was done around the La Passe site for other possible caves and passages between them. Unfortunately none were found. However, from the direction flown by the bats on leaving the roosts and on one occasion at dusk the bats leaving cave B, but never getting to cave A it can be strongly suggested that there are more roosts at the La Passe site or close by, although these may be only temporary roosts (see Fig. 2).

During the day, the bats preferred to roost in cave B where it was cooler and darker. It is also more protected by surrounding boulders and vegetation and so the bats are less exposed to predators and changes in the weather. Individuals appeared to have their own specific position within the roost.

The increased amount of vocalisation heard when members of the group entered a cave was a result of the new-comers attempting to locate this position and in many circumstances, displace other bats in order to roost. Cave A became more populated at dusk when the bats were preparing to feed. The entrance to cave A is in a small clearing in the forest and offers an easier route out. One bat was observed at 18:45hrs on 29th March circling a moth flying directly outside the left-side of cave A, but failed to catch it.

The difference in ultrasound used by the bats inside and outside the cave although only small is similar to the differences found by NICOLL & SUTTIE (1982). This also matches different levels of ultrasound that bats use when performing different activities such as foraging in dense vegetation foraging in open spaces and navigating in caves (NEUWEILER 2000). NICOLL & SUTTIE (1982) recorded a wider range of vocalization frequencies for bats flying in and outside of the cave: 35-40kHz for (compared to 28-29kHz in the present study) and an audible sound at 15-20kHz within the cave (compared to 24-26kHz).

Although it was not possible to distinguish between males and females the fact that no protruding external genitalia were visible may indicate that the bats were not in a reproductive phase. NICOLL & SUTTIE (1982) suggested that *C. seychellensis* could be polyoestrous due the presence of young bats in April in one year of their study. This study coincided with this period though no young were seen. However, the aggressive behaviour and loud vocalisation seen by a single bat roosting with 2-3 other larger bats, slightly away from the main group in cave B could be the sign of a protective male with pregnant females. This could be possible as these bats appeared larger than many others. This would also fit with the high frequency of vocalisation seen by NICOLL & SUTTIE (1982) and would also give support to the suggested a harem system (NICOLL & SUTTIE 1982).

The bats were more active around periods of bad weather. This matches the previous observations (in NICOLL & SUTTIE 1982); although no bats were seen foraging around the La Passe settlement area at these times, this activity is probable as insects are most abundant during bad weather.

The present study provided an accurate count of the bats and a preliminary account of their behaviour. Future research should aim to investigate the remaining questions over foraging behaviour and the existence of the harem system.

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APPENDIX I.

Summary of observations on the sheath-tailed bat (August 2001). NADINE CLARK

The sheath-tailed bat *Coleura seychellensis* was located in two roost sites (A and B) in granite boulder caves above La Passe, Silhouette. Roost A, although as large in size as roost B, only had a few bats present. This may be due to the lighter, more exposed opening of the first roost. A maximum of 4 bats were seen in roost A, forming two groups of two. The bats are found normally quite a way back into the cave in the darkest part. The bats seem to move between the two roost sites which may suggest that there is no set group occupying roost A. In roost B a maximum of 12 bats have been recorded at any given time. I would estimate the population of sheath-tailed bats, spread between the two roost sites, to be approximately 13. The bats roost in the second roost virtually in the centre of the cave approximately equidistant from the three openings. The pattern of distribution on the ceiling varied daily but the general trend was a main group in the centre of the ceiling consisting of at least 6 bats. Sometimes all the bats were in this main group, at other times two groups would form to the north-west of the main group. This group could consist of 1-4 bats. Often the main group formed a triangle or diamond shape with the extremities pointing towards the entrances to the cave. Both cave entrances were approximately north-west facing and fairly sheltered from the wind. The entrance to roost B is much more concealed than roost A which may account for the difference in bat numbers. The bats spent the majority of the time attached to the ceiling with just their hind feet. They were occasionally seen holding on with all four feet but this was rare. To move position within the colony (a frequent occurrence) the bats either flew and landed at the new position, often taking several attempts, or else moved across the ceiling on all fours. The bats were generally very vocal as they moved, as were their neighbours. These shifts in colony position often resulted in the neighbour the bat was moving towards, also moving. This could in some instances ‘upset’ the group to such an extent that the colony may all move position (generally by flight) . Physical contact between bats was frequent and ranged from gentle nudging using their wings, to more aggressive behaviour with banging into each other as they swung backwards and forward from the ceiling. The bats also seemed to roost very close together at times so that it was difficult to discern any individual bat. In general two bats would huddle together virtually holding onto the same piece of rock and touching each other. This made estimating the number of bats incredibly difficult and may have led to an under-estimate of numbers. Physical contact generally coin-

cided with loud, complex, high-pitched calling. The bats were very vocal with normally only two minutes going by between calling. The maximum length of time of silence recorded in roost B was 8 minutes. The calling could last from 1 second to 8 minutes of continuous 'chatter' in the colony. Ultrasound was detected during some, but not all of the calling , at around 30-40kHz. The bats did not appear to react to outside noises whether they were mynah birds, fruit bats, falling stones or leaves. The only thing that could possibly upset them was the helicopter and possibly the sound recording equipment. From the short time of study it was not possible to distinguish the part of the day when they are at their most active or quietest.

Fig. 6 Bats circling outside roost A at dusk