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MAMMAL ASSESSMENT FOR HIMA SITES

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1. INTRODUCTION

The magnitude and complexity of threats to biodiversity, the fast rate of biodiversity loss, and its effect on the well-being of human communities are well-documented by a growing number of scientists (Soulé 1986, Primack 2002, Wilson 2002, Wilson and Peter 1988, Brockelman 1989, Bunting 1990, Solbrig 1991). Lebanon is a small Middle Eastern country with a rich biodiversity. Despite its relatively small size, Lebanon boasts a range of ecological zones, each with its distinct flora and fauna. However, this biodiversity is currently threatened by deforestation, urban expansion, pollution, over-use of water, overhunting, and a lack of environmental awareness (Hamadeh et al. 1996). As a result forest and grassland cover has been reduced from 70% of Lebanon's current surface area 100 years ago, to less than 7% in the past 20 years, with heavy losses in cover during the war years from 1975 – 1991 (UNEP 1996). Moreover, demand on lands for urbanization and activities associated with it, the remaining forest cover will only represent less than 5% of its original size and this is expected to decrease more besides the yearly forest fires, the bad economic situation in the country is leading people to resort to wood for cooking and heating. If these trends continue, people will increasingly destroy many of the remaining natural resources. Such threats have not only affected forest and grassland cover directly, but also threatened the fauna species associated with them. Among the most threatened species are mammalian species.

Surveys, research, and conservation actions in Lebanon have concentrated on flora and faunal groups other than mammals. Mammals are probably the least well-studied faunal group in Lebanon. This is related to the effort needed to study them. Mammals are nocturnal and shy species, studying them is difficult and requires more effort and sophisticated equipment than studying other faunal groups.

Even though formal information on the ecology and conservation of mammals has proved scarce in Lebanon. Yet, most are threatened by habitat destruction, urbanization, excessive hunting, and persecution. Several species like the caracal (*Caracal caracal*), and Syrian brown bear (*Ursus arctos syriacus*) have become extinct nationally, while others like wolves (*Canis lupus*), wild and jungle cats (*Felis silvestris* and *F. chaus*), striped hyaenas (*Hyaena hyaena syriaca*), and bats are locally threatened.

The constantly changing circumstances in and around forests affect many of the Lebanese species, in particular those most under threat of national extinction. Monitoring these wild species and their presence should be investigated. Monitoring is the process whereby the distribution and abundance of species are recorded at intervals to reveal trends in their status. This monitoring or investigation is necessary if we are to anticipate, detect and act upon problems before they become acute, to confirm or refute suspicions about trends in rarity or pest status and to underpin solutions and evaluate efficient management. The most fundamental facts about an animal population are its distribution and abundance, which demand a national monitoring scheme to enable us to detect trends in these attributes.

In short, for effective legislation and sound conservation and management policies related to Lebanese mammals, nationwide information about the distribution, abundance, and status of each species is required. This sort of information can be obtained through a national mammal

monitoring scheme. However, limited by funding, starting monitoring on protected areas or Himas bases might be helpful for a wider national mammal monitoring scheme.

The Hima is a community-based conserved area that is sustainably used to protect natural resources and benefit people. It is a good approach for encouraging locals to protect their environment and conserve biodiversity. Himas might be criticized for their small sizes, especially when considering mammals that have large home ranges. Nonetheless, Himas can play a major role in spreading awareness among local people about the conservation of natural resources and act as a stepping stone for many species during their movement between protected areas. Assessing mammals in the Himas is crucial for biodiversity conservation for several reasons including

1. The Himas consist of many different landscapes and habitats
2. Encompass different flora and fauna species
3. They are the sole natural area that is not disturbed by urbanization
4. Taking into consideration the large home range of mammals they could act as corridors or stepping stones between different protected areas. This will allow a larger space for such species hence decreasing their threat of extinction and favoring their abundance.

2. MATERIAL AND METHODS

Biodiversity assessment for this ecological study depended mainly on local knowledge and field visits and surveys.

2.1 RRA/PRA Methods

Local people have developed a sophisticated knowledge system. They are very knowledgeable about the biodiversity within their area. They have compiled a huge practical understanding of the natural resources, threats facing biodiversity, changes occurring within their surroundings, and adaptation to these changes and threats sustainably.

Participatory Rural Appraisal (PRA) has become a recognized method for investigating indigenous knowledge of natural resources and their management. PRAs help in providing a complete understanding of the status of the natural resources and the ecosystem from the end-users' perspective. Their experience will broaden our knowledge and expose us to practices on how to best mitigate the negative impact on the environment.

The RRA/PRA method used in this study was based on Chambers (1992) and Bernard (1995). During the survey, local knowledge on the use of natural resources and biodiversity in the Himas was collected from focal group discussions, and individual interviews with shepherds, farmers, and local people met while conducting the field survey.

Information thoughts are presented below:

- 1- Fauna species that were and are present.
- 2- Population trends in mammal populations

- 3- Factors affecting these trends.

2.2 Literature Review:

The secretive nocturnal life of mammals made them the least studied group of animals. An extensive literature review was conducted on the mammal fauna of Lebanon in general and areas close to the Himas in particular.

The literature review of fauna was based on the information available in the literature and international online academic information. The activity of reviewing literature covered the following:

- a- Reports and Grey Reports
- b- Archives of relevance
- c- Projects in Lebanon
- d- Research Departments of Universities.

2.3 Field Survey

The assessment for mammals was carried out as follows.

- 1- **Diurnal Surveys:** The site was visited and transects were located. These transects were surveyed on foot. Dens, owl pellets, footprints, tracks, and scats of mammals encountered were identified, photographed and their GPS points were recorded
- 2- **Small Mammals Survey:** The Himas were comprehensively surveyed for small mammals specifically rodents and shrews over two seasons Spring (May) and fall (September). Twenty-seven trapping stations were deployed for five consecutive nights and covered the different landscapes/habitats present in the Himas. The stations were distributed as follows among the five Himas: 6 stations in Ras El Maten (Figure 1), 6 stations in Hammana (Figure 2), 4 stations in Kherbet Qanafar (Figure 3) 6 stations in Ain Zebdeh (Figure 4), and 5 in Ibl El Saqi (Figure 5). In each station, 10 Sherman® live rodent traps (Plate 1) spaced 2-4m apart were set at dawn and were checked the next day at dusk in locations close to identified burrows or suitable habitats. The traps were baited with a mix of peanut butter, cucumber, sunflower seeds, and canary feed mix. Animals caught were identified, recorded, measured, photographed, marked, and released.



Plate 1. Sherman live rodent traps are being distributed at Ibl Al Saqi Hima

- 3- **Camera Trapping:** Camera trapping is a non-invasive method that allows the assessment of diurnal and nocturnal animals and predicts the abundance of the species with minimal disturbance. Twenty-five Pre-baited active and passive remote camera traps triggered by both motion and heat were deployed for one year (From April 2022 to April 2023) to record the presence of mammals in all five Hima. The cameras were distributed as follows: 6 cameras in Ras El Maten (Figure 1), 5 cameras in Hammana (Figure 2), 4 camera traps in Kherbet Qanafar (Figure 3), 5 in Ain Zebdeh (Figure 4), and 5 in Ibl El Saqi (Figure 5). The cameras were tied to a tree 40-60cm above the ground (Plate 2), programmed to shoot photographs for 24 hours/day with an interval of 5 minutes between photos and to record the date and time on each photograph. The bait was positioned 4-6 meters away from the camera trap. The bait consisted of meat, bones, cucumber, carrots, apples, and bread to attract existing wildlife. The sites for installing the camera traps were chosen randomly to cover the whole Hima and marked using Global Positioning System (GPS). Broken and stolen camera traps were replaced. Each Camera trap was visited for the first month on weekly bases to check on the suitability of the site, verify the cameras are working normally, add bait, and download the photos. Afterward, the cameras were visited on biweekly bases. Photos were downloaded on a laptop (Plate 2) in the field and animals in the photos were identified and counted.

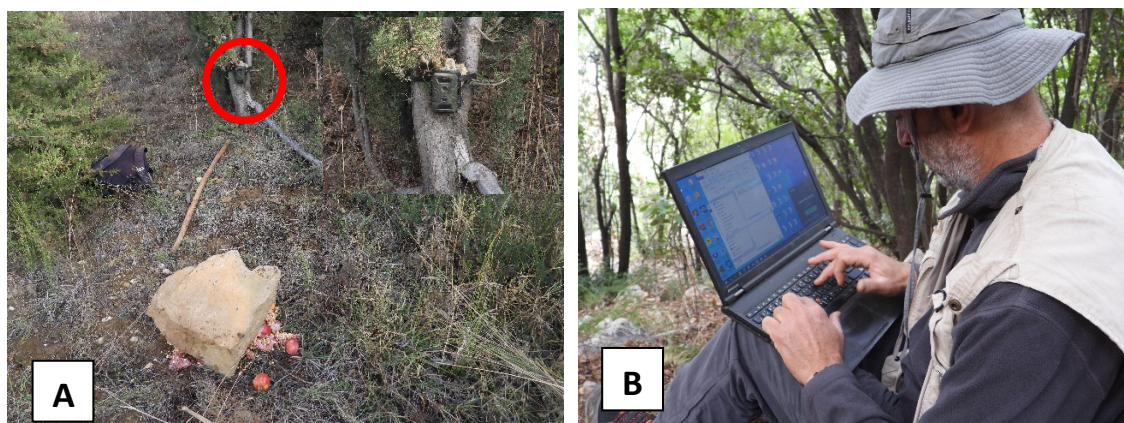


Plate 2. Camera traps fixed on a tree (A) and down loading the photos (B)

- 4- **Night Surveys:** These surveys were commenced using a 4x4 vehicle and a powerful spotlight to scan for animal eye shine (Plate 3). The pace was slow to increase the chances of sighting the animals. Once the eye shine has been detected, the animal was identified and a GPS point was recorded.



Plate 3. Using powerful spotlight and active bat detectors during night drives.

5- **Bat Survey:** was conducted following the below methods:

- a. During day time, rock cracks, depressions, old houses, and caves were visited and checked for bat presence.
- b. During the night drives, ANABAT Walkabout Active Bat Detector® was used (Plate 3 and 4) to record bat frequencies encountered in each Hima. Whenever a bat frequency was detected, it was recorded with time and GPS locality. Data from the Active Bat Detector was downloaded on trip bases, and their calls were identified and recorded.



Plate 4 Using active bat detector during the night survey.

- c. Use of Passive Bat Detectors: Seventeen ANABAT Swift Passive Bat Detectors® made by Titley Scientific, Columbia, Missouri USA (Plate 5) were installed at all five Himas for 2-ten consecutive nights in Spring and Fall and programmed to start recording calls half an hour before sunset till half an hour after sunrise. The detectors were distributed as follows: 4 in Ras El Maten Hima (Figure 1), 4 in Hammana Hima (Figure 2), 2 in Kherbet Qanafar Hima (Figure 3), 3 in Ain Zebdeh Hima (Figure 4), and 4 in Ibl Al Saqi Hima (Figure 5)

Anabat Insight software was used to analyze the recorded calls. Bat activity was calculated as the number of passes per bat species. Each ‘bat pass’ (defined as a sequence of at least two echolocation pulses of a passing bat) was counted and notes were made on the maximum frequency and range of the pulse. The number of passes was used as an estimate of the species relative abundance.



Plate 5 Installing a Passive bat detector at Ibl Al Saqi Hima and the box shows the microphone.

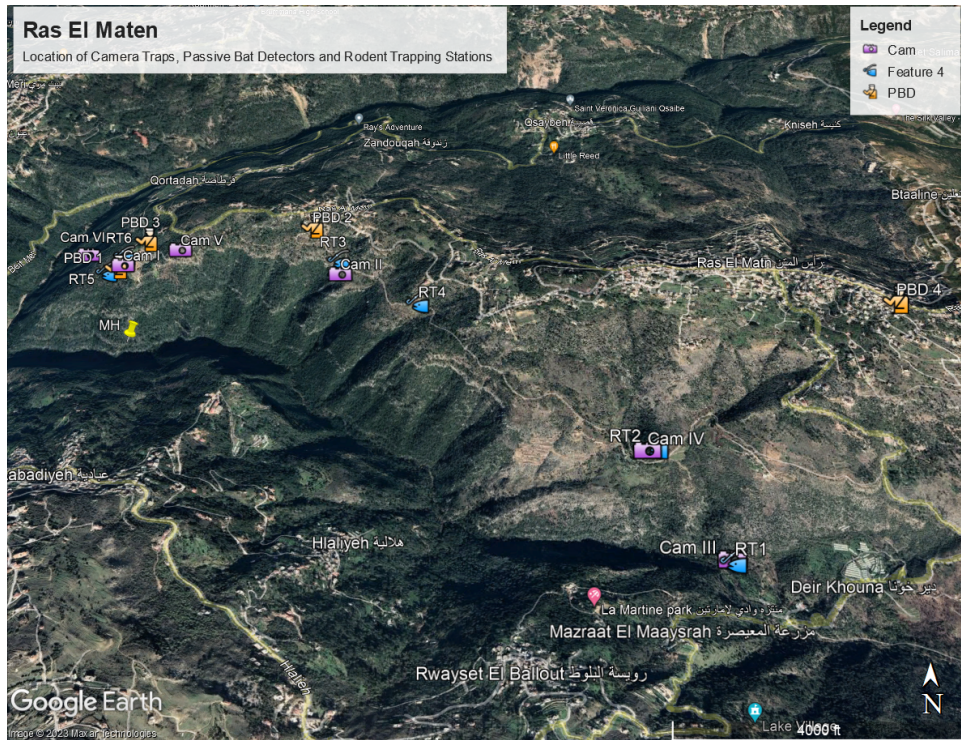


Figure 1. Locations of small mammal trapping sites, camera trapping, and passive bat detectors in the Hima of Ras El Maten.

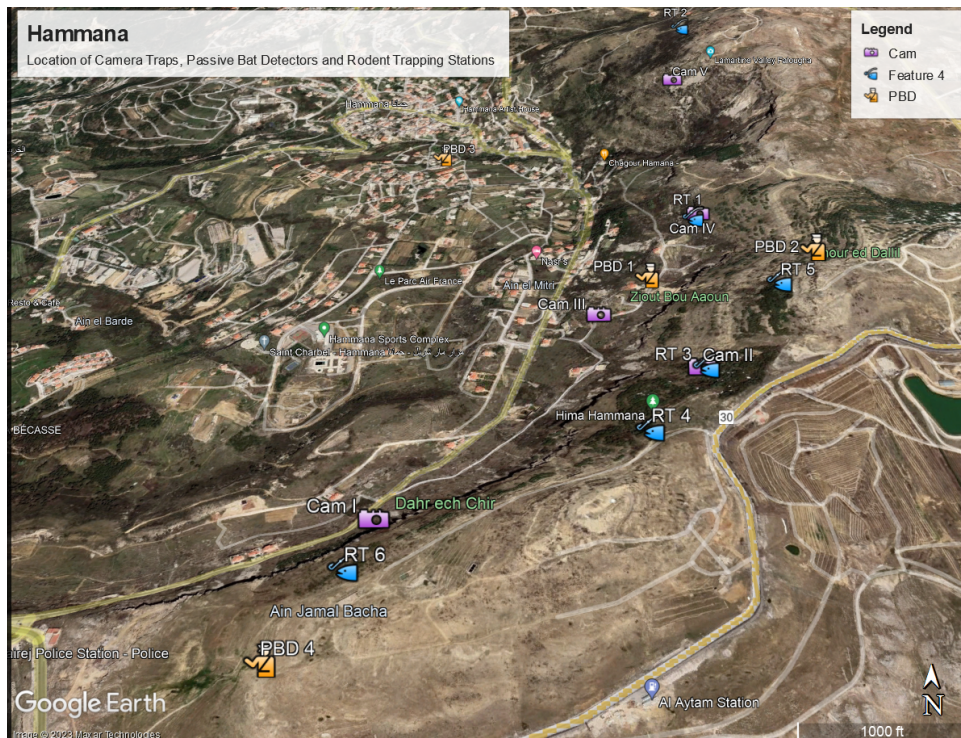


Figure 2. Locations of small mammal trapping sites, camera trapping, and passive bat detectors in the Hima of Hammana.

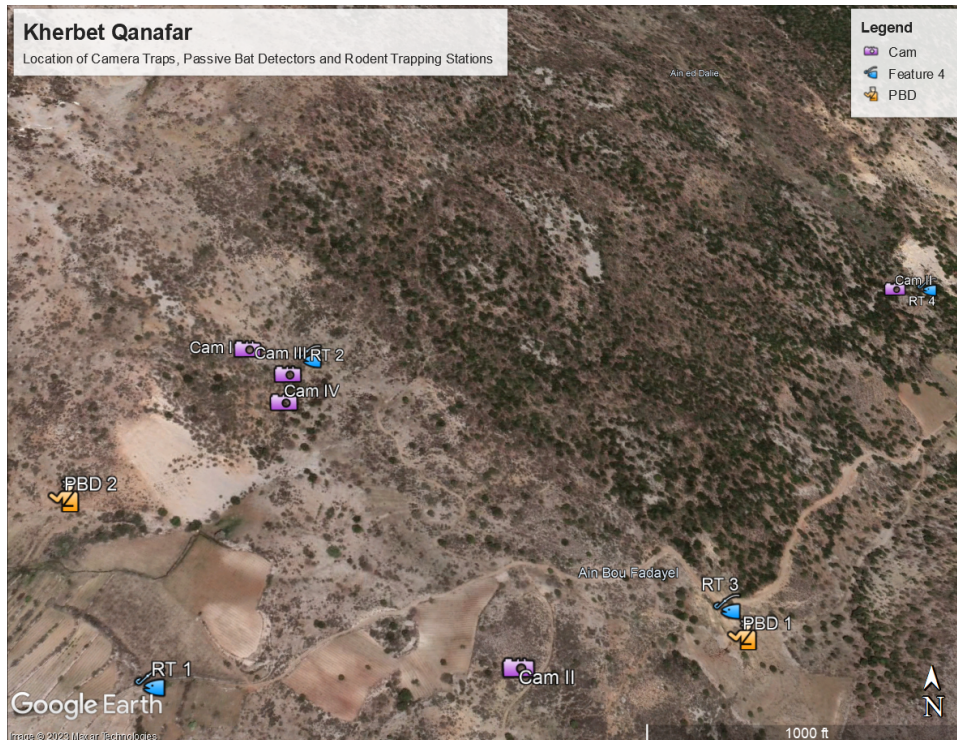


Figure 3. Locations of small mammal trapping sites, camera trapping, and passive bat detectors in the Hima of Kherbet Qanafar.

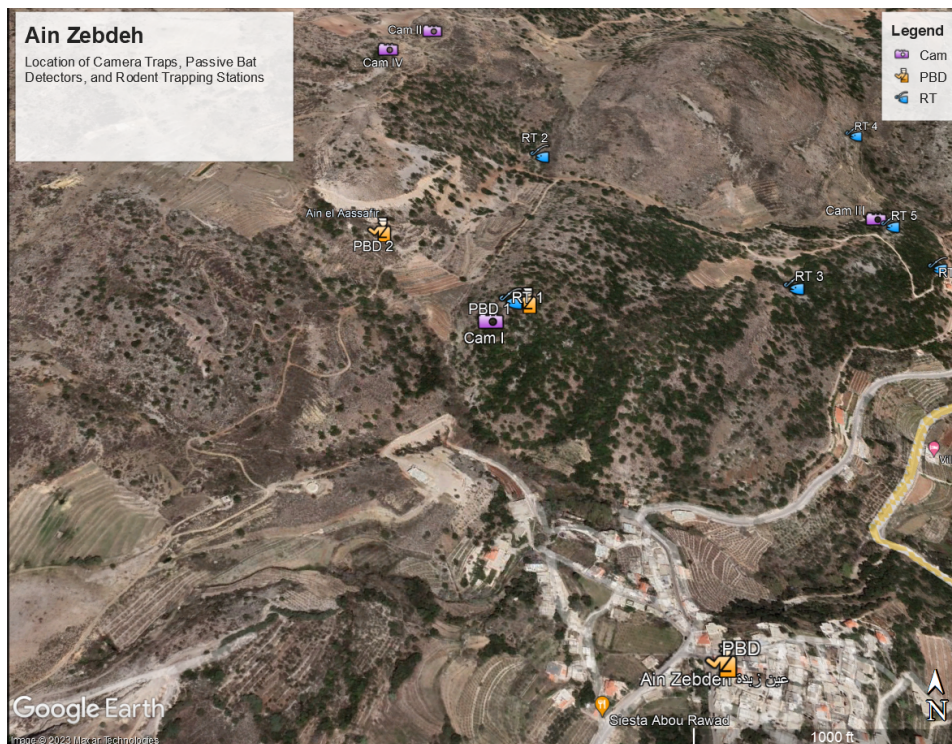


Figure 4. Locations of small mammal trapping sites, camera trapping, and passive bat detectors in the Hima of Ain Zebdeh.



Figure 5. Locations of small mammal trapping sites, camera trapping, and passive bat detectors in the Hima of Ebl El Saqi.

3. Completeness of Coverage

Most of the work was carried out as planned. However, some obstacles were faced including

- All five Himas namely Ras AlMaten, Hammana, Kherbet Qanafar, Ain Zebdee, and Ibl AlSaqi were covered thoroughly while Qleile and Mansouree were not due to security reasons. Even though the two latter Himas were visited more than once but we couldn't do any field work just sight observation. We hope during the next phase we will be able to study them
- We faced a problem with Rodent Trapping at Hammana Hima. Traps were removed from two sites because of security and safety reasons. Even though these sights could have been potential sites for rodents. Will try to study these sites in the next phase.
- Seven camera traps were stolen in Hammana, Kherbet Qanafar, Ain Zebdeh and Ibl Al Saqi. This resulted in losing the data in these cameras. Hence we resort to replacing some of these cameras and adding more on different sites.
- Three bat detectors at Ras AlMaten and Ibl Al Saqi Hima were out of order so we had to replace them and extend the monitoring period.
- For bat identification the *Miotis spp.* Have very similar calls hence there might be some error in identifying the species but not the genus

Listing some of the causes above is expected to affect the results. Nonetheless, the time allocated was used very efficiently and most of the area was covered and observed intensively. Therefore, any shortage or missing data was mitigated by increasing the effort.

4. Study Area

Ras El Maten

Ras El Matn Hima is a mixed deciduous and evergreen (pine oaks) forest, characterized by the co-occurrence of Calliprinos pine and oak trees, situated on a steep thick shelf limestone slope, overlooking the Beirut River Valley, also known as the “Lamartine Valley”. The forest is divided into two main zones: the upper virgin and reforested woodland and the lower degraded forest and scrubland.

Ras El Matn hima is considered a biodiversity hotspot, with a high number of mammal species, including insectivores, bats, carnivores, and rodents, among others. The presence of abundant resources, including water and forage, combined with a variety of microhabitats, contributes to the richness and diversity of the mammal fauna.

Hammana

Hammana Hima is a stunning and unique ecosystem. It is situated on a sandstone ridge, and it overlooks the village, located on the western borders of Jabal Kneisseh, one of the summits of Mount Lebanon, and just south of Jabal Sannine. The location is characterized by a coniferous cedar-pine forest, which provides a shelter for numerous bird species and other animals. The mountain chain is home to an array of plant species and endemism. The site receives an average of 1,100-1,200 millimeters of precipitation per year.

Hammana hima features various transects, such as slope, trail, and woodland, and quadrats, including woodland, forest clearings, and pasture. These are placed at different altitudes between 1,450 and 1,550 meters. The site is rich in its avifauna, and it is significant for floristic, entomological, and herpetological biodiversity.

Kherbet Qanafar-Ain Zebdeh

Kherbet Qanafar-Ain Zebdeh Hima is a unique and diverse ecosystem located on the eastern slopes of Mount Lebanon and Jabal Barouk. The site is situated at an elevation of approximately 1,200 meters above sea level, making it a Supramediterranean site, and its geological composition is characterized by thick shelf limestone. This combination of elevation and geological composition creates a range of soil types and conditions that support a variety of plant and animal life.

The Hima is a mixed broadleaf forest that covers approximately 600 hectares and is part of one of the largest remaining areas of natural forest in Lebanon. The forest is dominated by oak and pine trees and includes several distinct habitats, each with its unique features and characteristics.

The oak forest is a dominant feature of the ecosystem, providing critical habitat for a wide range of plant and animal species. The site also includes several reforestation sites that are actively managed and maintained to promote the growth and health of the forest.

The Hima's mixed broadleaf forest also includes areas of scrubland, which are characterized by sparse vegetation and rocky outcroppings.

The site's riparian zone includes the Ain Zebdeh and Kherbet Qanafar rivers, which support a rich and diverse array of aquatic and semi-aquatic species.

The agricultural land within the Hima includes orchards and fields of wheat and barley that provide important habitat and food sources for the surrounding biodiversity.

Ebel el Saqi

Ebel el Saqi Hima is a complex and diverse ecosystem located on the western slopes of Mount Hermon. The site is situated at an elevation of approximately 700 meters above sea level which makes it a Eumediterranean site. The geological composition of the site is characterized by a combination of volcanic basalts, chalks, limestone substrates, and sandstones overlain by thick shelf limestones, creating a range of soil types and conditions that support a variety of plant and animal life.

The hima comprises several distinct habitats, each with its unique features and characteristics. The 38-hectare pine woodland is a dominant feature of the ecosystem, providing critical habitat for a wide range of plant and animal species. The site also includes several reforestation sites that are actively managed and maintained to promote the growth and health of the forest.

The stony hillsides and scrubland habitats within the Hima are characterized by rocky outcroppings and sparse vegetation, providing a home for species adapted to harsh and challenging environments. These habitats support a diverse range of plant and animal life.

The riverine ecotone is a crucial feature of the ecosystem, providing a vital habitat for aquatic and semi-aquatic species. The riparian zone along the Hasbani River and its tributaries support a rich and diverse array of plant and animal life, including species such as the Syrian spiny-tailed lizard and the common kingfisher.

The agricultural land within the Hima includes olive groves and grain fields that provide important habitats and food sources for a variety of species. These habitats are particularly important for species that have adapted to human-dominated landscapes, such as many bird species that rely on agricultural fields for foraging and nesting.

5. RESULTS

5.1. Local Knowledge

Local knowledge is recognized as an important approach to understanding biodiversity, the threats it faces, and the best management practices to conserve it. Local people have lived with biodiversity for decades and they are very knowledgeable about its diversity and status. In the Himas, farmers and shepherds have lived and used the area under question for decades; they are knowledgeable about its biodiversity and recognize its trends. During this survey, focal group discussions and personal interviews were conducted with local people. These interviews aimed at understanding the species of mammals present and their trends.

Most people interviewed agreed that the Himas host different species of mammals. The main mammal species recognized by respondents were hedgehogs, foxes, jackals, wolves, badgers, stone martens, wild cats, hyaenas, wild boars, porcupines, squirrels, and small rodents. Most agreed that wild boars are increasing in number and causing problems to their crops. In addition, most respondents recognize the large population of foxes and jackals too. On the other hand, respondents reported that the population of hyaenas and wolves is very small since they are persecuted a lot by locals and shepherds relating this to humans and livestock. As well squirrel population was considered very large in Ras AlMaten Hima and it is affecting the pine produce in the area. Samples of selected interviews from the people are documented below.

In Ras Al Maten Hima,

We met Mr. Naji Hatoum a shepherd who has been using the area for grazing his goats in the winter. Mr. Hatoum told us about the mammals found in Ras AlMaten Hima. He said *“Hedgehogs are found but are not very common in the Hima. The area is full of jackals, foxes, and wild boars. Hyraxes are found in the rocky area and their population is very healthy. Porcupines are found in the Hima but are not very common as people do hunt them. Squirrels are very abundant, especially in the pine forest. However, there are no wolves in the Hima or at least we have never encountered them”*.

We met afterward Ayman Salha who said: *“there are a lot of wild boars, jackals, and foxes in the Hima as well as, hyaenas, porcupines, hedgehogs, badgers, stone martins, bats, and squirrels”*. He claimed that wild boars are causing problems for farmers and that squirrels are affecting pine production.

In Hammana Hima

We met Mr. Mohammad Ghosn a shepherd that uses the area in the summer. He said *“We come to graze our livestock in summer. In the area, there is a lot of wild animals mainly foxes, jackals, badgers, hyaenas, wolves, wild cats, and porcupine. We have never seen any wild boar or squirrels in the area and there are a lot of rodents”*

Another shepherd Sheikh Abou Yehya Ghosn who has a tent-like summer house in Dahr AlBaidar said *“The area here is full of wild animals. There are foxes, wolves, cats, jackals, hyaenas, stone martins, and much more. Foxes are very common but hyaenas and wolves are rare. We rarely meet them while we encounter foxes every night and even get close to our houses. Field mice are everywhere you can hear and see them during day time.”* He added, *“Animal populations are not like they used to be their numbers are decreasing a lot”*.

In Ain Zebdee – Kherbet Qanafar Hima

We Met Mr. Adel Ammouri. He said *“In Ain Zebdee wild animals are abundant like foxes, jackals, stone martins, wild cats, and hyaenas. Besides, there are a lot of wolves, wild boars, and porcupines. Wolves and hyaenas got close to the houses during winter times. Porcupines are killed by bedouins a lot in the area”*

We met a shepherd from Kherbet Qanafar who said *“The mountain is full of wolves, foxes, jackals, hyaenas and wild boars. Sometimes I encounter wild cats, badgers, and stone martins but their number is very low. Once they caught in our village a big cat with long hair on its ears they call it washaq in Arabic it is like a small tiger”*. He added, *“Wolves and hyaenas will be very common in the winter season and they do get close to our barns and attack our animals”*

In Ibl AlSaqi Hima

We met Mr. Zein AlAshqar who told us about the Hima and the animals that are found there. He said *“The area is very rich in jackals and wild boars that are becoming as pests affecting the olive orchards. Foxes and porcupines are very common. You can see in the Hima as well stone martins, badgers, wild cats, and hyaenas. Hedgehogs used to be abundant in the area but now due to pesticides their number is decreasing. Field voles are very common and sometimes they cause problems to our cereal crops. There is an animal that we call Jqayel in Arabic it is not a jackal but looks like one, is a very aggressive animal that attacks humans. We see some bats during the summer at sunset”*

Mr. Elias, a municipality police said *“Ibl is famous for its wild boar where many hunters do hunt them but they remain very common. There is a lot of jackals, foxes, badgers, and stone martin that attacks our chicken, wild cats, hyaenas, and a lot of porcupines that some people do hunt. We have never seen a wolf in the Hima or the village. Hedgehogs are becoming very rare”*.

5.2. Field Survey

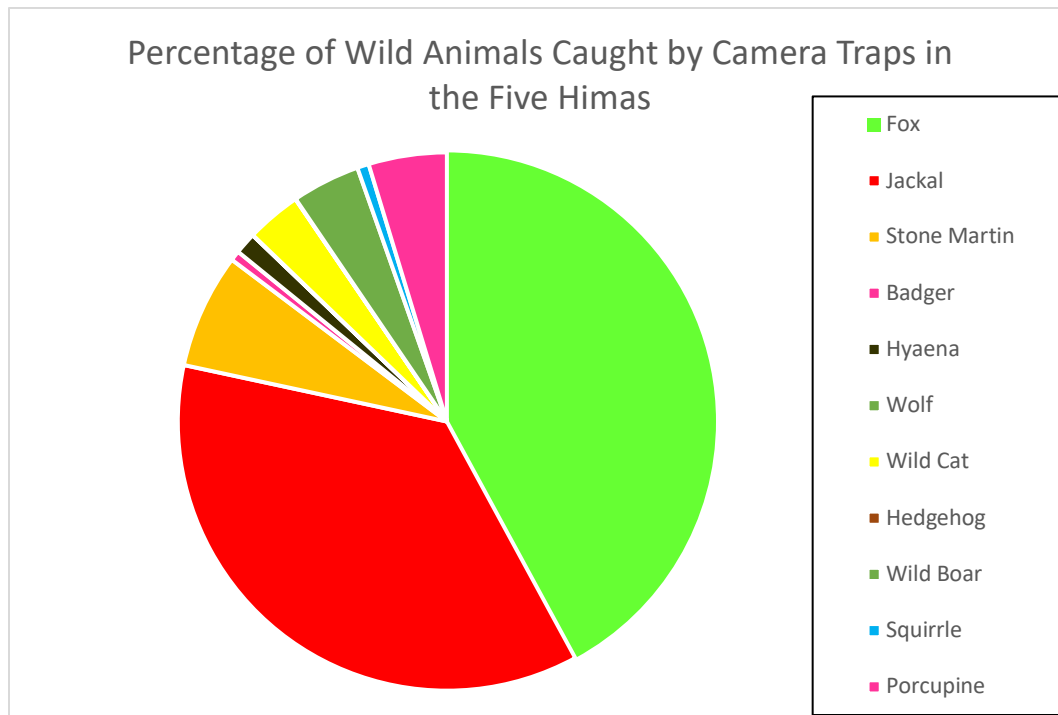
The 7620 camera trapping days, 270 acoustic passive bat surveys, and the 2500 rodent trapping nights resulted in documenting 36 species of mammals belonging to six orders, 16 families, and two sub-families observed in the five Himas (Table 1). In addition to wild animals, 4 species of domestic animals were observed including goats, sheep, dogs, and cats. Of the species encountered two are vulnerable (VU) and four are near threatened (NT) according to the IUCN Redlist for the Mediterranean. Foxes were the most (42%) caught by camera traps followed by jackals (36%) while wolves and hedgehogs were the least (0.02%) caught by camera traps (Graph 1). Through the acoustic survey, Kuhl's pipistrelle bats were the most recorded (60%) followed by common pipistrelle bats (24%) while the Savi's pipistrelle bats and the Horseshoe bats were least recorded (less than 1%) (Graph 2). Moreover, broad-toothed field mice were most (82%) trapped during rodent trapping while black rats and Tristami jirds were the least (0.45%) trapped (Graph 3).

Table 1. Species encountered in the five Himas

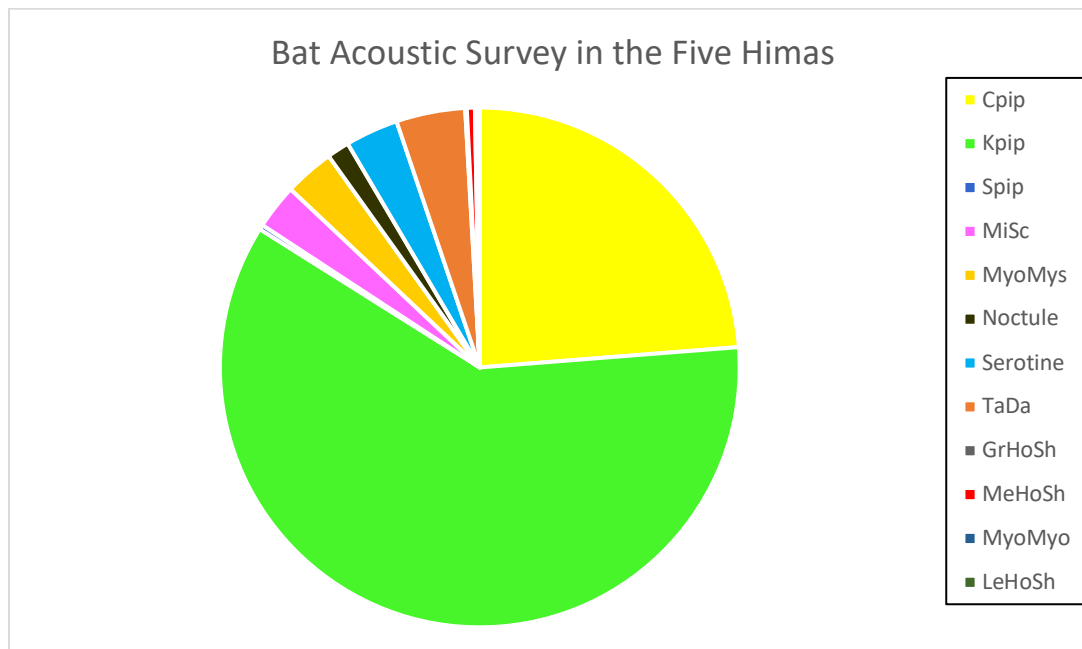
	Order	Family	Scientific Name	Common Name	Arabic Name	IUCN Status Mediterranean
1	Insectivora	Erinaceidae	<i>Erinaceus concolor</i>	Hedgehog	القنفذ	LC
2		Soricidae	<i>Crocidura suaveolens</i>	Lesser white-toothed Shrew	الذبابة	LC
3	Chiroptera	Pteropodidae	<i>Rousettus aegyptiacus</i>	Egyptian Fruit bat	خفاش الفاكهة المصري	NT
4		Molossidae	<i>Tadarida teniotis</i>	European Free-tailed bat	الخفاش الأوروبي طليق الذنب	LC
5		Rhinolophidae	<i>Rhinolophus ferrumequinum</i>	Great horseshoe bat	الخفاش النضوي الكبير	NT
6			<i>Rhinolophus hipposideros</i>	Lesser horseshoe bat	الخفاش النضوي الصغير	NT
7			<i>Rhinolophus Euryale</i>	Mediterranean horseshoe bat	خفاش البحر المتوسط النضوي	VU
8		Vespertilionidae	<i>Pipistrellus pipistrellus</i>	Common pipistrelle	خفاش بيبستريل الشائع	LC
9			<i>Pipistrellus kuhlii</i>	Kuhl's pipistrelle	خفاش بيبستريل كوهلي	LC
10			<i>Hypsugo savii</i>	Savi's Pipistrelle	خفاش سافي	LC
11			<i>Eptesicus Serotinus</i>	Serotine bat	خفاش الليل	LC
12			<i>Nyctalus Noctula</i>	Noctule bat	خفاش نكتول الشائع	LC

13			<i>Miniopterus Shreibersii</i>	Schreiber's Bent-winged bat	خفاش شريبر طويل الجناح	NT
14			<i>Myotis myotis</i>	Greater Mouse-eared bat	خفاش فأري الأذن الكبير	LC
15			<i>Myotis Mystacinus</i>	Whiskered bat	خفاش ابو شوارب	LC
16	Carnivora	Canidae	<i>Canis aureus</i>	Jackal	ابن اوى	LC
17			<i>Canis lupus</i>	Wolf	الذئب	LC
18			<i>Vulpus vulpus paleastina</i>	Fox	الثعلب	LC
19		Mustelidae	<i>Martes Fiona</i>	Stone martin	النمس	LC
20			<i>Meles meles</i>	Badger	الغرير	LC
21		Hyaenidae	<i>Hyaena hyaena syriaca</i>	Striped hyaena	الضبع المخطط	VU
22		Felidae	<i>Felis silvestris</i>	Wild cat	الهر البري	LC
23	Hyracoidae	Procaviidae	<i>Procavia capensis</i>	Rock hyrax	الطيسون	LC
24	Artiodactyla	Suidae	<i>Sus scrofa</i>	Wild boar	الخنزير البري	LC
25	Rodentia	Sciuridae	<i>Sciurus anomalus</i>	Squirrel	السنجاب	LC
26		Hystriidae	<i>Hystrix hystrix indica</i>	Porcupine	النيص	LC
27		Spalacidae	<i>Spalax leucodon</i>	Mole rat	الحلد	LC
28		Muridae	<i>Apodemus mystacinus</i>	Broad-toothed field mouse	فار الحقل	LC
29			<i>A. flavicollis</i>	Yellow-necked field mouse	فار الحقل	LC
30			<i>A. harmonensis</i>	Jabal Harmon field mouse	فار الحقل	LC
31			<i>Rattus rattus</i>	Black rat	الجرذ الأسود	LC
32			<i>Rattus norvegicus</i>	Brown rat	الجرذ البني	LC
33			<i>Mus musculus</i>	House mouse	فأر البيوت	LC
34			<i>Acomys dimidiatus</i>	Spiny mouse	الفأر المشوك	LC
35		Gerbillinae sf.	<i>Meriones tristami</i>	Tristami jird	جرذ تريستام	LC
36		Microtinae sf.	<i>Microtis guentherii/socialis</i>	Social vole	عكبر الحقل	LC

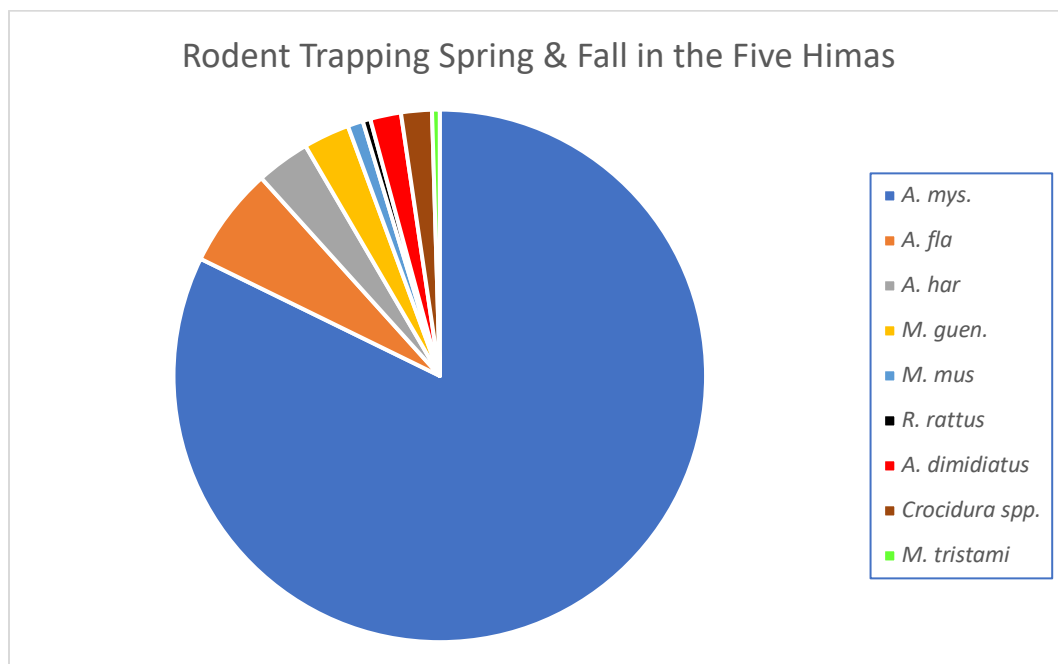
Graph 1. Animals caught by camera traps during the study period



Graph 2. Percentage of total bat calls in the five Himas during Spring and Fall



Graph 3. Percentage of total rodents trapped in the five Himas during Spring and Fall



Photos of bats encountered in the five Himas



Photo 1. European free-tailed bat *Tadarida teniotis* (Rafinesque 1814) (Photo by *Leonardo Ancillotto, EUROBATS*)



Photo 2. The greater horseshoe bat, *Rhinolophus ferrumequinum*



Photo 3. Common pipistrelle bat, *Pipistrellus pipistrellus*



Photo 4. Kuhl's pipistrelle bat *Pipistrellus kuhlii*



Photo 5. Savi's Pipistrelle bat *Hypsugo savii*



Photo 6. Serotin bat, *Eptesicus Serotinus*



Photo 7. Noctule bat, *Nyctalus Noctula*
(Photo by *Matti Masing*, *EUROBATS*)

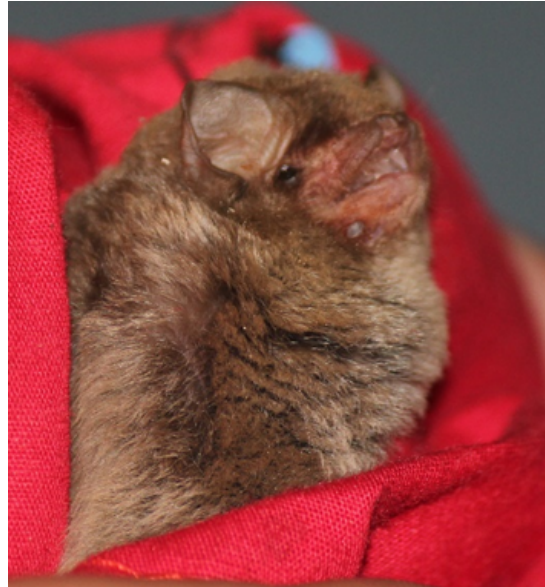


Photo 8. Shreibers bent winged bat, *Miniopterus Shreibersii*



Photo 9. Whiskered bat, *Myotis Mystacinus*
(Photo by *Branko Micevski, EUROBATS*)



Photo 10. The Greater mouse-eared bat
Miotis miotis

Photos of rodents encountered in the five Himas.



Photo 11. Broad-toothed field mouse *Apodemus mystacinus*



Photo 12. Yellow-necked field mouse *Apodemus flavicollis*



Photo 13. Jabal Harmoun field mouse *Apodemus harmonensis*



Photo 14. Social/field vole, *Microtis guentherii*

5.3. Mammals of Ras AlMaten Hima

The 1950 camera trapping days, the 80 passive acoustic bat surveys, and the 600 rodent trapping nights resulted in documenting a total of 20 species of mammals in Ras Al Maten Hima. These species belonged to six orders, 14 families, and 1 sub-families (Table 2). In addition to goats and domestic dogs. Among these species, one is near threatened (NT) the Egyptian fruit bats and two are Vulnerable (VU) the Mediterranean horseshoe bat, and the striped hyaena.

Table 2. Species encountered at Ras AlMaten Hima.

	Order	Family	Scientific Name	Common Name	Arabic Name	IUCN Status Mediterranean
1		Soricidae	<i>Crociodura suaveolens</i>	Lesser white-toothed Shrew	زبابة البساتين	LC
2	Chiroptera	Pteropodidae	<i>Rousettus aegyptiacus</i>	Fruit bat	خفاش الفاكهة المصري	NT
3			<i>Rhinolophus Euryale</i>	Mediterranean horseshoe bat	خفاش ذو حضوة الحصان المتوسطي	VU
4		Vespertilionidae	<i>Pipistrellus pipistrellus</i>	Common pipistrelle	خفاش بيبستريل الشائع	LC
5			<i>Pipistrellus kuhlii</i>	Kuhl's pipistrelle	خفاش بيبستريل كولي	LC
6			<i>Eptesicus Serotinus</i>	Serotine bat	خفاش الليل	LC
7	Carnivora	Canidae	<i>Canis aureus</i>	Jackal	ابن اوى	LC
8			<i>Vulpus vulpus paleastina</i>	Fox	الثعلب	LC
9		Mustelidae	<i>Martes Fiona</i>	Stone martin	النمس	LC
10		Hyaenidae	<i>Hyaena hyaena syriaca</i>	Striped hyaena	الضبع المخطط	VU
11		Felidae	<i>Felis silvestris</i>	Wild cat	الهر البري	LC
12	Hyracoidae	Procaviidae	<i>Procavia capensis</i>	Rock hyrax	الطيسون	LC
13	Artiodactyla	Suidae	<i>Sus scrofa</i>	Wild boar	الخنزير البري	LC
14	Rodentia	Sciuridae	<i>Sciurus anomalus</i>	Squirrel	السنجاب	LC
15		Hystriidae	<i>Hystrix hystrix indica</i>	Porcupine	النيس	LC
16		Spalacidae	<i>Spalax leucodon</i>	Mole rat	الحد	LC
17		Muridae	<i>Apodemus mystacinus</i>	Broad-toothed field mouse	فار الحقل	LC
18			<i>Rattus rattus</i>	Black rat	الجرذ الأسود	LC
19			<i>Rattus norvegicus</i>	Brown rat	الجرذ البني	LC
20		Microtinae sf.	<i>Microtis guentherii/soci alis</i>	Social vole	عكبر الحقل	LC

5.3.1. ORDER INSECTIVORA

5.3.1.1. Family Soricidae

1. Lesser white-toothed shrew: *Crocidura suaveolens*.

Two juvenile individuals of a lesser white-toothed shrew (Plate 6) were trapped by the Sherman live traps in Spring at only one location and away from a water source.



Plate 6. Lesser white-toothed shrew: *Crocidura suaveolens* trapped at Ras El Maten Hima.

5.3.2. ORDER CHIROPTERA

5.3.2.1. Family Pteropodidae

1. The Egyptian Fruit Bat, *Rousettus aegyptiacus*, Geoffroy 1810 Fruit bats

Two colonies of fruit bats were encountered in Ras AlMaten Hima one of which is a new record for fruit bats distribution in Lebanon.

- The first colony was encountered in AlHesken Cave above the river. The colony is being monitored since 2008. The population in this colony is decreasing sharply due to human actions that include shooting bats and putting fire in the cave (Plate 7).



Plate 7. Fire and empty shells that were encountered in AlHesken Cave.

- The second colony (Plate 8) that was newly discovered consisted of c. 50 individuals. The colony is located in the upper part of the Hima. It is a drop fall of c. 12 meters



Plate 8. A small colony of fruit bats in the newly discovered cave

5.3.2.2. Family Rhinolophidae

1. The Greater Horseshoe Bat. *Rhinolophus euryale* Blasius, 1853

The Mediterranean Horseshoe bats were only observed in Al Hesken Cave at Hima Ras AlMaten (Plate 9). This species is vulnerable according to IUCN Redlist species and it has limited distribution in Lebanon.



Plate 9. Mediterranean horseshoe bat caught at Al-Hesken Cave

5.3.2.3. Family Vespertilionidae

1. Common Pipistrelle Bat, *Pipistrellus pipistrellus*, Schreber 1774 (Photo 3)

The common pipistrelle is a very common bat species in Lebanon. It is the first bat to start foraging after sunset. This bat is also common in Hima Ras AlMaten. It was seen flying after sunset and its calls were detected by the active bat detector (Plate 10) during the night drive and with the passive bat detector.

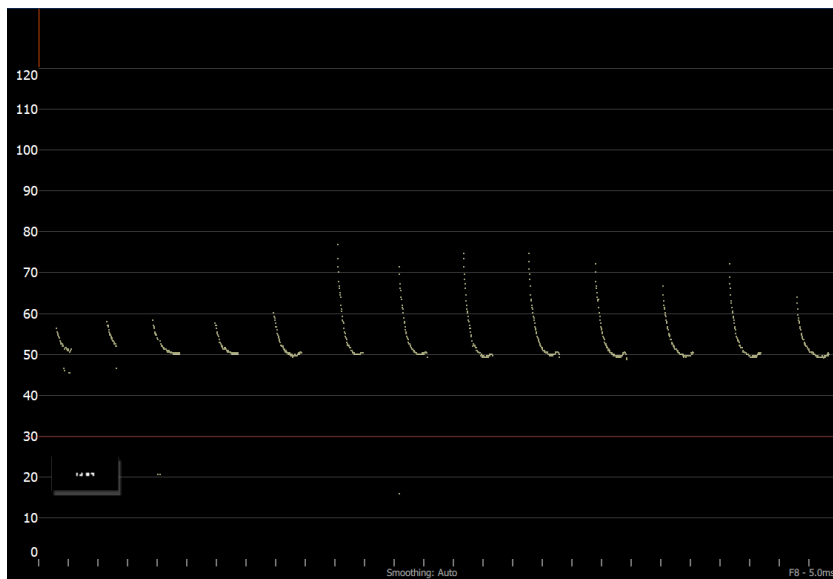


Plate 10. Calls of common pipistrelle recorded by the active bat detectors during the night survey

Kuhl's Pipistrelle Bat, *Pipistrellus kuhlii*, Kuhl 1817 (Photo 4)

Kuhl's pipistrelle bats were the most common bat in Ras AlMaten Hima and their calls (Plate 11) were recorded during each acoustic monitoring and were most (49%) recorded by the passive bat detectors.

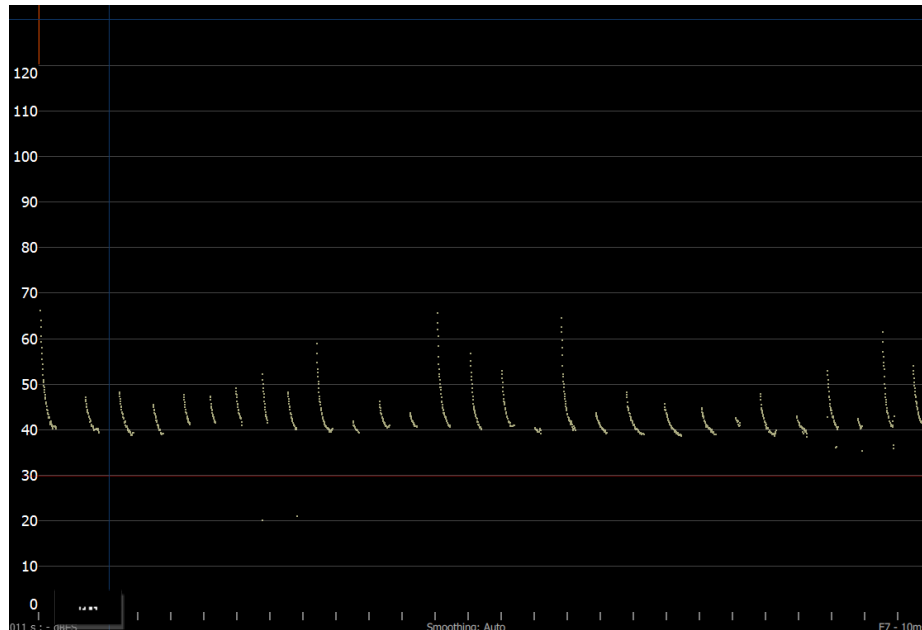
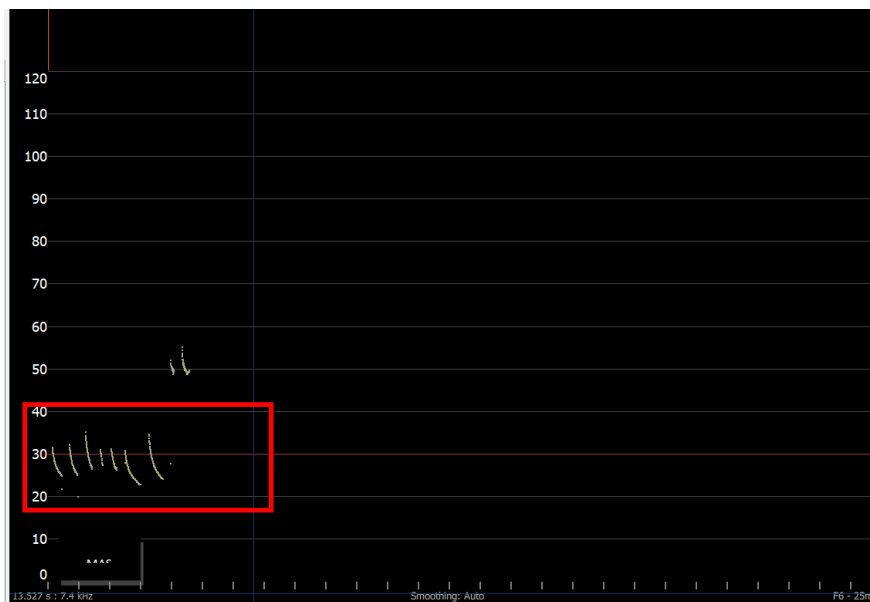


Plate 11. Calls of Kuhl's pipistrelle recorded by active bat detectors during the night survey at Ras AlMaten Hima

3. Serotine Bat, *Eptesicus serotinus* Schreber, 1774 (Photo 6)

The serotine bat is not common in Lebanon. It was recognized from its calls that were recorded by the Swift Anabat passive bat detector (Plate 12)



5.3.3. ORDER CARNIVORA

5.3.3.1. Family Canidae

1. Common Jackal; *Canis aureus syriacus*, Linnaeus 1758

Jackals are very common in Hima Ras AlMaten. Their scats were very common in the Hima, they were encountered during night drives (Plate 12A) and they were most photographed by the camera traps (50% of the photos) and c. 25% of their photos were taken during day time (Plate 13B).



Plate 13. Jackals were encountered during night drives (A) and a couple were photographed by camera traps during daytime (B)

2. Red Fox; *Vulpus vulpus palaestina*, Linnaeus 1758

Foxes are the second most common species photographed by camera traps (26% of all photos) (Plate 14B) in the Hima after jackals, and 9% of the photos were taken during day time (Plate 14 A).



Plate 14. Photos of foxes captured by camera traps during day (A) and night (B) hours.

5.3.3.2. Family Mustelidae

1. Stone martin; *Martes foina syriaca*, Erxleben 1777

Stone martins were not as common as the above two carnivores. Stone martins were not encountered during the night drives and their photos only constituted 7% of the photos taken by the camera traps (Plate 15).



Plate 15. Stone martin caught by camera trap at Ras AlMaten Hima

5.3.3.3. Family Hyaenidae

1. Striped hyaena; *Hyaena hyaena syriaca*, Linnaeus 1758

Striped hyaenas were present in Ras AlMaten Hima nonetheless their population is very low. They were photographed only 3 times in the Hima (Plate 16) and their scats (Plate 17) were encountered in 10 locations during the transect surveys.



Plate 16. Striped hyaena photographed by the camera trap at Ras AlMaten Hima



Plate 17. Striped hyaena scats that were encountered during transect surveys at Ras AlMaten Hima.

5.3.3.4. Family Felidae

1. Wild cat; *Felis silvestris tristrami*, Schreber 1777

Photos of the wild cats represented c. 9% of the photos taken by the camera traps in Ras AlMaten Hima. They were photographed in more than one location in the Hima, mainly in the upper part (Plate 18).



Plate 18. Wild cat photographed by one of the camera traps at Ras AlMaten Hima

5.3.4. ORDER HYRACOIDEA

5.3.4.1. Family Procaviidae

1. Rock Hyrax; *Procavia capensis syriaca*

The rock hyrax was only encountered in this Hima. They were encountered during each visit to the Hima either as single individuals or small populations (Plate 19A). Besides their scats and latrines (Plate 19B) were encountered in many places in the Hima which could be related to the suitable habitat for this species (Plate 20).

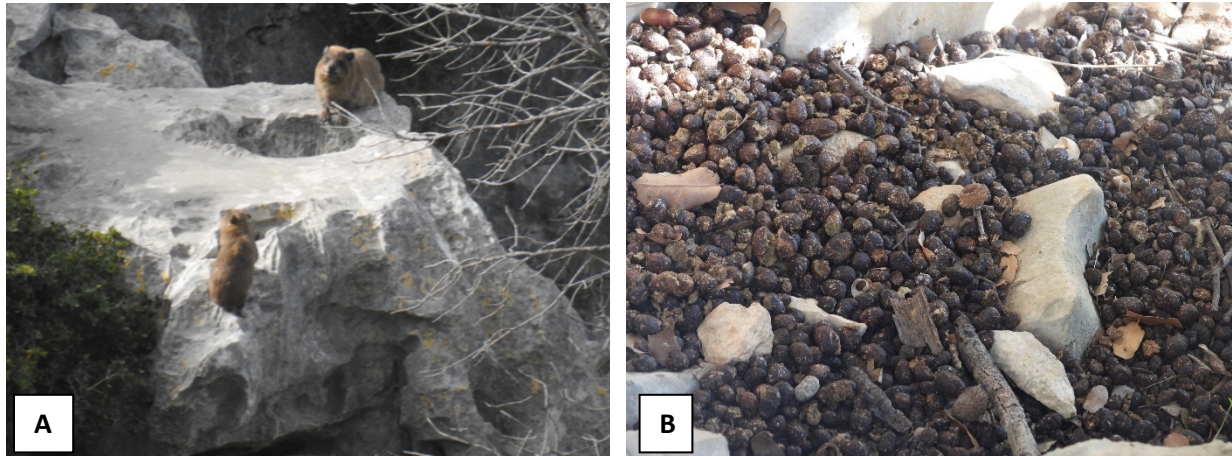


Plate 19. Rock hyrax basking in the sun (A) and many of these latrines for hyraxes (B) were encountered in Hima Ras AlMaten.



Plate 20. Landscape from Ras AlMaten Hima which is a typical habitat for rock hyrax

5.3.5. ORDER ARTIODACTYLA

5.3.5.1. Family Suidae

1. Wild Boar; *Sus scrofa lybicus* Linnaeus, 1758

Wild boar were very common in the Hima, especially in the lower part of the Hima. They were third photographed (13% of the photos) after jackals and foxes. The photos taken included single individuals, mothers and piglets, and groups of adults (Plate 21). Besides their tracks were also common in the Hima.



Plate 21. A group of wild boars at Ras AlMaten Hima.

5.3.6. ORDER RODENTIA

5.3.6.1. Family Sciuridae

1. The Persian Squirrel; *Sciurus anomalus syriacus*, Gueldenstaedt 1785

Tracks of squirrels were very common in Ras AlMaten Hima reflecting their high population. Their tracks were spread all over the reserve besides their photos constituted 4% of the photos taken by camera traps (Plate 22).

Squirrels are very important for the health of the forest nonetheless as their number increase they will start a conflict with people, especially in Ras AlMaten Hima where a lot of pine producers are present.

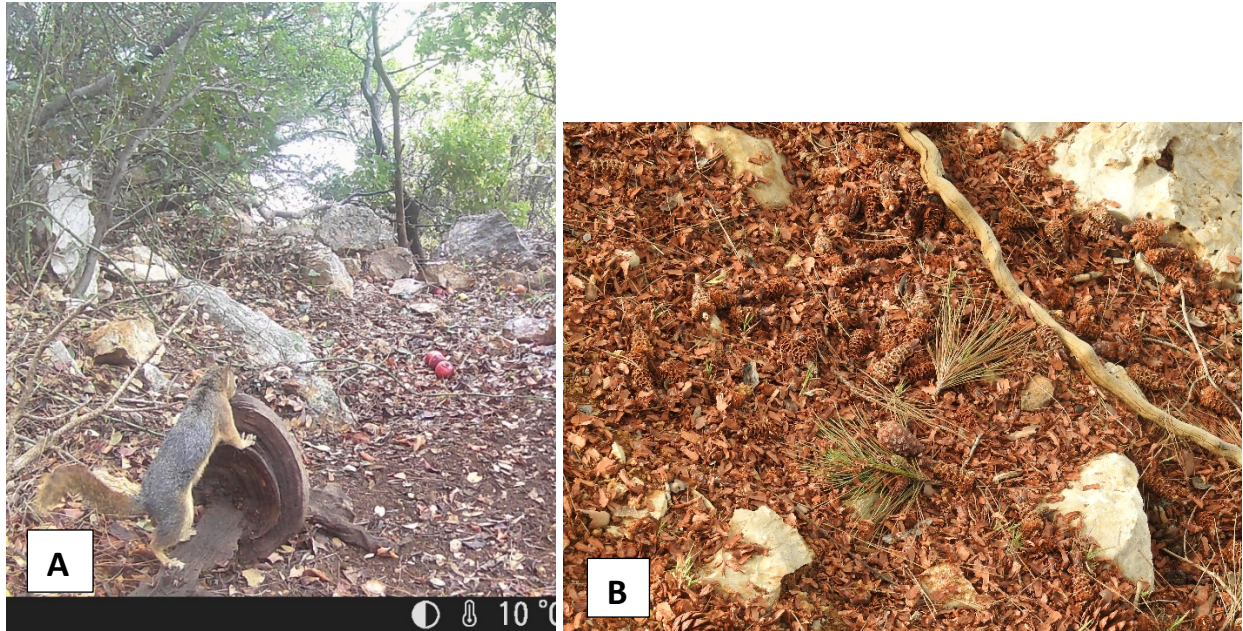


Plate 22. Persian Squirrel captured by a camera trap (A) and in the eaten pine cone by squirrel (B) at Ras AlMaten Hima

5.3.6.2. Family Hystricidae

1. Porcupine; *Hystrix indica indica*, Kerr 1792

Porcupines are nocturnal, shy animals, and live in very harsh terrain. Hence encountering them during night drives is very difficult. Nonetheless using camera traps we were able to document them in Ras AlMaten Hima (1.5% of the photos) (Plate 23).



Plate 23. Porcupine photographed at Ras AlMaten Hima.

5.3.6.3. Family Spalacidae

1. Mole Rat; *Spalax leucodon ehrenbergi*, Nehring 1898

Mole rats were not very common in this Hima. Their tracks were not as common and we were not able to trap any during this survey. This could be due to the dominating rocky landscape that does not suit this species.

5.3.6.4. Family Murinae

1. Broad-toothed field mouse; *Apodemus mystacinus*, Danford and Alston 1877 (Photo 11)

The most common mouse in the Mediterranean forest is the broad-toothed field mouse. This mouse was very common in Ras AlMaten Hima and constituted c. 84% of the rodents trapped.

2. Black rat; *Rattus rattus*, Linnaeus 1758

Black rats were trapped only once during the rodent trapping session in Hima Ras AlMaten but were photographed more than 400 times with camera traps (Plate 24).



Plate 24. A black rat that was captured by the camera trap at Ras AlMaten Hima.

3. Brown or Norway rat; *Rattus norvegicus norvegicus*, Berkenhout 1769

Brown rats were not so common in the Hima which could be related to their proximity to human settlement. It was not caught by the live traps, nonetheless, it was photographed by the camera traps (Plate 25).



Bushnell

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Plate 25. Brown rat captured by the camera trap at Ras AlMaten Hima.

5.3.6.5. Family Microtinae

1. Levant vole; *Microtus guentheri guentheri*, Danford and Alston 1880 (Photo 14)

Tracks of levant or social vole were very common in just one open area at the border of the Hima upper part and only one individual was trapped. Ras AlMaten Hima is not a typical habitat of *M. guentheri* as it lacks open flat areas.

5.4. Mammals of Hammana Hima

The 1410 camera trapping days, the 80 passive acoustic bat surveys, and the 400 rodent trapping nights resulted in documenting 22 species of wild mammals and two domestic mammals goats and dogs. These species belonged to three orders, 10 families, and 2 sub-families (Table 3). Among these species two are near threatened (NT) the greater horseshoe bat and Schreiber's Bent-winged bat and one is vulnerable (VU) the striped hyaena. Many obstacles (mainly security) were faced in Hammana Hima which limited our effort on camera trapping and rodent trapping. We lost two camera traps in the Hima and we have to remove two rodent trapping stations so they won't be removed by shepherds or steel collectors.

Table 3. Species encountered at Hammana Hima

	Order	Family	Scientific Name	Common Name	Arabic Name	IUCN Status Mediterranean
1	Chiroptera	Molossidae	<i>Tadarida teniotis</i>	European Free-tailed bat	الخفاش الأوروبي طليق الذنب	LC
2		Rhinolophidae	<i>Rhinolophus ferrumequinum</i>	Great horseshoe bat	الخفاش النضوي الكبير	NT
3		Vespertilionidae	<i>Pipistrellus pipistrellus</i>	Common pipistrelle	خفاش بيبستريل الشائع	LC
4			<i>Pipistrellus kuhlii</i>	Kuhl's pipistrelle	خفاش بيبستريل كوهلي	LC
5			<i>Hypsugo savii</i>	Savi's Pipistrelle	خفاش سافي	LC
6			<i>Eptesicus Serotinus</i>	Serotine bat	خفاش الليل	LC
7			<i>Nyctalus Noctula</i>	Noctule bat	خفاش نكتول الشائع	LC
8			<i>Miniopterus Shreibersii</i>	Schreiber's Bent-winged bat	خفاش شريبر طويل الجناح	NT
9			<i>Myotis Mystacinus</i>	Whiskered bat	خفاش ابو شوارب	LC
10	Carnivora	Canidae	<i>Canis aureus</i>	Jackal	ابن اوى	LC
11			<i>Vulpus vulpus paleastina</i>	Fox	الثعلب	LC
12		Mustelidae	<i>Martes Fiona</i>	Stone martin	النمس	LC
13			<i>Meles meles</i>	Badger	الغرير	LC
14		Hyaenidae	<i>Hyaena hyaena syriaca</i>	Striped hyaena	الضبع المخطط	VU
15		Felidae	<i>Felis silvestris</i>	Wild cat	الهر البري	LC
16	Rodentia	Sciuridae	<i>Sciurus anomalus</i>	Squirrel	السنجاب	LC
17		Spalacidae	<i>Spalax leucodon</i>	Mole rat	الخلد	LC

18		Muridae	<i>Apodemus mystacinus</i>	Broad-toothed field mouse	فار الحقل	LC
19			<i>A. flavicollis</i>	Yellow-necked field mouse	فار الحقل	LC
20			<i>A. harmonensis</i>	Jabal Harmon field mouse	فار الحقل	LC
21		Gerbillinae sf.	<i>Meriones tristami</i>	Tristami jird	جرذ تريسّام	LC
22		Microtinae sf.	<i>Microtis guentherii/soci alis</i>	Social vole	عكبر الحقل	LC

5.4.1. ORDER CHIROPTERA

5.4.1.1. Family Vespertilionidae

1. European Free-Tailed Bat, *Tadarida teniotis* (Rafinesque 1814) (Photo 1)

The European Free-tailed bat is a high-flying bat. It was recognized by its calls that were recorded by the passive bat detectors (Plate 26). Their calls represented 17% of the total bat calls in Hamman Hima.

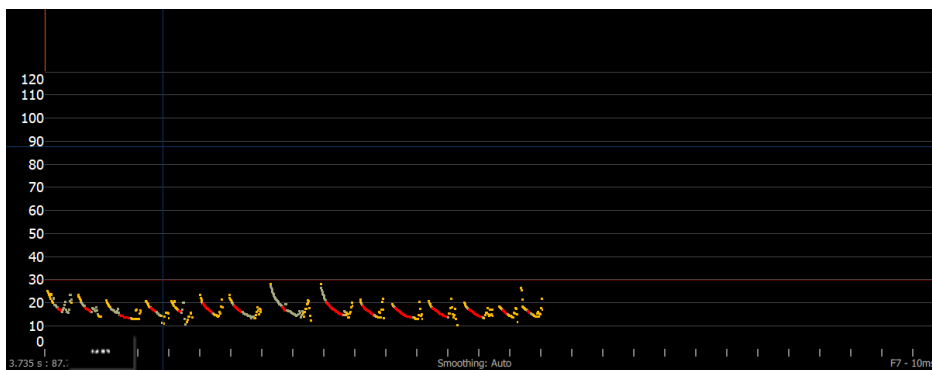


Plate 26. Calls of The European Free-Tailed bat that were recorded by the passive bat detector at Hammana Hima

5.4.1.2. Family Rhinolophidae

1. The Greater Horseshoe Bat, *Rhinolophus ferrumequinum* (Schreber 1774) (Photo 2)

This bat was recognized from its calls that were recorded by the passive bat detector (Plate 27) but were not encountered in the Hima.

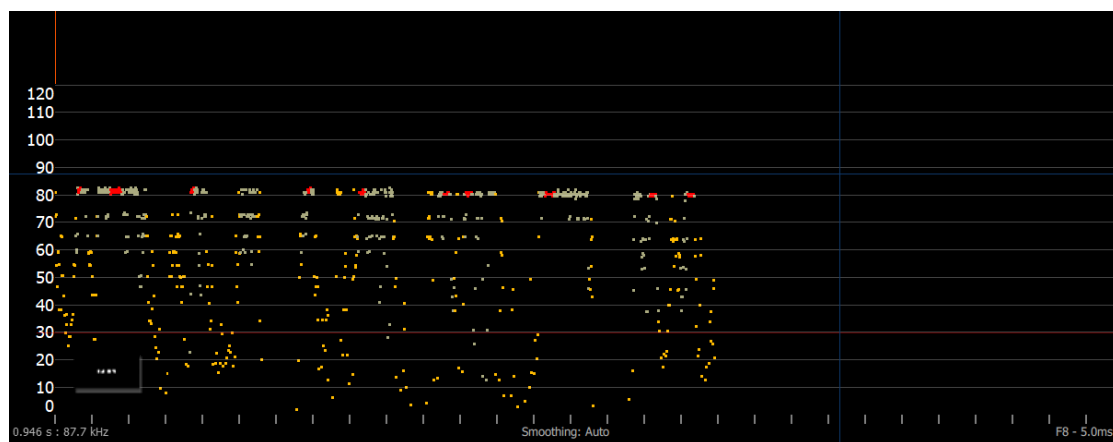


Plate 27. Calls of the Greater horseshoe bat that were recorded by the passive bat detector at Hammana Hima.

5.4.1.3. Family Vespertilionidae

1. Common pipistrelle Bat, *Pipistrellus pipistrellus*, Schreber 1774 (Photo 3)

The common pipistrelle is a common bat in Lebanon. It was recorded in all the passive bat detectors and it was the most common bat recorded in Hammana Hima. Its calls (Plate 28) constituted 48% of all bat calls recorded at Hammana Hima.

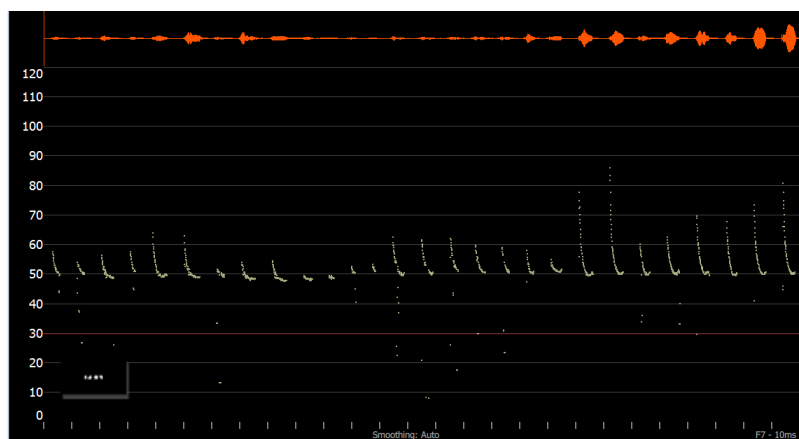


Plate 28. Common pipistrelle calls recorded during night acoustic surveys at Hammana Hima

2. Kuhl's pipistrelle Bat, *Pipistrellus kuhlii*, Kuhl 1817 (Photo 4)

Kuhl's pipistrelle bats were not as common as the common pipistrelle and their calls (Plate 29) constituted 10% of all bat calls at Hammana Hima.

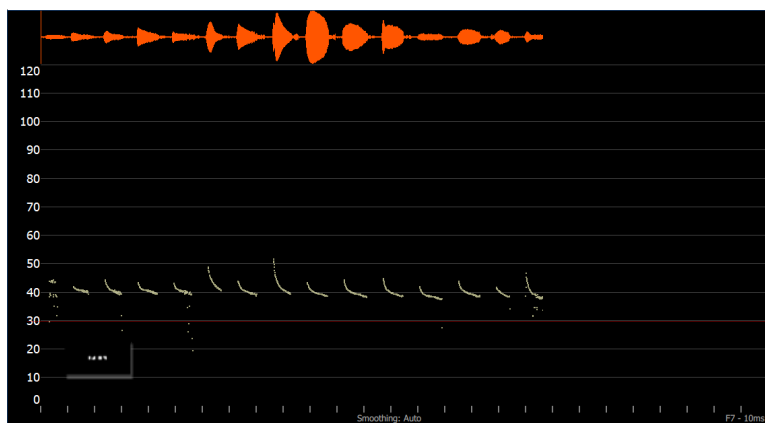


Plate 29. Calls of Kuhl's pipistrelle recorded during acoustic surveys at Hammana Hima

3. Savi's Pipistrelle Bat, *Hypsugo savii* (Bonaparte 1837) (Photo 5)

Savi's pipistrelle bat belongs to the most widespread bats of Lebanon, its localities are scattered across the whole country however it was not the case at Hammana Hima where its calls (Plate 30) constituted less than 1% of total bat calls at Hammana Hima.

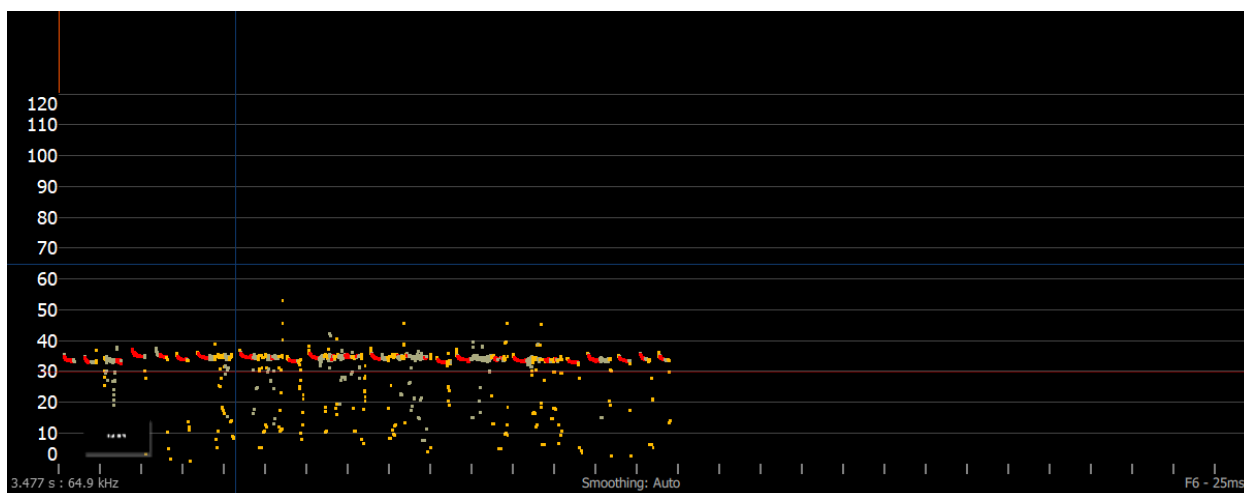


Plate 30. Calls of Savi's Pipistrelle bat recorded at Hammana Hima.

4. Serotine Bats, *Eptesicus Serotinus* (Schreber 1774) (Photo 6)

The serotine bat was recognized from its calls (Plate 31). Its calls were frequently recorded and constituted 13% of all bat calls.

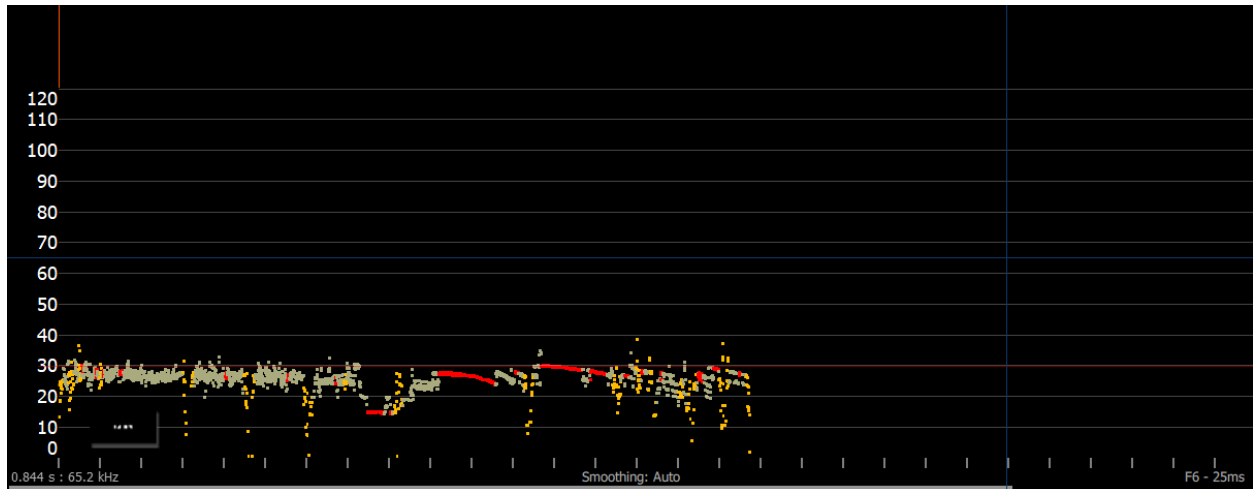


Plate 31. Calls of Serotine bat that were recorded by the passive bat detector at Hammana Hima.

5. Noctule bat, *Nyctalus Noctula* (Schreber 1774) (Photo 7)

Noctule bat presence at Hammana Hima was documented through its calls that were recorded by the passive bat detector (Plate 32). Noctule bats are rare in this Hima species and their calls constituted only 4% of all the bat calls.

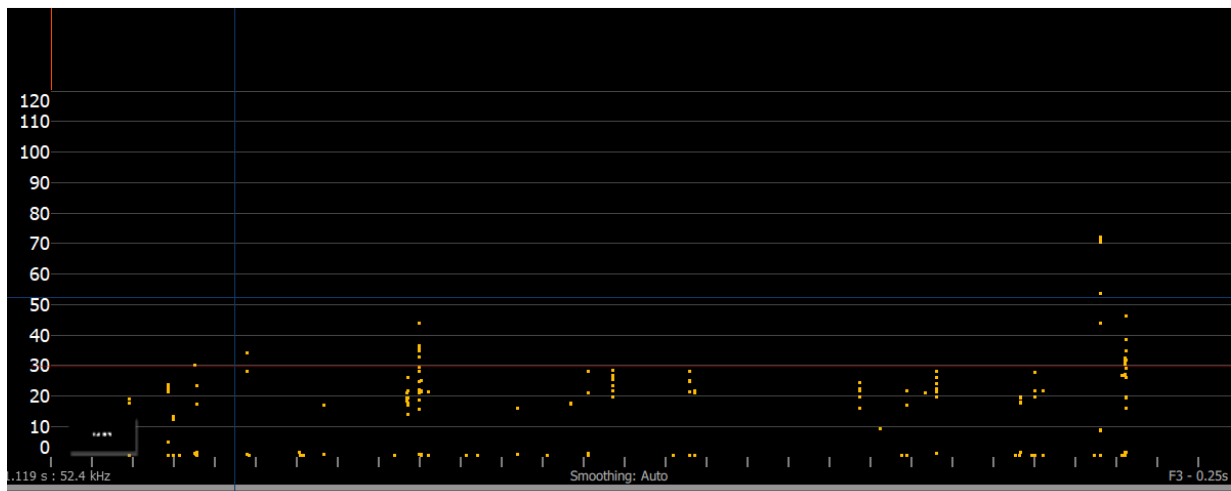


Plate 32. Calls of Noctule bat that were recorded by the passive bat detector at Hammana Hima.

6. Schreiber's Bent-winged bat, *Miniopterus Shreibersii* (Kuhl 1817) (Photo 8)

Schreiber's Bent-winged bats were rare as well in Hammana Hima. Its calls (Plate 33) were represented by c. 4% of all bat calls.

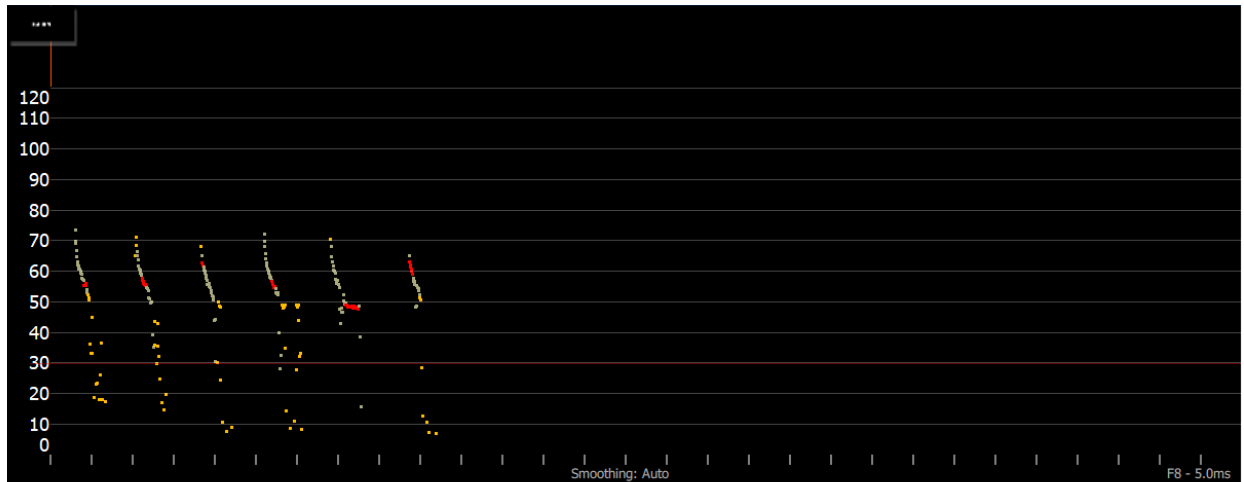


Plate 33. Calls of Shriber's bent-winged bat that were recorded by the passive bat detector at Hammana Hima.

7. Whiskered Bat, *Myotis Mystacinus* (Kuhl 1817) (Photo 9)

Similarly, Whiskered bats were not common in Hammana Hima and their calls (Plate 34) represented c. 3% of all bat calls.

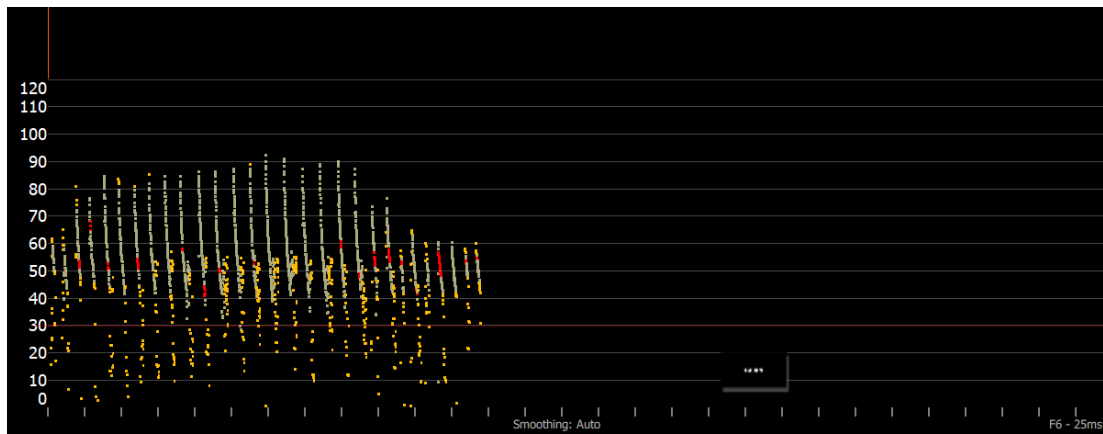


Plate 34. Calls of whiskered bat that were recorded by the passive bat detector at Hammana Hima.

5.4.2. ORDER CARNIVORA

5.4.2.1. Family Canidae

1. Common Jackal; *Canis aureus syriacus*, Linnaeus 1758

Jackals are common species in Hammana Hima even though they constitute only 25% of the photos from the camera traps. This could be referred to the high altitude of Hammana and its distance from urban areas. Jackals were captured during the day and night times with the camera traps (Plate 35)



Plate 35. Common Jackals captured by camera traps during day and night times at Hammana Hima.

2. Red Fox; *Vulpus vulpus palaestina*, Linnaeus 1758

Foxes are the most common species found in Hammana. Most (69%) of the camera trap photos were of foxes. They were photographed day and night (Plate 36). In addition, they were encountered during every night drive and their scats and footprints were very common, especially on snow (Plate 37).

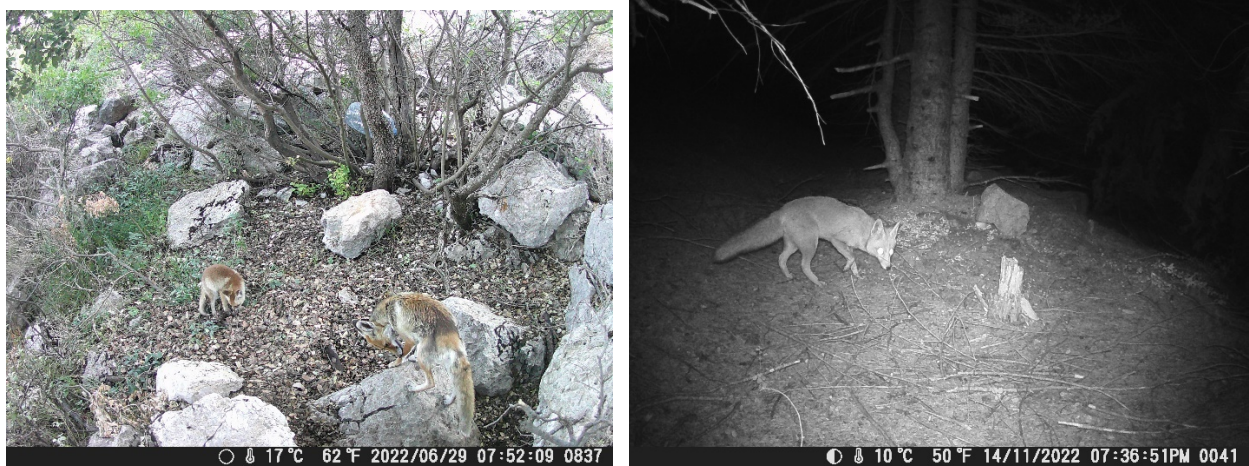


Plate 36. Foxes (cubs) captured by camera traps during day and night times at Hammana Hima.



Plate 37. Foxes footprints playing on the snow (A) and the fox shining eyes during the night drives (B)

5.4.2.2. Family Mustelidae

1. Stone martin; *Martes foina syriaca*, Erxleben 1777

Stone martins were frequently found at the Hammana Hima, were less captured by camera traps than foxes and jackals, and constituted only 6% of the photos. In addition, their scats (Plate 38) were encountered more often during the transect survey.



Plate 38. Photo of stone martin captured by camera traps and its scats in the box observed at Hammana Hima

2. Badger; *Meles meles canescens*, Linnaeus 1758

Badgers were also photographed by camera traps in this Hima (Plate 39). However, badgers are not common in the Hima and this was reflected by the number of times they were caught by camera traps. Only 0.6% (N=8) of the photos from the camera traps contained badgers.



Plate 39. Photo of a badger captured by camera traps at Hammana Hima.

5.4.2.3. Family Hyaenidae

1. Striped hyaena; *Hyaena hyaena syriaca*, Linnaeus 1758

Knowing the status of striped hyaenas in Lebanon, they were fairly encountered in Hammana Hima. Their photos (Plate 40) constituted 4.5% (N=57) of the camera trap photos.



Plate 40. Striped hyaena captured by a camera trap at Hammana Hima.

5.4.3. Family Felidae

1. Wild cat; *Felis silvestris tristrami*, Schreber 1777

Wild cats were the least photographed in Hammana Hima. One was only photographed in the camera traps towards Falougha before the camera was stolen. In addition, a few scats (Plate 41) of the wild cats were encountered during the transects survey. Hence more efforts have to be carried out concerning this species as it was photographed in a place comparatively very far from human presence.



Plate 41. Scats of wild cats encountered during transect survey at Hammana Hima.

5.4.4. ORDER RODENTIA

5.4.4.1. Family Sciuridae

1. The Persian Squirrel; *Sciurus anomalus syriacus*, Gueldenstaedt 1785

The footprints of a squirrel were only encountered once on the snow (Plate 42). This was the only time that their presence was confirmed.



Plate 42. Footprints of a squirrel on snow encountered at Hammana Hima.

5.4.4.2. Family Spalacidae

1. Mole Rat; *Spalax leucodon ehrenbergi*, Nehring 1898

Mole rats were not trapped at Hammana Hima. Nonetheless, their mounds were encountered a lot reflecting their abundance (Plate 43).



Plate 43. Mount of a mole rat from Hammana Hima

5.4.4.3. Family Murinae

1. Broad-toothed field mouse; *Apodemus mystacinus*, Danford and Alston 1877 (Photo 11)

The broad-toothed field mouse was common in the Hima. They were the most trapped species (61%) in the Hima.

2. Harmoun field mouse; *Apodemus harmonensis*, Linnaeus 1758 (Photo 13)

This mouse species is not very common in Lebanon as it is restricted to high elevations. Nonetheless, it was the second trapped (39%) after *A. mystacinus*.

3. House mouse; *Mus musculus*, Linnaeus 1758

The presence of the house mouse was confirmed from the owl pellets collected from different locations in the Hima.

5.4.4.4. Family Microtinae

1. Levant or social vole; *Microtus guentheri guentheri*, Danford and Alston 1880 (Photo14)

Tracks of field voles were very common in Hammana Hima and most were active however none was trapped. This was because in many areas we were obliged to remove the traps due to safety reasons since the traps were put in the open and easily detected by people. However, some were

photographed during the field visits (Plate 44). In addition, many samples were retrieved from owl pellets collected from different locations at the Hima.



Plate 44. Field vole encountered at Hammana Hima. The photos in the boxes represent their tracks and skulls in the owl pellet.

5.4.4.5. Family Gerbillinae

1. Tristram's Jird; *Meriones tristrami*, Thomas 1892 (Plate 82)

The skull of Tristram's jird was retrieved from owl pellets collected from the Hima but none were trapped.

5.5. Ibl AlSaqi Hima

The 1530 camera trapping days, 60 acoustic passive bat surveys, and the 500 rodent trapping nights resulted in documenting 29 species of wild mammals one of which is a new record for Lebanon. These species belonged to 5 orders, 13 families, and 1 sub-family. In addition to three species of domestic animals namely sheep, goats, and dogs (Table 4). Two of the species found in Ibl AlSaqi Hima are vulnerable (VU) according to IUCN redlist for the Mediterranean namely the Mediterranean horseshoe bat and the striped hyaena and three species are near threatened (NT) including Greater and lesser horseshoe bat and Schreiber's Bent-winged bat.

Table 4. Species encountered at Ibl Al Saqi Hima

	Order	Family	Scientific Name	Common Name	Arabic Name	IUCN Status Mediterranean
1	Insectivora	Erinaceidae	<i>Erinaceus concolor</i>	Hedgehog	القنفذ	LC
2		Soricidae	<i>Crocidura suaveolens</i>	Lesser white-toothed Shrew	الذبابة	LC
3	Chiroptera	Molossidae	<i>Tadarida teniotis</i>	European Free-tailed bat	الخفاش الأوروبي طليق الذنب	LC
4		Rhinolophidae	<i>Rhinolophus ferrumequinum</i>	Great horseshoe bat	الخفاش النضوي الكبير	NT
5			<i>Rhinolophus hipposideros</i>	Lesser horseshoe bat	الخفاش النضوي الصغير	NT
6			<i>Rhinolophus Euryale</i>	Mediterranean horseshoe bat	خفاش البحر المتوسط النضوي	VU
7		Vespertilionidae	<i>Pipistrellus pipistrellus</i>	Common pipistrelle	خفاش بيبستريل الشائع	LC
8			<i>Pipistrellus kuhlii</i>	Kuhl's pipistrelle	خفاش بيبستريل كوهلي	LC
9			<i>Hypsugo savii</i>	Savi's Pipistrelle	خفاش سافي	LC
10			<i>Eptesicus Serotinus</i>	Serotine bat	خفاش الليل	LC
11			<i>Nyctalus Noctula</i>	Noctule bat	خفاش نكتول الشائع	LC
12			<i>Miniopterus Shreibersii</i>	Schreiber's Bent-winged bat	خفاش شريبر طويل الجناح	NT
13			<i>Myotis myotis</i>	Greater Mouse-eared bat	خفاش فأري الأذن الكبير	LC
14			<i>Myotis Mystacinus</i>	Whiskered bat	خفاش ابو شوارب	LC

15	Carnivora	Canidae	<i>Canis aureus</i>	Jackal	ابن اوى	LC
16			<i>Vulpus vulpus paleastina</i>	Fox	الثعلب	LC
17		Mustelidae	<i>Martes Fiona</i>	Stone martin	النمس	LC
18			<i>Meles meles</i>	Badger	الغريب	LC
19		Hyaenidae	<i>Hyaena hyaena syriaca</i>	Striped hyaena	الضبع المخطط	VU
20		Felidae	<i>Felis silvestris</i>	Wild cat	الهر البري	LC
21	Artiodactyla	Suidae	<i>Sus scrofa</i>	Wild boar	الخنزير البري	LC
22	Rodentia	Hystriidae	<i>Hystrix hystrix indica</i>	Porcupine	النيص	LC
23		Spalacidae	<i>Spalax leucodon</i>	Mole rat	الحلد	LC
24		Muridae	<i>Apodemus mystacinus</i>	Broad-toothed field mouse	فار الحقل	LC
25			<i>A. flavicollis</i>	Yellow-necked field mouse	فار الحقل	LC
26			<i>Rattus norvegicus</i>	Brown rat	الجرذ البني	LC
27			<i>Mus musculus</i>	House mouse	فأر البيوت	LC
28			<i>Acomys dimidiatus</i>	Spiny mouse	الفأر المشوك	LC
29		Microtinae sf.	<i>Microtis guentherii/soci alis</i>	Social vole	عكبر الحقل	LC

5.5.1. ORDER INSECTIVORA

5.5.1.1. Family Erinaceidae

1. Hedgehogs; *Erinaceus concolor*, Martin 1838

Hedgehogs were one of the two insectivores present at Ibl Saqi Hima. Their presence in the Hima was confirmed by a dead individual that was seen at the entrance of the Hima (Plate 45).



Plate 45. A dead hedgehog was encountered at the entrance of Ibl AlSaqi Hima

5.5.1.2. Family Soricidae

1. Lesser White-Toothed Shrew, *Crocidura suaveolens*, Pallas 1811

Two individuals of the lesser white-toothed shrew (Plate 46) were trapped during the trapping course at Ibl AlSaqi Hima



Plate 46. The lesser white-toothed shrew caught at Ibl AlSaqi Hima

5.5.2. ORDER CHIROPTERA

1. European Free-Tailed Bat, *Tadarida teniotis* (Rafinesque 1814) (Photo 1)

The European free-tailed bats were rare in Hima Ibl AlSaqi. Only a few calls (1.7%) of the European free-tailed bat were recorded by the passive bat detectors in Ibl AlSaqi Hima (Plate 47).

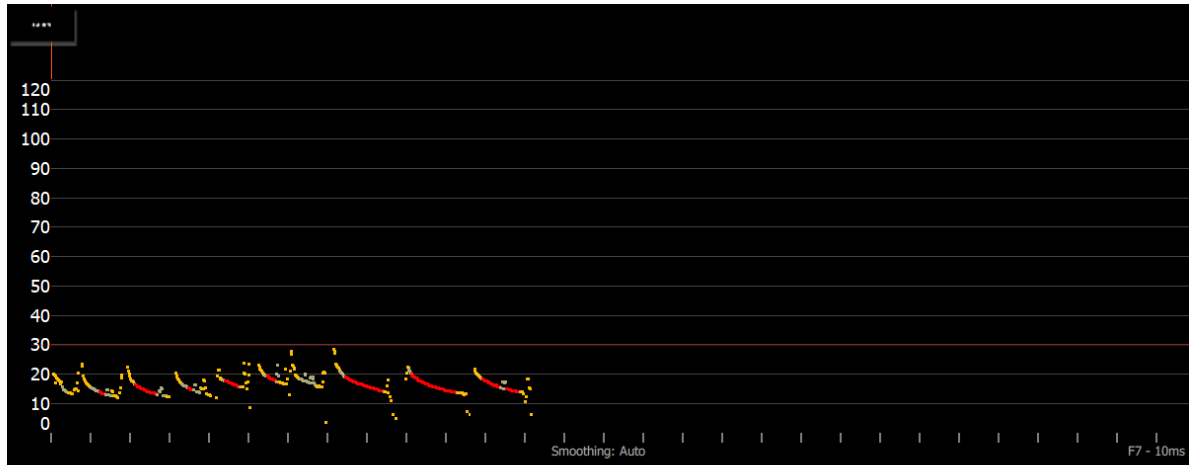


Plate 47. Calls of European free-tailed bat were recorded by the passive bat detector at Ibl Al Saqi Hima.

5.5.2.1. Family Rhinolophidae

1. The Greater Horseshoe Bat, *Rhinolophus ferrumequinum*, Schreber 1774

The greater horseshoe bat was encountered at three locations in caves at Ibl AlSaqi Hima (Plate 48). However, their calls were not recorded at any of the passive bat detectors



Plate 48. Photo of a greater horseshoe bat encountered in one cave at Ibl Alsaqi Hima.

2. Lesser Horseshoe Bat, *Rhinolophus hipposideros*, Borkhausen 1797

The lesser horseshoe bats were encountered in two caves in Ibl Saqi Hima (Plate 49). Three individuals in one cave and 5 in another.



Plate 49. A photo of a hibernating lesser horseshoe bat photographed in a cave at Ibl AlSaqi Hima

3. Mediterranean Horseshoe Bat, *Rhinolophus euryale* (Blasius 1853)

The Mediterranean horseshoe bat was observed at Ibl AlSaqi Hima from its call and one individual was encountered in one cave (Plate 50).

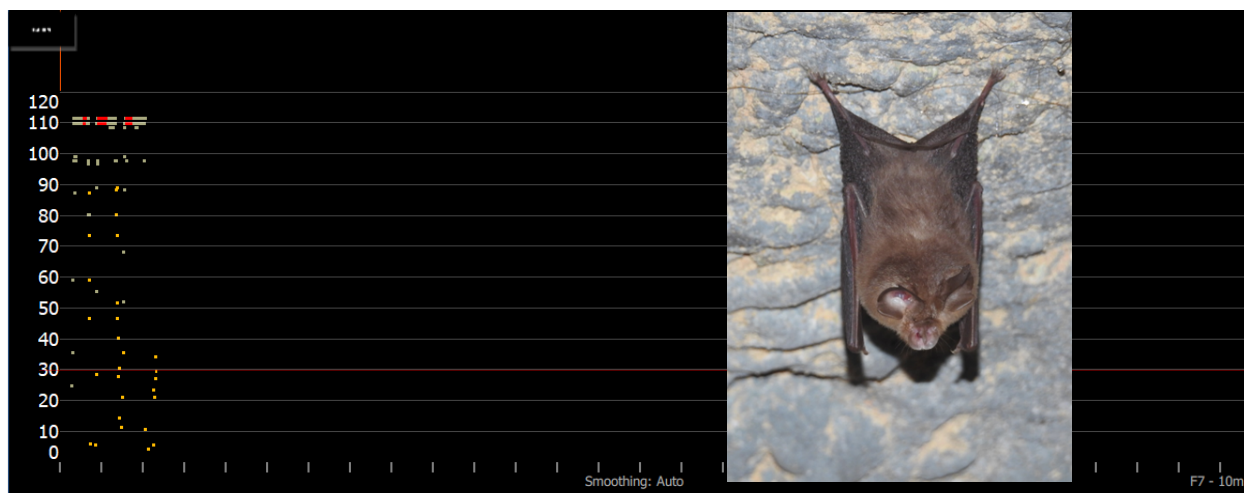


Plate 50. Calls of *Rhinolophus euryale* (Blasius 1853) and its photo from a cave at Ibl AlSaqi Hima.

5.5.2.2. Family Vespertilionidae

1. Common Pipistrelle Bat, *Pipistrellus pipistrellus*, Schreber 1774 (Photo 3)

Common Pipistrelle bats were the second common bat at Ibl AlSaqi Hima. Its calls (Plate 51) constituted 15% of all bat calls recorded at Ibl AlSaqi.

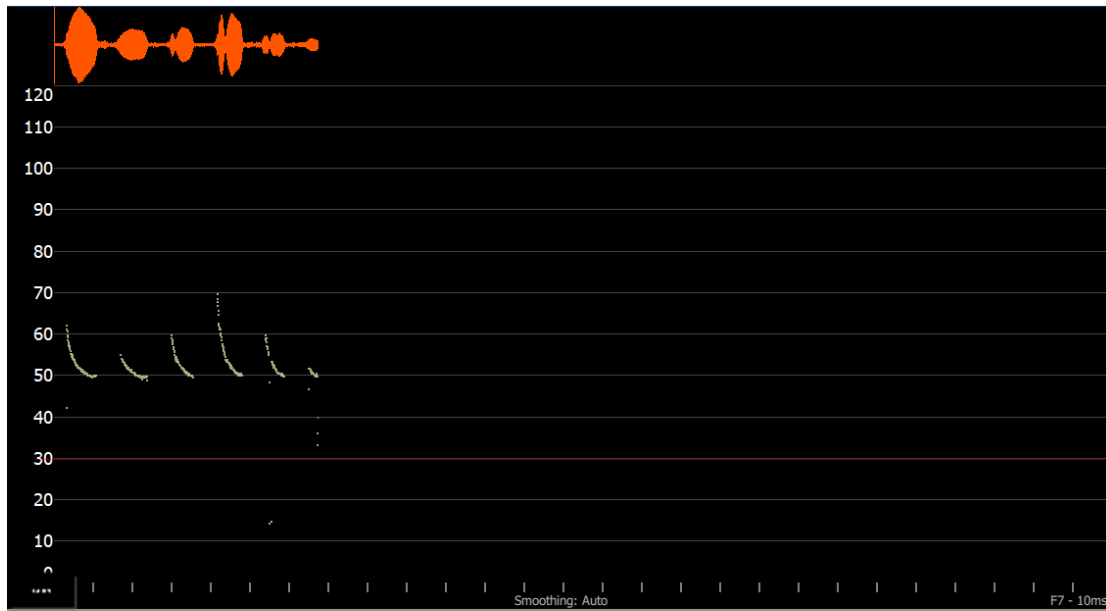


Plate 51. Calls of the common pipistrelle recorded during the night acoustic survey at Ibl Al Saqi Hima

2. Kuhl's Pipistrelle Bat, *Pipistrellus kuhlii*, Kuhl 1817 (Photo 4)

Kuhl's pipistrelle bats were the most common bat at Hima Ibl Alsaqi. Most (75%) of the calls (Plate 52) recorded by the bat detectors were for Kuhl's pipistrelle.

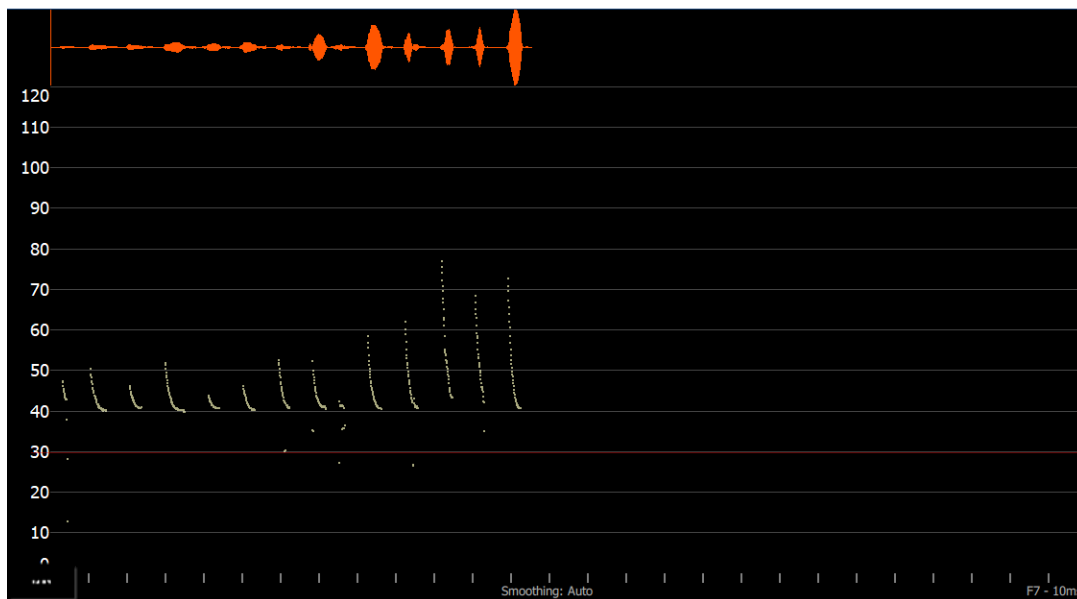


Plate 52. Kuhl's pipistrelle bat calls were recorded during the active acoustic surveys at Ibl AlSaqi Hima.

3. Savi's Pipistrelle Bat, *Hypsugo savii* (Bonaparte 1837) (Photo 5)

Savi's pipistrelle bats were the least recorded at Ibl AlSaqi Hima and their calls (Plate 53) constituted only 0.2% of all calls.

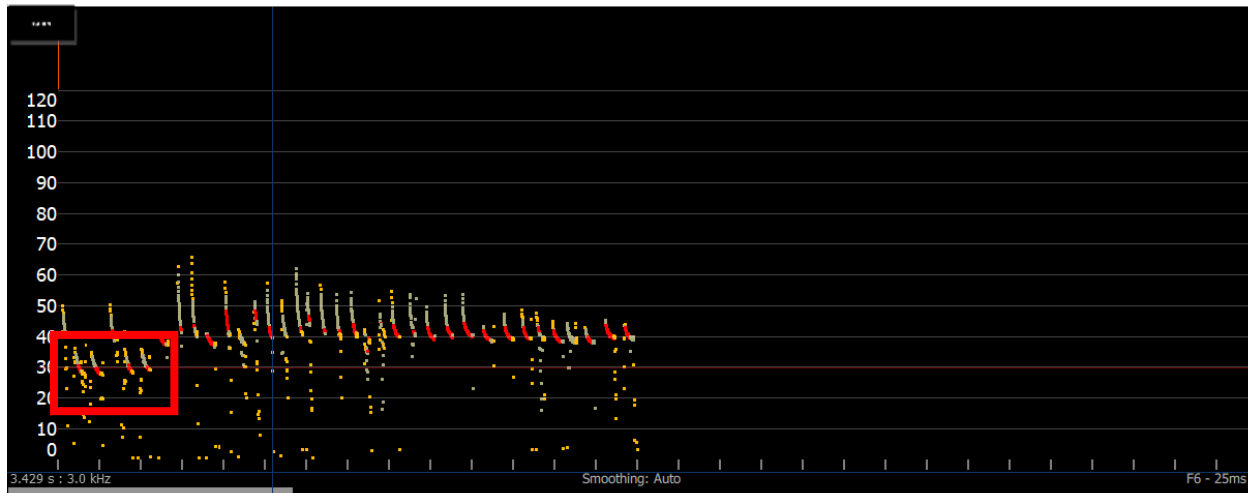


Plate 53. Calls of Savi's pipistrelle bat that were recorded by the passive bat detector at Ibl Al Saqi Hima.

4. Serotine Bat, *Eptesicus Serotinus* (Schreber 1774) (Photo 6)

Serotine bats were recognized from their calls (Plate 54). However, they are very rare in the Hima and their calls constituted only 1% of all bat calls recorded at Ibl AlSaqi Hima.

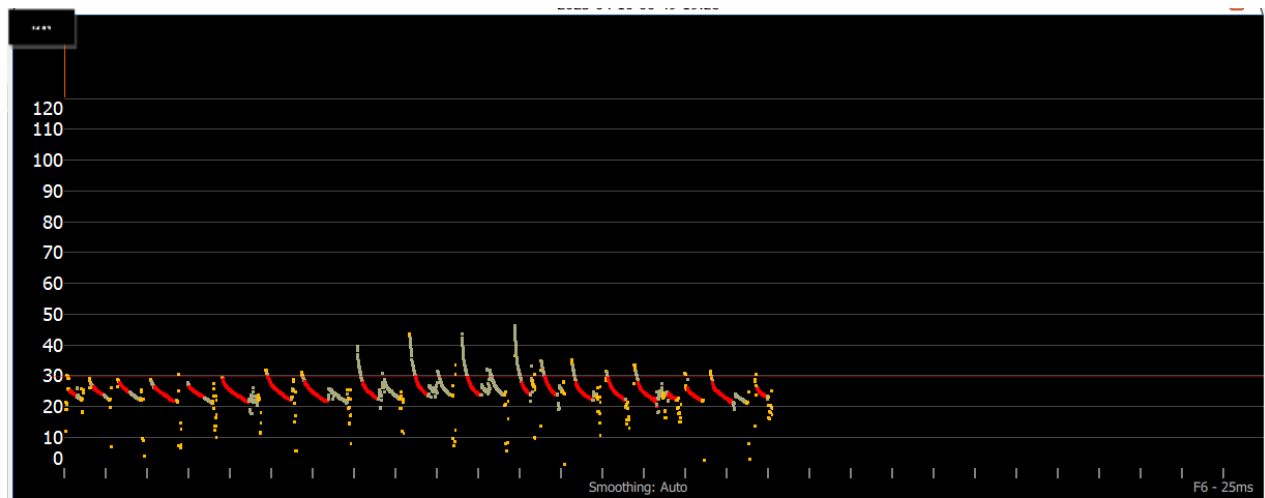


Plate 54. Calls of Serotine bats that were recorded by the passive bat detector at Ibl Al Saqi Hima.

5. Noctule Bat, *Nyctalus Noctula* (Schreber 1774) (Photo 7)

Noctule bats were rare as well at Ibl AlSaqi Hima Their calls (Plate 55) constituted only 1% of all bat calls recorded at Ibl AlSaqi Hima

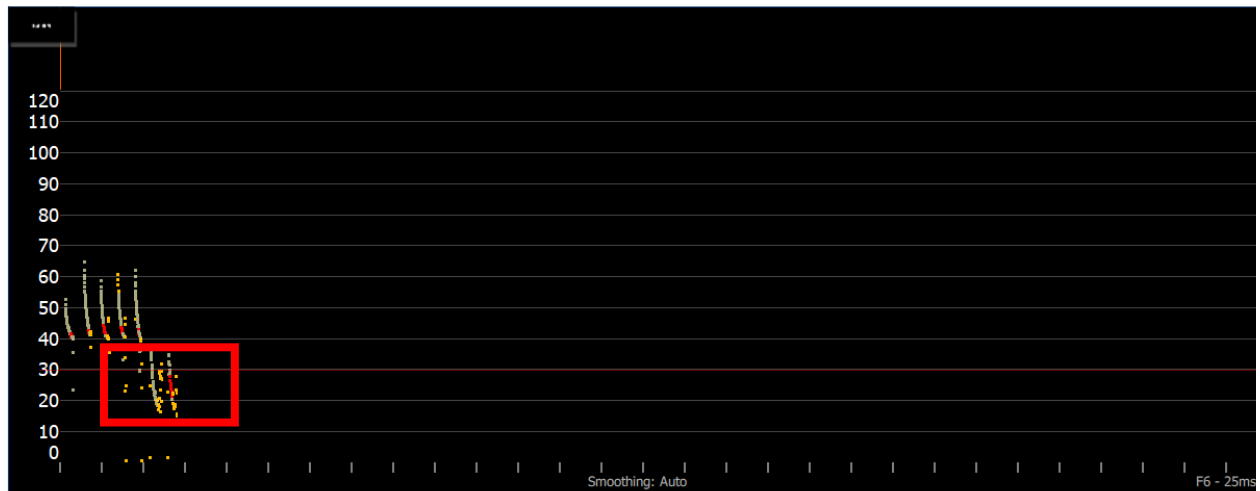


Plate 55. Calls of Noctule bat that were recorded by the passive bat detector at Ibl Al Saqi Hima.

6. Schreiber’s Bent-winged bat *Miniopterus Shreibersii* (Kuhl 1817) (Photo 8)

Shriber’s bent-winged bats were not abundant in the Hima. Their calls (Plate 56) constituted 2.6% of all bat calls.

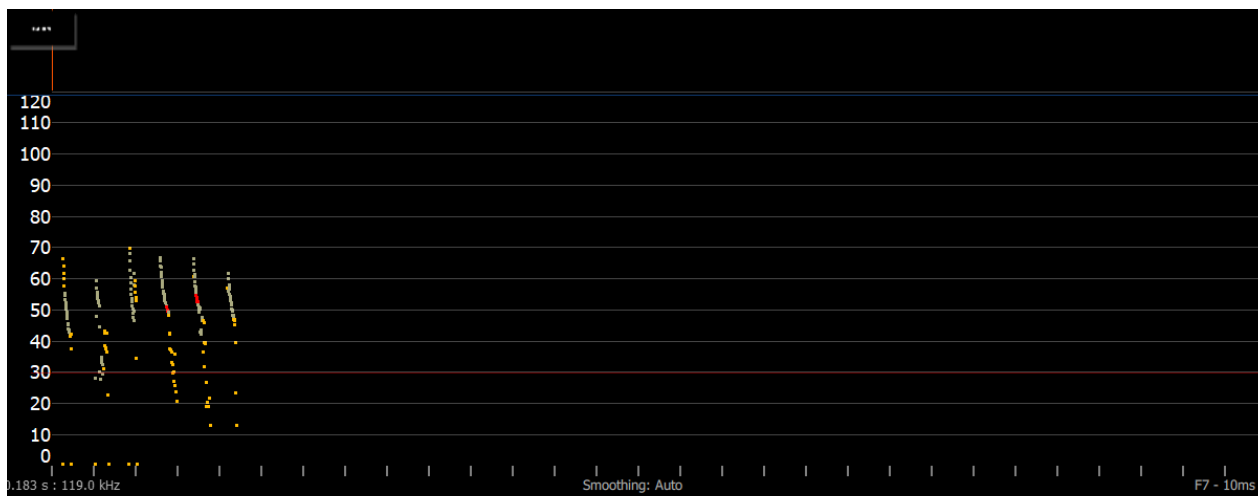


Plate 56. Calls of Shriber’s bent winged bat that were recorded by the passive bat detector at Ibl Al Saqi Hima.

7. The Greater Mouse-Eared Bat, *Myotis myotis* (??) (Photo 10)

The calls of the greater mouse-eared bats (Plate 57) were the least recorded (0.17%) at Ibl Al Saqi Hima. These calls need more confirmation especially since *myotis* calls are hard to be distinguished at the species level.

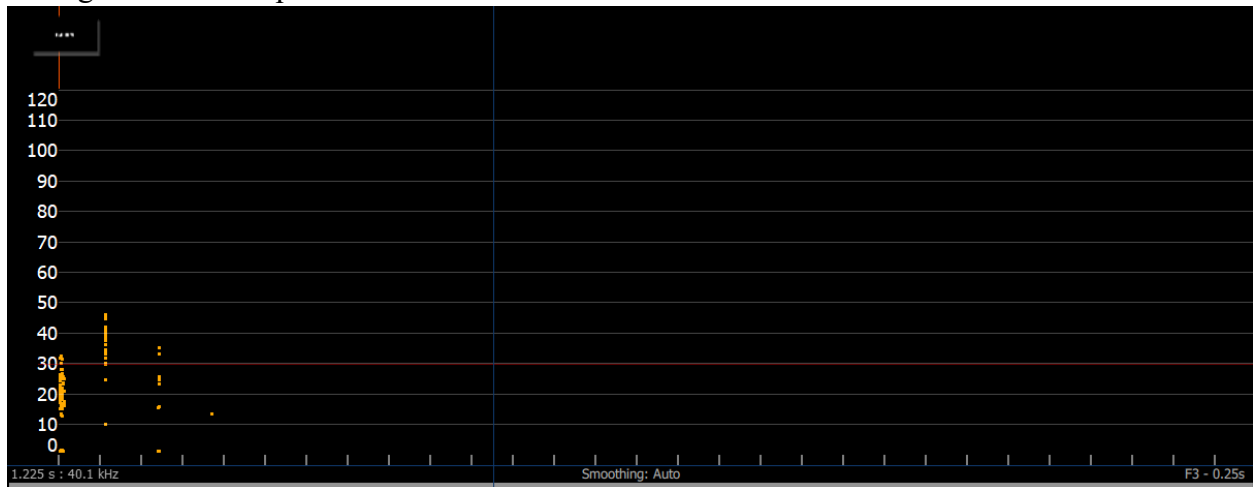


Plate 57 Calls of the greater mouse-eared bat recorded by the passive bat detector at Ibl Al Saqi Hima

8. The Whiskered Bat, *Myotis mystacinus*, Kuhl 1817 (Photo 19)

The calls (Plate 58) of the whiskered bat were recorded during the active and passive acoustic survey in Ibl Al Saqi Hima. However, this species is uncommon in the Hima (3% of all calls)

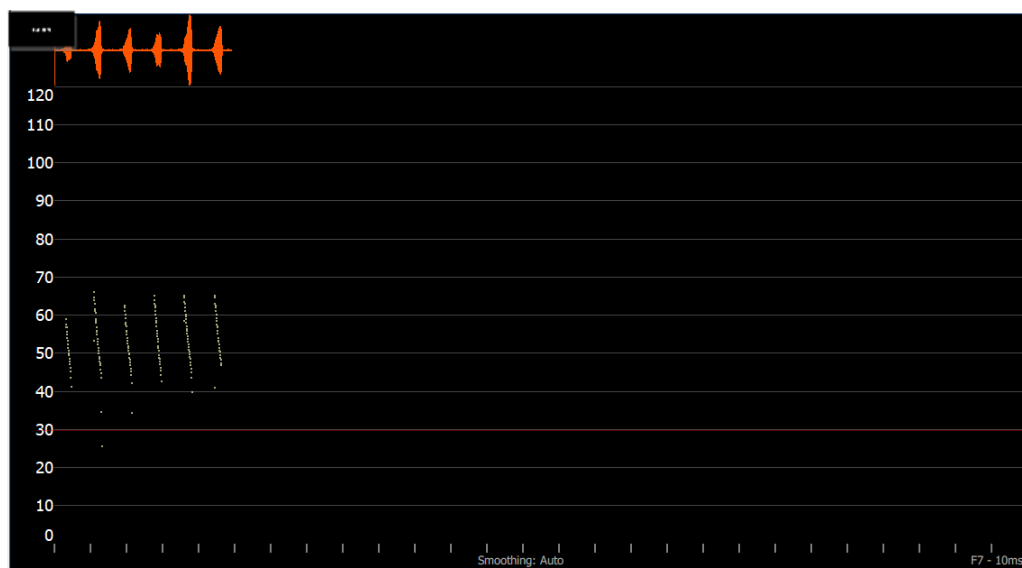


Plate 58 Calls of the whiskered bat recorded during night active acoustic survey at Ibl Al Saqi Hima.

5.5.3. ORDER CARNIVORA

5.5.3.1. Family Canidae

1. Common Jackal; *Canis aureus syriacus*, Linnaeus 1758

Jackals are very common in Ibl AlSaqi Hima and they were the most photographed (47%) species and 34% of these photos were taken during day time. Their abundance was recognized where in many photographs where more than one individual (Plate 59) was observed in the same photo.



Plate 59. Three jackals were captured by camera traps at one location at Hima Ibl AlSaqi.

2. Red Fox; *Vulpus vulpus palaestina*, Linnaeus 1758

Red foxes comprised c. 15% of the camera trap photos. Their scats were more often encountered and were even seen during the diurnal transect surveys in the early mornings (Plate 60).



Plate 60. Red fox encountered in the early morning during the transect survey at Ibl AlSaqi Hima

5.5.3.2. Family Mustelidae

1. Stone martin; *Martes foina syriaca*, Erxleben 1777

Stone martins were encountered as well in the Hima. They are well-distributed and they have a healthy population. They were photographed in all the camera traps (Plate 61) and their photos constituted 12% of all the photos.



Plate 61. Photo of a stone martin captured by camera traps at Ibl AlSaqi Hima.

2. Badger; *Meles meles canescens*, Linnaeus 1758

Badgers were the least encountered at Ibl AlSaqi Hima. Only 1.3% of the photos captured by camera traps were of badgers (Plate 62).



Plate 62. Badger captured by the camera trap at Ibl AlSaqi Hima.

5.5.3.3. Family Felidae

1. Wild cat; *Felis silvestris tristrami*, Schreber 1777

Wild cats were photographed only at one location at the Hima (Plate 631) and their photos constituted 6% of all the photos captured by camera traps.



Plate 63. Photo of a wild cat at Ibl AlSaqi Hima.

5.5.4. ORDER ARTIODACTYLA

5.5.4.1. Family Suidae

1. Wild Boar; *Sus scrofa lybicus* Linnaeus, 1758

Wild boars are very common in Ibl AlSaqi Hima. Their photos were captured by all the camera traps and in many photos, more than one individual was present (Plate 64). Besides, their tracks were all over the Hima from soil disturbance to tree rubbing.



Plate 64. Three wild boars captured by camera traps at Hima Ibl AlSaqi.

5.5.5. ORDER RODENTIA

The small rodent population was surprisingly low compared to the other Himas comprising only 9% of all the rodents caught in all the Himas. Nonetheless, It has a good species diversity where 6 species were trapped among which one was new to Lebanon.

5.5.5.1. Family Sciuridae

1. The Persian Squirrel; *Sciurus anomalus syriacus*, Gueldenstaedt 1785

Red squirrels were not seen in the Hima even though many locals confirmed their presence.

5.5.5.2. Family Hystricidae

1. Porcupine; *Hystrix indica indica*, Kerr 1792

Porcupines were the most common in Ibl AlSaqi Hima compared to the other Himas. Their tracks, quills, and scats (Plate 65) were all over the Hima. Besides they were photographed by all the camera traps in the Hima and most photos two were captured together (Plate 66)

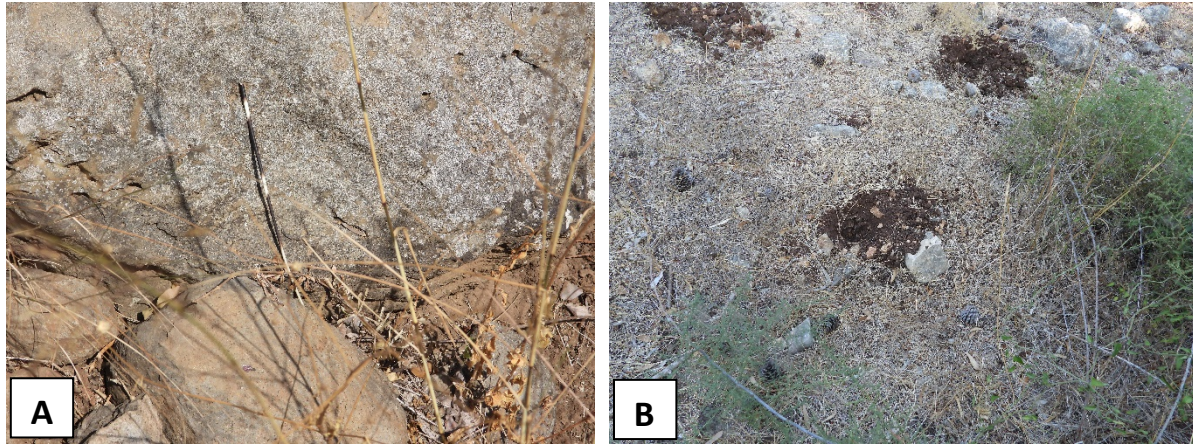


Plate 65. Porcupine quills (A) and tracks (B) encountered in Ibl AlSaqi Hima



Plate 66. Two porcupines captured by a camera trap at Ibl AlSaqi Hima.

5.5.5.3. Family Spalacidae

1. Mole Rat; *Spalax leucodon ehrenbergi*, Nehring 1898

Mounds of mole rats (Plate 67) were well distributed in Ibl AlSaqi Hima reflecting their abundance.



Plate 67. Tracks of mole rat at Ibl Al Saqi Hima.

5.5.5.4. Family Murinae

1. Broad-toothed field mouse; *Apodemus mystacinus*, Danford and Alston 1877 (Photo 11)

Broad-toothed field mice were not common as compared to other Himas. Very few were trapped.

2. Yellow-necked field mouse; *Apodemus flaviculus*, Linnaeus 1758 (Photo 12)

The yellow-necked field mice were not common according to the number caught. Only one individual was caught during the Fall trapping session

3. House mouse; *Mus musculus*, Linnaeus 1758

The house mouse was only trapped twice in the Hima

4. Arabian Spiny mouse; *Acomys dimidiatus dimidiatus*, Cretzschmar 1826

This is the first documented record of this mouse species in Lebanon. Four individuals were trapped at only one location at Ibl AlSaqi Hima. Hence more assessments and monitoring should be carried out for this species.

5.5.5.5. Family Microtinae

1. Field or Social vole; *Microtus guentheri guentheri*, Danford and Alston 1880 (Photo 14)

Levant or field vole was the most common rodent in Ibl AlSaqi Hima. This was confirmed by the vast number of holes made by them and they were most trapped (30%) in Ibl AlSaqi Hima.

5.6. Mammals of Hima Ain Zebdeh – Kherbet Qanafar

These two Himas will be treated as one since they are bordering each other and having the same habitat.

The 2730 camera trapping days, 50 acoustic passive bat surveys, and the 1000 rodent trapping nights resulted in documenting 28 species of wild mammals. These belonged to six orders, 14 families, and 2 sub-families (Table 5). In addition to four domestic species sheep, goats, cats, and dogs. One species was vulnerable (VU) according to the IUCN redlist for the Mediterranean the striped hyaena and three bat species are near threatened (NT) namely the greater and lesser horseshoe bat and Schreiber's Bent-winged bat.

Table 5. Species encountered at Ain Zebdeh and Kherbet Qanafar Himas

	Order	Family	Scientific Name	Common Name	Arabic Name	IUCN Status Mediterranean
1	Insectivora	Erinaceidae	<i>Erinaceus concolor</i>	Hedgehog	القنفذ	LC
2	Chiroptera	Molossidae	<i>Tadarida teniotis</i>	European Free-tailed bat	الخفاش الأوروبي طليق الذنب	LC
3		Rhinolophidae	<i>Rhinolophus ferrumequinum</i>	Great horseshoe bat	الخفاش النضوي الكبير	NT
4			<i>Rhinolophus hipposideros</i>	Lesser horseshoe bat	الخفاش النضوي الصغير	NT
5		Vespertilionidae	<i>Pipistrellus pipistrellus</i>	Common pipistrelle	خفاش بيبستريل الشائع	LC
6			<i>Pipistrellus kuhlii</i>	Kuhl's pipistrelle	خفاش بيبستريل كوهلي	LC
7			<i>Nyctalus Noctula</i>	Noctule bat	خفاش نكتول الشائع	LC
8			<i>Miniopterus Shreibersii</i>	Schreiber's Bent-winged bat	خفاش شريبر طويل الجناح	NT
9			<i>Myotis Mystacinus</i>	Whiskered bat	خفاش ابو شوارب	LC
10	Carnivora	Canidae	<i>Canis aureus</i>	Jackal	ابن اوى	LC
11			<i>Canis lupus</i>	Wolf	الذئب	LC
12			<i>Vulpus vulpus paleastina</i>	Fox	الثعلب	LC
13		Mustelidae	<i>Martes Fionia</i>	Stone martin	النمس	LC
14			<i>Meles meles</i>	Badger	الغرير	LC
15		Hyaenidae	<i>Hyaena hyaena syriaca</i>	Striped hyaena	الضبع المخطط	VU
16		Felidae	<i>Felis silvestris</i>	Wild cat	الهر البري	LC
17	Artiodactyla	Suidae	<i>Sus scrofa</i>	Wild boar	الخنزير البري	LC

18	Rodentia	Sciuridae	<i>Sciurus anomalus</i>	Squirrel	السناجب	LC
19		Hystriidae	<i>Hystrix hystrix indica</i>	Porcupine	النيس	LC
20		Spalacidae	<i>Spalax leucodon</i>	Mole rat	الحلد	LC
21		Muridae	<i>Apodemus mystacinus</i>	Broad-toothed field mouse	فار الحقل	LC
22			<i>A. flavicollis</i>	Yellow-necked field mouse	فار الحقل	LC
23			<i>A. harmonensis</i>	Jabal Harmon field mouse	فار الحقل	LC
24			<i>Rattus rattus</i>	Black rat	الجرذ الأسود	LC
25			<i>Rattus norvegicus</i>	Brown rat	الجرذ البني	LC
26			<i>Mus musculus</i>	House mouse	فأر البيوت	LC
27		Gerbillinae sf.	<i>Meriones tristami</i>	Tristami jird	جرذ تريستام	LC
28		Microtinae sf.	<i>Microtis guentherii/socialis</i>	Social vole	عكبر الحقل	LC

5.6.1. ORDER INSECTIVORA

5.6.1.1. Family Erinaceidae

1. Hedgehogs; *Erinaceus concolor*, Martin 1838

The hedgehog was documented from only one photo from camera traps installed in Kherbet Qanafar and one road kill on Ain Zebdeh road (Plate 68).

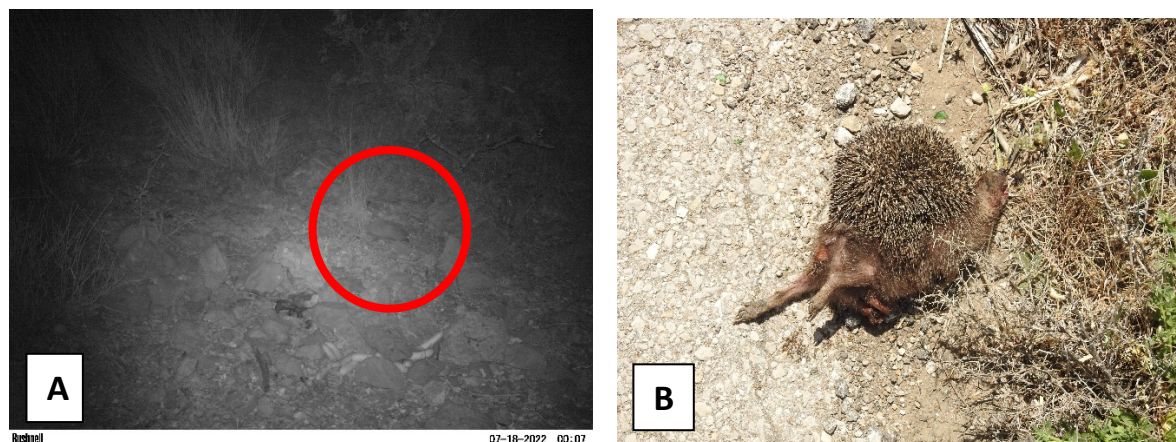


Plate 68. Hedgehog captured by a camera trap at Kherbet Qanafar Hima (A) and a dead one encountered on the road at Ain Zebdeh Hima (B)

5.6.2. ORDER CHIROPTERA

5.6.2.1. Family Vespertilionidae

1. European Free-Tailed Bat, *Tadarida teniotis* (Rafinesque 1814) (Photo 1)

The European Free-tailed bat was as well recognized by its calls (Plate 69) that were recorded by the passive bat detectors. Their calls were the least detected (0.6%) in these two Himas.

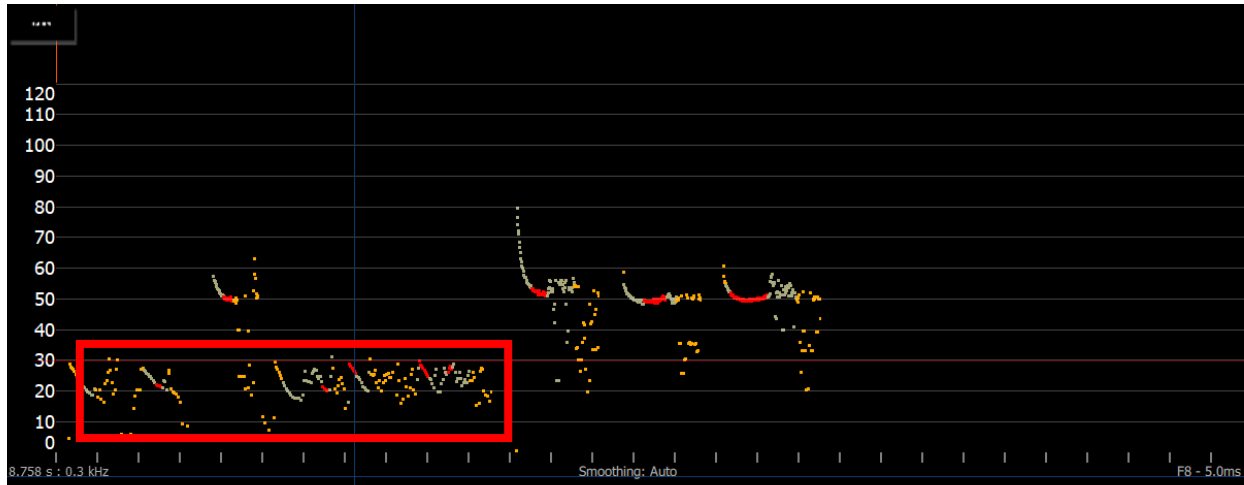


Plate 69. Calls of The European Free-Tailed bat that were recorded by the passive bat detector at Ain Zebdeh Hima

5.6.2.2. Family Rhinolophidae

1. The Greater Horseshoe Bat, *Rhinolophus ferrumequinum*, Schreber 1774 (Photo 2)

The greater horseshoe bat was recorded only once by the passive bat detector located at Ain Zebdeh Hima (Plate 70).

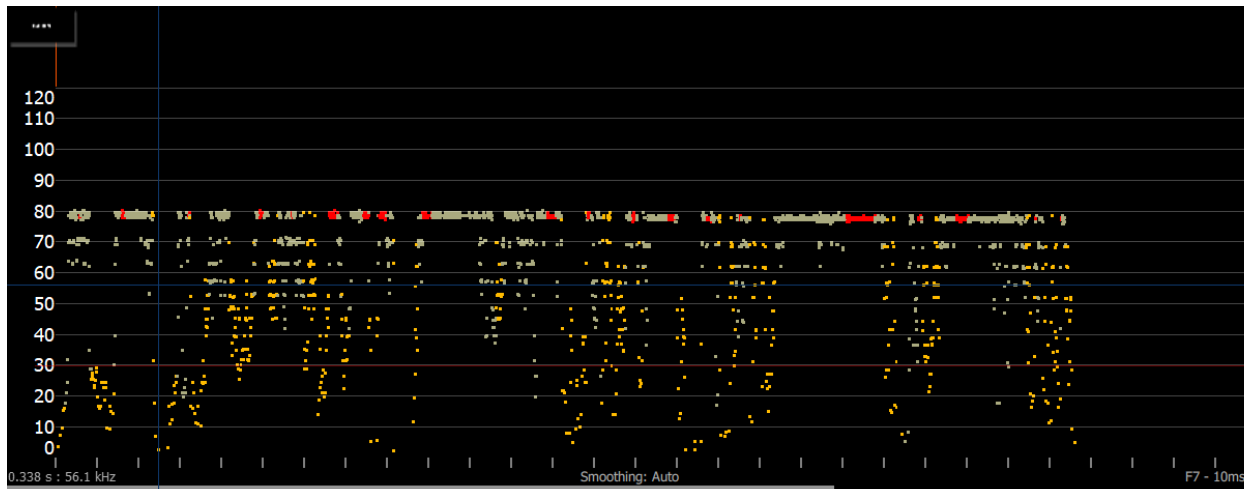


Plate 70. Calls of the greater horseshoe bat that were recorded by the passive bat detector at Ain Zebdeh Hima

2. The Lesser Horseshoe Bat, *Rhinolophus hipposideros*, Borkhausen 1797

Three individuals were observed hibernating in an old house at Ain Zebdeh. It looks like this place has been used as a roosting site based on the guano seen on the floor (Plate 71)



Plate 71. Photo of the lesser horseshoe bat at an old house at Ain Zebdeh and their guano.

5.6.2.3. Family Vespertilionidae

1. Common Pipistrelle Bat, *Pipistrellus pipistrellus*, Schreber 1774 (Photo 3)

The common pipistrelle bat was the most common bat species encountered at Ain Zebdeh and Kherbet Qanafar Himas (46% of bat calls in both Himas). They were seen and their calls were recorded in both active and passive bat detectors (Plate 72).

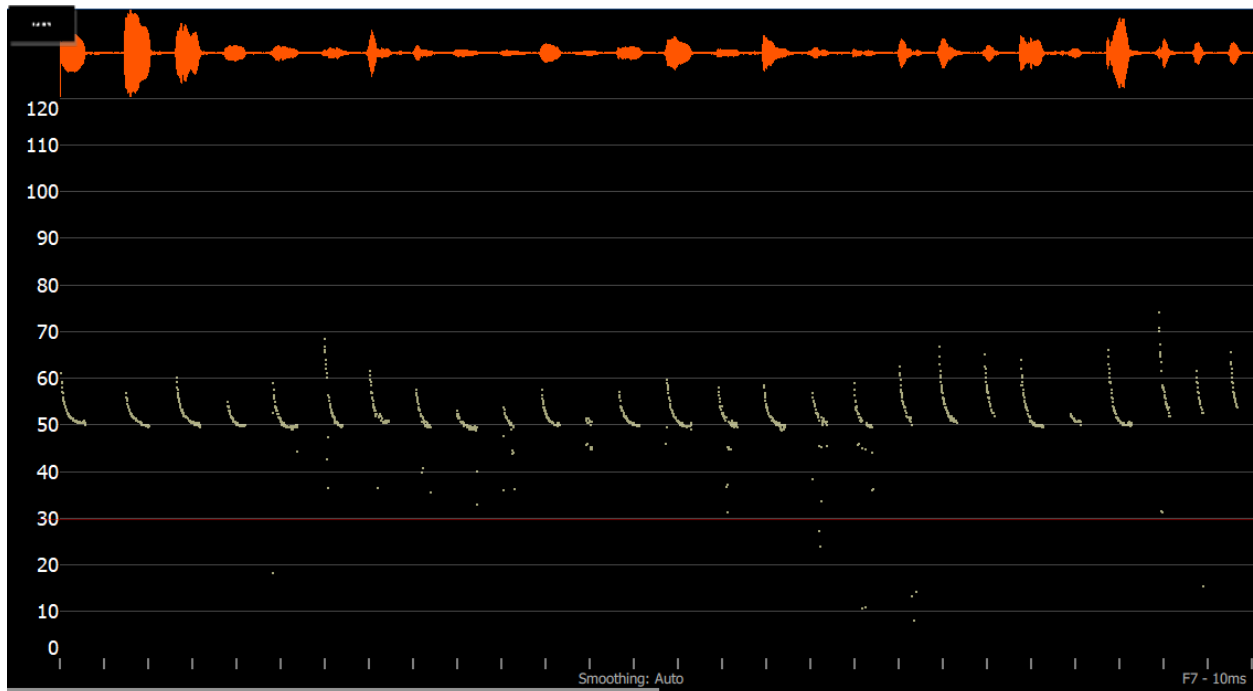


Plate 72. Common pipistrelle calls recorded during the active acoustic survey at Kherbet Qanafar Hima

2. Kuhl's Pipistrelle Bat, *Pipistrellus kuhlii*, Kuhl 1817 (Photo 4)

The Kuhl's pipistrelle bats were as well very common at Ain Zebdeh and Kherbet Qanafar Himas (40% of the calls of both Himas). They were seen and their calls (Plate 73) were recorded by both active and passive bat detectors.

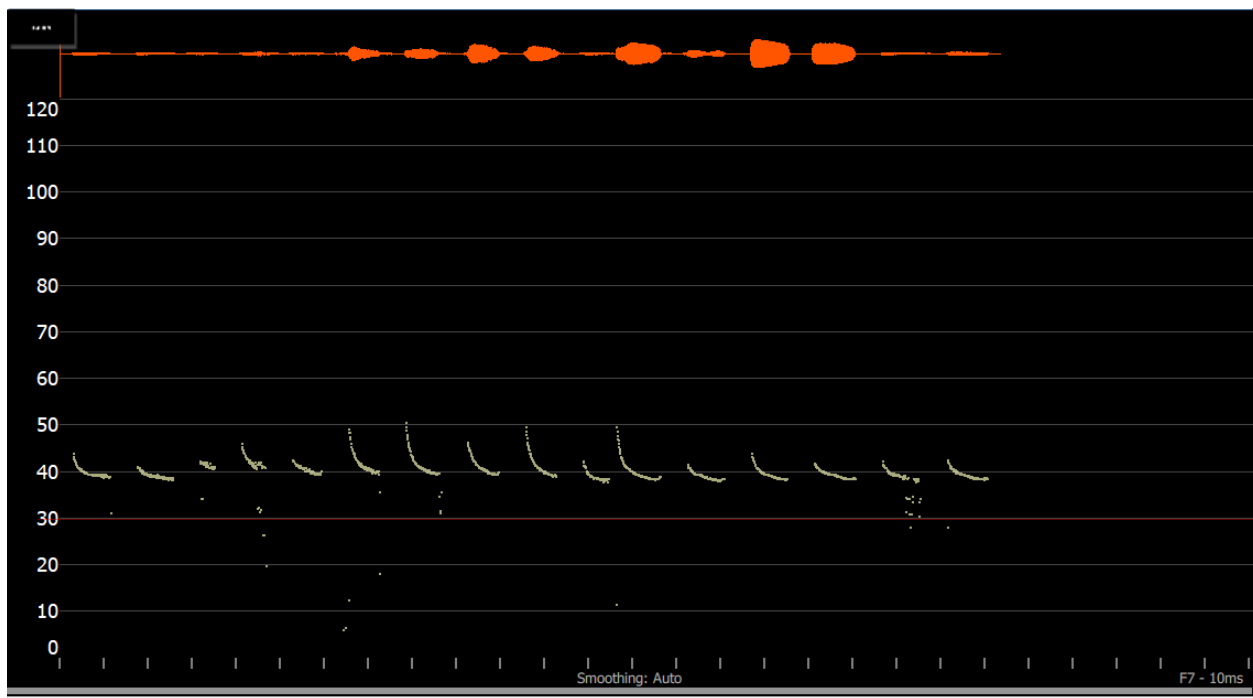


Plate 73. Calls of Kuhl's bat recorded during the active acoustic survey at Kherbet Qanafar Hima.

3. Noctule Bat, *Nyctalus Noctula* (Schreber 1774) (Photo 7)

Noctule bat were rare Ain Zebdeh – Kherbet Qanafar Himas. Their calls (Plate 74) constituted only 1.3% of all bat calls recorded at these Himas.

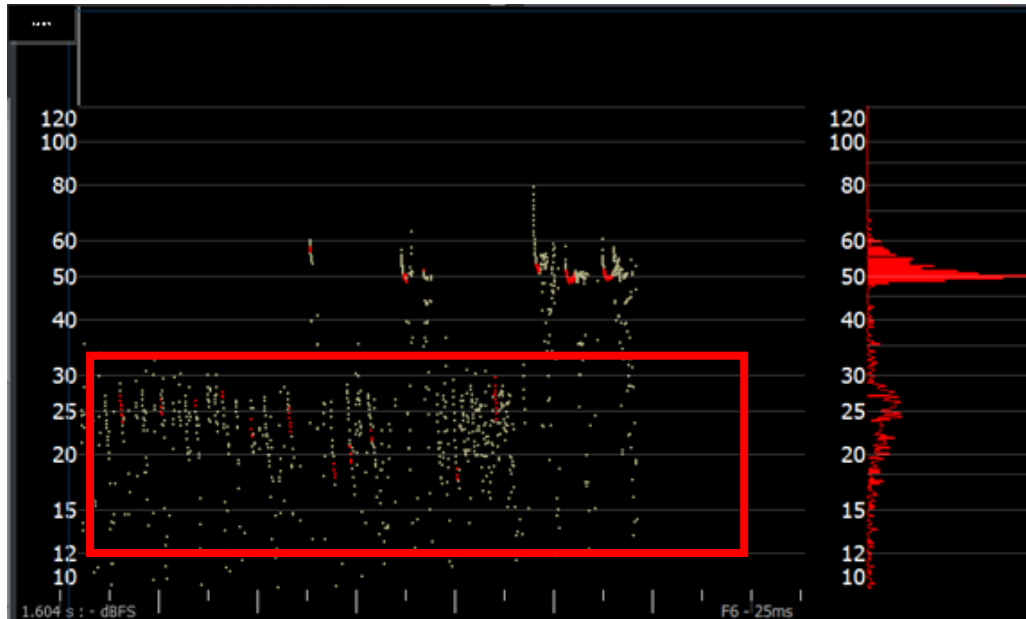


Plate 74. Calls of Noctule bat that were recorded by the passive bat detector at Ain Zebdeh Hima.

4. Schreiber's Bent-winged bat *Miniopterus Shreibersii* (Kuhl 1817) (Photo 8)

Schreiber's bent-winged bats were not abundant in these two Himas. Their calls (Plate 75) constituted 3.2% of all bat calls.

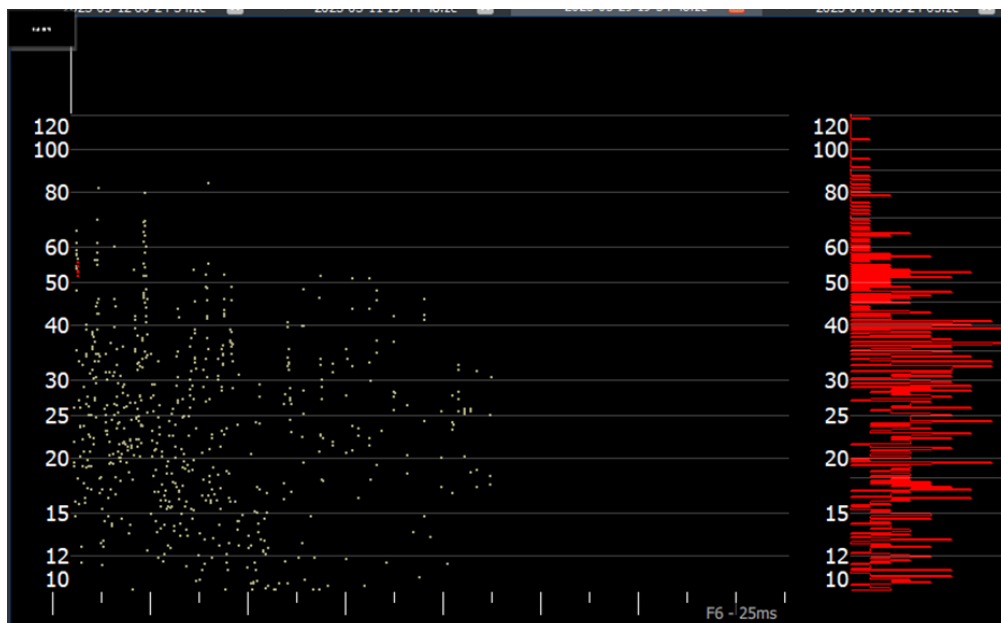


Plate 75. Calls of Shriber's bent-winged bat that were recorded by the passive bat detector at Ain Zebdeh Hima.

5. The Whiskered Bat, *Myotis mystacinus*, Kuhl 1817 (Photo 19)

The calls (Plate 76) of the whiskered bat were recorded by the passive acoustic survey in Ain Zebdeh Hima. Their calls recorded (7%) third after the two pipistrelle species in the two Himas.

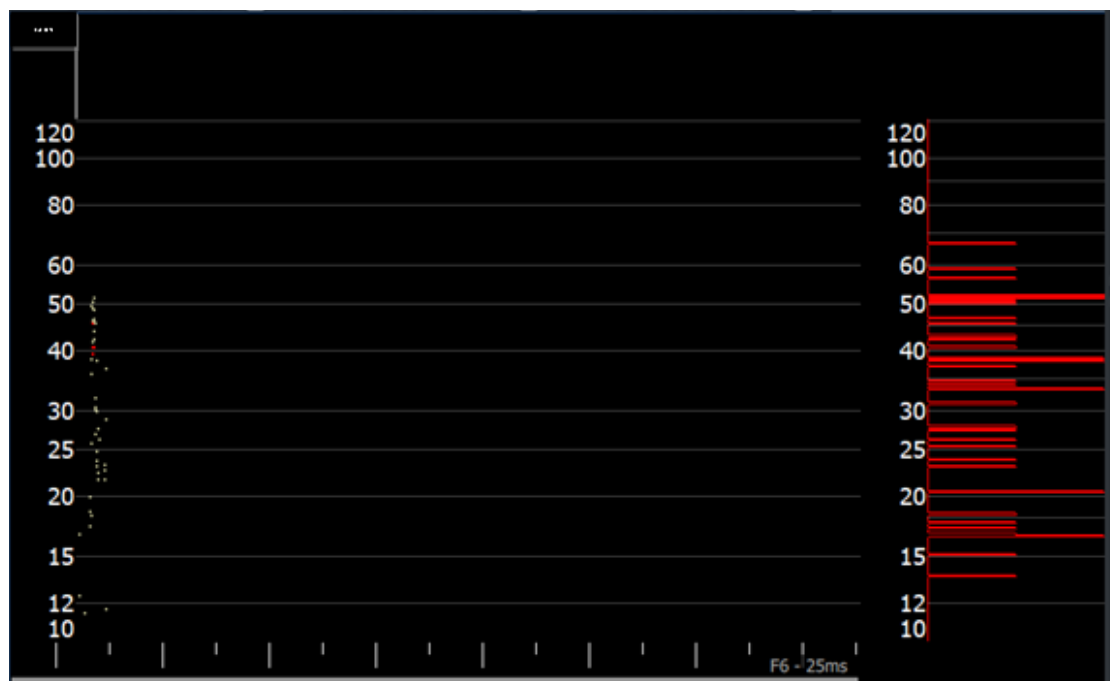


Plate 76. Calls of the whiskered bat recorded during a night active acoustic survey at Ain Zebdeh Hima.

5.6.3. ORDER CARNIVORA

5.6.3.1. Family Canidae

1. Common Jackal; *Canis aureus syriacus*, Linnaeus 1758

Jackals were very common in Both Himas and were next recorded and photographed (Plate 77) by camera traps (34% of all photos taken by the camera traps in Both Himas) after foxes



Plate 77. A couple of Jackals were captured by Camera traps at Hima Ain Zebdeh.

2. Wolf; *Canis lupus pallipes*, Linnaeus 1758

One photo from a camera trap is expected to be a wolf. Moreover, locals confirmed the presence of wolves at Hima Ain Zebdeh and the high mountains of Kherbet Qanafar.

3. Red Fox; *Vulpus vulpus palaestina*, Linnaeus 1758

Red foxes were the most common species found in Kherbet Qanafar and Ain Zebdeh. This was confirmed by the camera traps (50% of the photos taken in both Himas) (Plate 78) and their scats distribution along both reserves. In addition, they were most encountered during the night drives.



Plate 78. Fox captured by a camera trap at Kherbet Qanafar Hima

5.6.3.2. **Family Mustelidae**

1. Stone martin; *Martes foina syriaca*, Erxleben 1777

Stone martins were common in the two Himas. Their photos constituted 4% of the total photos taken by camera traps in both Himas (Plate 79). In addition, they were encountered during the night drive.



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Plate 79. Stone martin captured by a camera trap at Kherbet Qanafar

2. Badger; *Meles meles canescens*, Linnaeus 1758

Badgers were very rare in the two Himas even though it is typical habitat for them especially beside agricultural areas. Only 0.3% of the photos (Plate 80) taken in both Himas had badgers in them.



Plate 80. Badger photo captured by a camera trap at Ain Zebdee Hima

5.6.3.3. Family Hyaenidae

1. Striped hyaena; *Hyaena hyaena syriaca*, Linnaeus 1758

Striped hyaenas (Plate 81) were as well very rare in the two Himas (0.3% of all photos) although many locals from the two villages of the Himas confirmed their presence.



Plate 81. Striped hyaena captured by a camera trap at Kherbet Qanafar Hima

5.6.3.4. Family Felidae

1. Wild cat; *Felis silvestris tristrami*, Schreber 1777

Wild cats are rare in the two Himas. Their photos constituted less than 1% of all photos in both Himas (Plate 82). Besides they were more photographed in Kherbet Qanafar than Ain Zebdeh Hima.



Plate 82. Wild cat captured by a camera trap on snow at Kherbet Qanafar Hima.

5.6.4. ORDER ARTIODACTYLA

5.6.4.1. Family Suidae

1. Wild Boar; *Sus scrofa lybicus* Linnaeus, 1758

Wild boars were abundant in these two Himas. They constituted 7.5% of all the photos in both Himas. Moreover, many photos contained big flocks and big families. Besides their scats and tracks were all over the two Himas (Plate 83).



Plate 83. Wild boar and their scats, footprint, and tracks at Ain Zebdee Hima

5.6.5. ORDER RODENTIA

5.6.5.1. Family Sciuridae

1. The Persian Squirrel; *Sciurus anomalus syriacus*, Gueldenstaedt 1785

The Persian squirrel was only encountered once in Kherbet Qanafar Hima and not in Ain Zebdeh. Although there are a lot of walnut trees in Ain Zebdeh and many local people confirmed their presence.

5.6.5.2. Family Hystricidae

1. Porcupine; *Hystrix indica indica*, Kerr 1792

Porcupines were abundant in both Himas their photos constituted 3% of all photos captured by the camera traps in both Himas. Moreover, in many photos, couples were captured. Besides their scats were often encountered during the transect survey (Plate 84)



Plate 84. Porcupines and their scats at Ain Zebdeh Hima

5.6.5.3. Family Spalacidae

1. Mole Rat; *Spalax leucodon ehrenbergi*, Nehring 1898

Mole rats were very common in these Himas mainly because it is surrounded by agricultural areas. This was evidenced by their tracks (Plate 85) that were spread all over the two Himas.



5.6.5.4. **Family Murinae**

1. Broad-toothed field mouse; *Apodemus mystacinus*, Danford and Alston 1877 (Photo 11)

The broad-toothed field mice were the most common species in these two Himas. They represented 90.5% of the rodents caught in these two Himas.

2. Wood mouse; *Apodemus flaviculus*, Linnaeus 1758 (Photo 12)

The yellow-necked field mouse was less common than the broad-toothed and represented 8.5% of the rodents trapped.

5.6.5.5. **Family Microtinae**

1. Levant vole; *Microtus guentheri guentheri*, Danford and Alston 1880 (Photo 14)

Even though this species was not trapped but their holes and calls were very common reflecting their high abundance in both Himas.

5.6.5.6. **Family Gerbillinae**

1. Tristram's Jird; *Meriones tristrami*, Thomas 1892

Only one Tristram's jird was caught in Ain Zebdeh Hima during the Fall trapping season (Plate 86).



Plate 86. Tristram's Jird trapped in Ain Zebdeh Hima

6. DISCUSSIONS:

The Himas are small protected areas controlled by the municipality. They play an important role in biodiversity conservation by protecting natural resources and spreading awareness among the public at large. Nonetheless, for the conservation effort to be more effective, biodiversity assessment is important to understand what species are present in the area of concern to direct the awareness program accordingly. Mammals play an important role and are a main constituent of any ecosystem. Hence, assessing their presence is an important tool in ecology, biogeography, and most importantly conservation planning. Moreover, assessing mammals will identify gaps in our knowledge of their distribution and taxonomy and highlight issues needing further studies. Through this project, we worked on five Himas namely Ras AlMaten, Hammana, Kherbet Qanafar, Ain Zebdeh, and Ibl AlSaqi. We identified 36 mammal species among which two are vulnerable and four are near threatened according to IUCN redlist for the Mediterranean. Furthermore, four species namely (foxes, jackals, wild boar, and broad-toothed field mice) were very common in the five Himas.

6.1. Mammals Encountered at the Himas

In this section, we are going to discuss not only mammals of special conservation concern but common species as well since these species could be threatened or threaten other species and the ecosystem.

6.1.1. *Insectivora*

Insectivores such as hedgehogs and shrews play an important role in the ecosystem by controlling the insect population. These species were the least recorded in the Himas. This could be referred to the intensive use of pesticides in the surrounding agricultural areas. Insecticides have proven to affect many insectivores species either by direct contamination or affecting their food resources (Sanchez-Bayo, 2011, Balestieri et al 2019, Appenzeller et al. 2022,). Roadkill is another factor affecting the hedgehog population. Most of the observed hedgehogs were road killed. Moreover, shrews are being killed by being mistaken for rodents. Hence the importance of agriculture extension to the farmers surrounding the Himas and environmental education is important to conserve these Species.

6.1.2. *Chiroptera*

Bats are very sensitive mammals and they play a crucial role in the ecosystem. The ecosystem services that they provide are countless and priceless. They have a great role in conserving biodiversity and restoring ecosystems by feeding on insects, dispersing seeds, pollinating flowers, and recycling nutrients (Kunz et al. 2011, Maslo et al., 2021). Besides they are the longest-living animal compared to their size. Nonetheless, misconceptions have led to a decrease in their population and underestimated their role (Medellin et al. 2017; Kemp et al. 2019). The effect of these misconceptions was obvious in the Himas where bats are being persecuted a lot as in the case of AlHesken Cave at Ras ElMaten Hima (Plate 7) or at Ibl AlSaqi and Ain Zebdeh

Himas, where bats were hunted or disturbed and removed from old houses. Besides the excessive use of pesticides is depriving bats of their food (Insects) and causing bioaccumulation of these pesticides in the bats' bodies leading to their death. Hence, spreading information among the public on the importance of bats, their role, and the services they provide is crucial for their existence. In addition, installing gates with bat-free access at the caves where there are bat roosts will help not only in bat protection but also conserve the cave biodiversity from fungi to invertebrates to vertebrates.

6.1.3. *Carnivora*

Carnivores are as well important in any ecosystem to restore the natural balance. However, due to persecution by humans, this balance is disturbed. Killing large carnivores will cause the population of medium and small carnivores to flourish hence having more impact on the ecosystems and their biodiversity and human health (Levi and Wilmers 2012). In addition, an increase in the medium carnivore populations will affect negatively the population of small carnivores (Berger and Gese 2007, Crooks and Soule 1999) and cause an increase in the populations of rodents and other pests that these small carnivores feed upon. In the case of Lebanon where wolves and hyaenas are killed medium and small carnivores will flourish in addition to wild boars. Not only this but urban carnivores who can live among humans are increasing and this is affecting humans by attacking their belongings and competing with other small carnivores and themselves. This was very obvious in the Himas where jackals and foxes were the most abundant, stone martins were less photographed even though stone martins were reported to be very common in Lebanon (Abi-Said and Amr 2012). Furthermore, medium carnivores compete among themselves. This was obvious in the case of Hamman and Ras El Maten Hima where jackals were abundant, fewer foxes were photographed and the opposite happens in Hammana where the weather affected the jackal population negatively, with less competition with foxes affecting the foxes population positively. Hence monitoring these animals is important besides controlling the garbage dumps will affect the population of these carnivores and will probably help restoring this balance.

Wild cats are facing another threat which is cross-breeding with domestic ones. Cross-breeding between wild and free-ranging domestic species is one of the main problems threatening the conservation of threatened species, and this is occurring worldwide (Hubbard et al. 1992, Oliveria et al. 2008). Hence informing locals and shepherds not to have their domestic cats around the Himas is important for the conservation of these wild cats

Striped hyaenas were not as abundant as other carnivore species even though they were documented in all the Himas. Hence spreading awareness of this species is important for its conservation (Abi-Said 2010)

6.1.4. *Hyracoidae*

The rock hyrax is the only species that is habitat-specific. They are found wherever there are rocky cliffs, outcrops, or boulder screes providing cavities in which the colony can shelter. Their

presence is habitat specific which highlights the importance of protecting these habitats to conserve the rock hyrax population. Even though the rock hyraxes are not endangered worldwide but in Lebanon, they are threatened by habitat destruction and hunting. Rock hyraxes were only found in Ras ElMaten Hima which highlights the importance of this Hima and the role it plays in conserving this species.

6.1.5. *Artiodactyla*

The Artiodactyla is represented by one species the wild boar. Wild boar are very important in the ecosystem to turn up the soil, aerate it, control some agriculture pests, decrease climate change, and control forest fires by capturing carbon through feeding on the ground vegetation and opening trails. But when their population increases they become pests which is the case in Lebanon and the Himas. The population of wild boar in Lebanon increased since their predators are killed and goats are not allowed in some forests hence affecting the forest biodiversity and crops. This effect was seen in all the Himas under study.

6.1.6. *Rodentia*

Rodents contribute to the ecosystem function and may have a role as indicators for climate change. Both valuable ecosystem services and unwanted ecosystem disservices can be produced by the same organism (Gayer 2018). They are food for many predators, they alter the structure of the environment there by providing living space or resource opportunities to other organisms and are well known for their conflict with humans either by the destruction of crops or transmitting diseases. Their presence will reflect the status of the ecosystem. In the Himas the broad-toothed mouse was the most abundant species. This species is present in most of the Mediterranean forests. However, one species the *A. harmonsis* was only present in one Hima, The Hammana Hima since this species inhabit high mountainous areas.

6.1.7. *Domestic Animals*

Livestock was encountered in every Hima. Livestock plays an important role in the forest ecosystem. They disperse seeds, trample the soil to facilitate water storage, fertilize the soil, prevent forest fires, open roads in the forest, and affect climate change by carbon capture besides competing with wild boars on space and resources and encourage the existence of large carnivores. The livestock's negative impact on the forest ecosystem which sometimes leads to deforestation and extinction of species is dependent on the shepherds and the grazing area. Hence, training workshops for the shepherds on land use and rangeland management are important to decrease this negative impact.

Dogs and domestic cats were as well encountered in all the Himas. Dogs and cats accompanying shepherds and livestock or stray individuals will affect their wild relatives the wolves and wild cats resulting in hybridization. Hence spreading knowledge on this important issue among locals and shepherds will protect their wild relatives from hybridization and diseases.

6.2. Mammals of High Priority Based on Each Hima

Each Hima has its unique micro-landscape and ecosystem. This affects mammal diversity and their populations. Hence in the paragraphs below we will be discussing each Hima alone and highlight the species of conservation concern or species needing monitoring. Here it is important to mention that every species whether common or threatened should be monitored, its population assessed, and conserved. However, one of the objectives of this project is to highlight species of high priority for conservation. Hence, we will be identifying some species that we reckon need more attention than others. Some species could be common and of no conservation concern, nonetheless, their presence might affect other species or the ecosystem. For example, most bats are threatened by habitat destruction, excessive use of pesticides, persecution, and water and light pollution. Hence all bat species must be considered as high-priority species whether common or threatened, and their population should be monitored and protected. On the other hand wild boar population is not threatened and their population is increasing affecting agricultural land, crops, and the ecosystem. Hence they should be considered a priority species and their population should be monitored

6.2.1. Ras El Maten Hima

In Ras AlMaten 20 species were identified among them three species having an IUCN red list status namely the Egyptian fruit bat, the Mediterranean horseshoe bat, and the Striped hyena. These species are to be given a high conservation priority. Besides shrews, rock hyrax, wild cats, and squirrel are to be considered as high priority species and need to be monitored.

- a. **Shrews** (*Crocidura* spp.) are small sensitive mammals that provide a lot of services to the ecosystem and humans by controlling insect population. However, they are threatened in Lebanon and their population is declining. It is recommended to monitor their population and spread awareness among the public to conserve them.
- b. **The Egyptian fruit bat** (*Rousettus aegyptiacus*) is a near-threatened species according to IUCN redlist – Mediterranean. In Lebanon, this species is well distributed (Benda et al. 2016). It was recorded in c. 45 locations and a new location was discovered during this assessment in Ras ElMaten Hima. Even so, this species is being persecuted a lot and their habitat is being destroyed. In Al Hekan cave their population went down by almost 70% in the last 10 years due to hunting and putting fire in the cave (Plate 7). Hence it is recommended to monitor their population, close the cave with bat safe gate, and spread awareness among locals on the importance of these bats.
- c. **The Mediterranean horseshoe bat** (*Rhinolophus euryale*) is vulnerable species according to IUCN redlist Mediterranean and is highly endangered in Lebanon. According to Benda et al. (2016), this bat was recorded in 19 localities in Lebanon. During this assessment, only 2 individuals were recorded in Al Hesken cave. Hence their population should be monitored, more assessments and acoustic surveys to be carried out to study their distribution, and an awareness programme should be applied for their conservation.

- d. **The striped hyaena** (*Hyaena hyaena syriaca*) is vulnerable through its range but in Lebanon, even though it is well distributed but they are endangered by being persecuted due to misconception (Abi-Said and Abi-Said 2007). The Ras AlMaten Hima is their typical habitat nevertheless they were captured 3 times by the camera traps. Hence an awareness program should be administered in the villages surrounding the Hima and their population should be monitored.
- e. **The rock hyrax** (*Procavia capensis*) is a habitat-specific species. It was only found in Ras ElMaten Hima. Even though has no IUCN redlist status but it is threatened in Lebanon by hunting and habitat destruction. Since its distribution is habitat-specific, it is to be considered a high-priority species and its population should be monitored.
- f. **The wild cat** (*Felis selvistris*). It has a least concern status according to IUCN redlist but this species is at risk of extinction due to hybridization with domestic cats. Hence in Ras ElMaten Hima both domestic cats (*Felis catus*) and wild cats should be monitored to observe any possibility of hybridization.
- g. **The Persian squirrel** (*Sciurus anomalus*) is a common species in Ras ElMaten Hima and their population is on the increase. This increase in their population might affect the edible pine and increase their conflict with humans. Hence they should be considered as a priority species and their population should be monitored.

6.2.2. Hammana Hima

Twenty-two species were identified at Hammana Hima among them 12 species are considered high priority species nine bat species, stone martin, striped hyaena, and wild cat are to be considered as high conservation priority species and need to be monitored in addition to stone martin.

- a. For **bats, striped hyaena, and wild cats** refer to Ras ElMaten Hima.
- b. **The stone martin** (*Martes Fionia*) used to be very common in Lebanon and they are still in some areas. However, in Hammana Hima their population is fairly abundant compared to the other reserves. Hence their population should be monitored for any change.

6.2.3. Ibl AlSaqi Hima

Even though Ibl AlSaqi Hima is small in size however we recorded 29 species of mammals out of which 15 species are of high Conservation priority including hedgehogs, 11 bat species, striped hyaena, and wild cats.

- a. **Hedgehogs** (*Erinaceus concolor*) have a Least Concern status according to IUCN redlist. However, this species is highly endangered in Lebanon. This species is threatened by habitat destruction during their hibernation, road kills, persecution for medicine, and excessive use of pesticides. Only one dead individual was seen at the entrance of Ibl AlSaqi Hima. Hence this species is to be considered a high-priority species and their population should be assessed and monitored.
- b. **Shrews** (*Crocidura spp*) are other species of high conservation priority. Even though they are of Least Concern, in Lebanon their population is decreasing due to

- agricultural practices or being mistaken for mice. Their population should be monitored and management of the Hima should consider this species conservation.
- c. **Bats, striped hyaena and wild cats** are to be considered a high priority species (Refer to Ras ElMaten Hima)
 - d. **Wild boar** (*Sus scrofa*) should be given a monitoring priority due to their effect on the ecosystem and agriculture.

6.2.4. *Ain Zebdeh – Kherbet Qanafar Himas*

Ain Zibdeh and Kherbet Qanafar are the biggest among all Himas however we recorded 28 species of mammals out of which 13 species are of high Conservation priority including hedgehogs, 8 bat species, wolves, striped hyaena, and wild cats and one species the wild boar which is not of high conservation priority but need to be monitored due to its effect on biodiversity as well as agriculture.

- a. Ain Zebdeh and Kherbet Qanafar Himas are surrounded by agricultural lands. Hence insectivores like hedgehogs and bats play an important role in protecting these crops and decreasing the use of pesticides. Hence **Hedgehogs and bats** must be given a high conservation priority due to their role in controlling agricultural pests.
- b. **Wolves** (*Canis lupus pallipus*) are of Least Concern according to IUCN redist however in Lebanon are endangered due mainly to persecution. In these two Himas one photo only is suspected to be of a wolf and the locals and shepherd confirmed their presence. Hence they must be considered a species of high conservation priority and more investigations on their presence should be conducted
- c. As other Himas **striped hyaenas and wild cats** should be given a high conservation priority.
- d. **Wild boar** (*Sus scrofa*) are very common in Lebanon to a level that are becoming agricultural pests in some areas. This highlights their high monitoring priority in these two Himas. Since the two Himas are surrounded by agricultural lands, Hence to decrease the farmer-wild boar conflict their population should be monitored and act accordingly.

6.3. Hima Connectivity:

Himas are small protected areas with their main role to protect biodiversity and spread awareness among the local public. However, their small size will not allow large mammal populations or species with large home ranges to thrive. Hence for these Himas to play a role in conservation their size must be larger. Since we are limited in space an alternative will be through establishing corridors in-between Himas and between Himas and protected areas. Corridors are cornerstones of modern conservation. Corridors will facilitate the movement of individuals to enhance genetic exchange and support ecological processes (Forman 2002, Puth and Wilson 2001). The main aim of the corridors is to reverse the effect of habitat loss and fragmentation which is the main cause behind species extinctions worldwide (Gilbert et al. 1998) In the case of the five Himas understudy some are connected like Ain Zebdeh and Kherbet Qanafar and these two Himas are close to the Shouf Cedar Biosphere Reserve where corridors need little effort to be established. However, Ibl Saqi could be connected to Harmoun-protected areas but this needs much more effort but is doable. One recommended approach is establishing more Himas in nearby villages

that act as stepping stones to the Harmaoun protected area. And in turn, these Himas will be connected by corridors. As for Hammama Hima the closest protected area is the SCBR however the Beirut-Damascus highway will be the main obstacle in establishing this corridor. Nevertheless, proposing these corridors for later development on this highway could give good exposure to nature-friendly development projects.

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