

Wild Mammals in the Gaza Strip, with Particular Reference to Wadi Gaza

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Abstract: Mammalian fauna are considered good indicators of the degree of anthropogenic disturbance to the various ecosystems. Many mammalian species disappeared in the Gaza Strip during the last 5-6 decades and no efforts have been made to stop such disappearance. The present work aims at surveying the remnant wild mammals in the Gaza Strip; particularly in Wadi Gaza as a natural area. A total number of 15 mammalian species belonging to 5 orders and 11 families were recorded. Most mammalian species were of small sizes and residents. Seven disappeared mammalian species were mentioned by locals. The causes of disappearance were mostly anthropogenic and included the limited area of the Gaza Strip, over-population, residential and agricultural encroachment on the expense of natural areas and the over-exploitation of natural resources of which hunting was and stills a common practice threatening wildlife. The Israeli Occupation is still adversely affecting wildlife ecology in the area. Finally, the authors recommend improving cooperation of different parties to enhance the public awareness and to implement environmental laws and legislations to conserve nature and to protect wildlife.

Key words: Mammals, wildlife, survey, threats, Wadi Gaza, Gaza Strip.

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1. Introduction

The replacement of natural habitats by residential and cultivated areas has been changing the structure of animal and plant communities in Palestine, chiefly in relation to the composition and abundance of species. Mammals are considered good indicators of the degree of human disturbance in the various ecosystems. Some mammals; particularly rodents might become agricultural plagues with extreme population peaks (Galante and Cassini, 1994). In spite of the very limited area of the Gaza Strip (365 km²) compared the total area of Palestine (27,000 km²), it is fragmented by 21 Israeli settlements and is totally fenced by the Israeli political borders separating it from the other occupied territories of Palestine. This political situation already prevents movement of wildlife; particularly large mammals to and from the surrounding regions and as a result adversely affects wildlife ecology in the area (The United Nations Environment Program – UNEP, 2003). Similarly, the construction of the new Israeli Apartheid Separation Wall in the West Bank of Palestine is likely to have significant repercussions for wildlife movement, by adding further to the fragmentation of ecosystems and habitats and by cutting natural ecological corridors (The Palestinian Environmental NGOs Network – PENGON, 2003).

Approximately 500 birds, 100 mammals and 120 herpetofaunistic species, in addition to 400 fish were known to inhabit Palestine (Yom-Tov, 1988; Ali Shtayeh and Hamad, 1995 and 1997; The Palestinian Institute for Arid Land and Environmental Studies – PIALES, 1996 and The Palestinian Central Bureau of Statistics – PCBS, 2000). Qumsiyeh (1996) described most of the mammals living in the Holy Land (Palestine and Jordan) and found that many mammals have strong affinities to that of Africa, e.g. the Ethiopian Hedgehog *Paraechinus aethiopicus*, the Egyptian Fruit-bat *Rousettus aegypticus* and the Egyptian Mongoose *Herpestes ichneumon*. Some are representative of Asiatic species, e.g. the Indian Crested Porcupine *Hystrix indica*. Others have a European origin, e.g. the Northern Hedgehog *Erinaceus europaeus*. Still, other species are endemic of Palestine such as the Palestine Mole-rat *Spalax leucodon ehrenbergi*. He also stated that most mammals of Palestine have Palearctic affinities and a few have affinities to the Ethiopian and Oriental realms.

Work on wild mammals in the West Bank of Palestine seemed to be unclear where no literature was available, while in the Gaza Strip it seemed to be limited to few unpublished reports and a preliminary work (Abd Rabou, 1999 and 2000 and Yassin *et al.*, 2005). In addition, a recent Ph.D. thesis concerning wildlife ecology and management has been carried out in Wadi Gaza (Abd Rabou, 2005). The scarcity of scientific literature concerning wildlife in the Occupied Palestinian Territories (OPTs) promoted the conduction of the present work concerning mammals which is a part of a comprehensive study aiming at surveying and giving general observations on terrestrial vertebrate fauna in the Gaza Strip.

2. Material and Methods

2.1. Study Area

Wadi Gaza or the Valley of Gaza is an indispensable part of natural life in Palestine and has an interesting history and rich vegetation. The variety of habitats and the location of Wadi Gaza in the coastal zone of the Mediterranean give the area a rich and varied fauna. In recognition to its importance as a natural area and as the only wetland in the Palestine coast, Wadi Gaza was declared a nature reserve in June 2000 by the Palestinian National Authority. Wadi Gaza springs from the Negev Mountains and the Southern Heights of Hebron City in Palestine. It is considered the biggest in Palestine, if the Jordan Valley is excluded. Its catchment or drainage area is about 3500 km² (The

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Project for the Conservation of Wetland and Coastal Ecosystems in the Mediterranean Region – MedWetCoast, 2003). The total length of the Wadi is 105 km from its source to its end. The final portion of the Wadi which lies in the Gaza Strip extends 9 km from the Truce line in East Gaza to the coast where it discharges into the Mediterranean Sea. The width of the Wadi varies from one place to another, and is widest near its mouth where it forms a wetland or an estuary lake which is the most important habitat for migratory and resident water birds. The wetland is bordered by tall emergent plants like *Phragmites australis* and *Arundo donax*. *Tamarix nilotica* covers considerable areas as part of the maritime influence of the estuary lake. The maximum elevation of the Wadi is 30 meters above sea level, dropping to sea level where it reaches the Mediterranean (MedWetCoast, 2003). Since the early 1970s and after the implementation of retaining dams and diversion schemes by Israel on the upper course of the Wadi, the volume of water reaching Wadi Gaza began to diminish considerably, and large flows are restricted to occasional flash floods sweeping down the Wadi bed in wet years (Awadallah, 2000). Wadi Gaza is located centrally along the Gaza Strip coast and its banks support a number of terraces. It is known for its meanders, especially across the Strip where it changes track eight times (El-Khoudary and Anan, 1985). Wadi Gaza has a typical semi-arid Mediterranean climate, hot in summer and cold in winter. Peak months for rainfall are December and January. Finally, the resident population of the Wadi Gaza area accounts for approximately 10,000 people distributed in discrete, extended family groups of variable densities (MedWetCoast, 2003). Figure 1 shows that Wadi Gaza lies in the mid of the Gaza Strip and is bordered in the north-west by the Mediterranean Sea, the south-east by Al-Bureij Camp, the south-west by Al-Nuseirat Camp, and the north by Al-Zahra City.

2.2. Field Methods

Frequent site visits and observations and discussions with local people were used to determine terrestrial vertebrate faunistic species of which mammals are a part. Observations started at 8:00 and ended at 16:00. Although the Israeli measures affected the time schedule of field works, many visits were carried out in earlier hours and others extended to later hours in the purpose of monitoring nocturnal species. The survey period covered two years (October 2002 – September 2004), though old records of wildlife were considered. All

data collected in the field were recorded in a special data sheet designed for this purpose.

Wildlife surveys need advanced tools and secure places or ecosystems to be conducted in a successful manner. In the Gaza Strip and hence Wadi Gaza as a study area, the use of survey tools was incomplete, inadequate and very limited due to the Israeli measures and road closures. Moreover, the Wadi is not free of people who remove such traps and even taking or killing the animals caught. Binoculars and cameras have been used throughout the study period and photos were taken in the field for confirmatory purposes. Many hunters and local people in the area were good contributors to this work through their provisions to live as well as dead specimens to the surveyor. They used to prepare their hunting tools mainly the metal live traps with different sizes in the field by night. Road kills are good indicators for identifying such mammals and other vertebrate fauna occurring in the area. The captured and some of the dead specimens were taken to the Biology Department at the Islamic University of Gaza (BD/IUG) for further taxonomy and preservation. Knowledge on the occurrence of marine mammals depended much on people and fishermen observations.

Indirect observations were figured out by identification of fresh soil heaps of the Palestine Mole-rats and burrows of rodents. It is worth mentioning that many nocturnal species and shy animals have distinctive footprints and their presence in a certain area can be detected even when the animals themselves are hidden (Merz, 1984 and Sargent and Morris, 1999), and accordingly tracks and feces of some animal species were helpful in recognizing their existence. A variety of guide books were used in the present study for the identification of mammalian species occurring in the area (Boitani and Bartoli, 1983; Harrison and Bates, 1991; Qumsiyeh, 1996 and Hoath, 2003).

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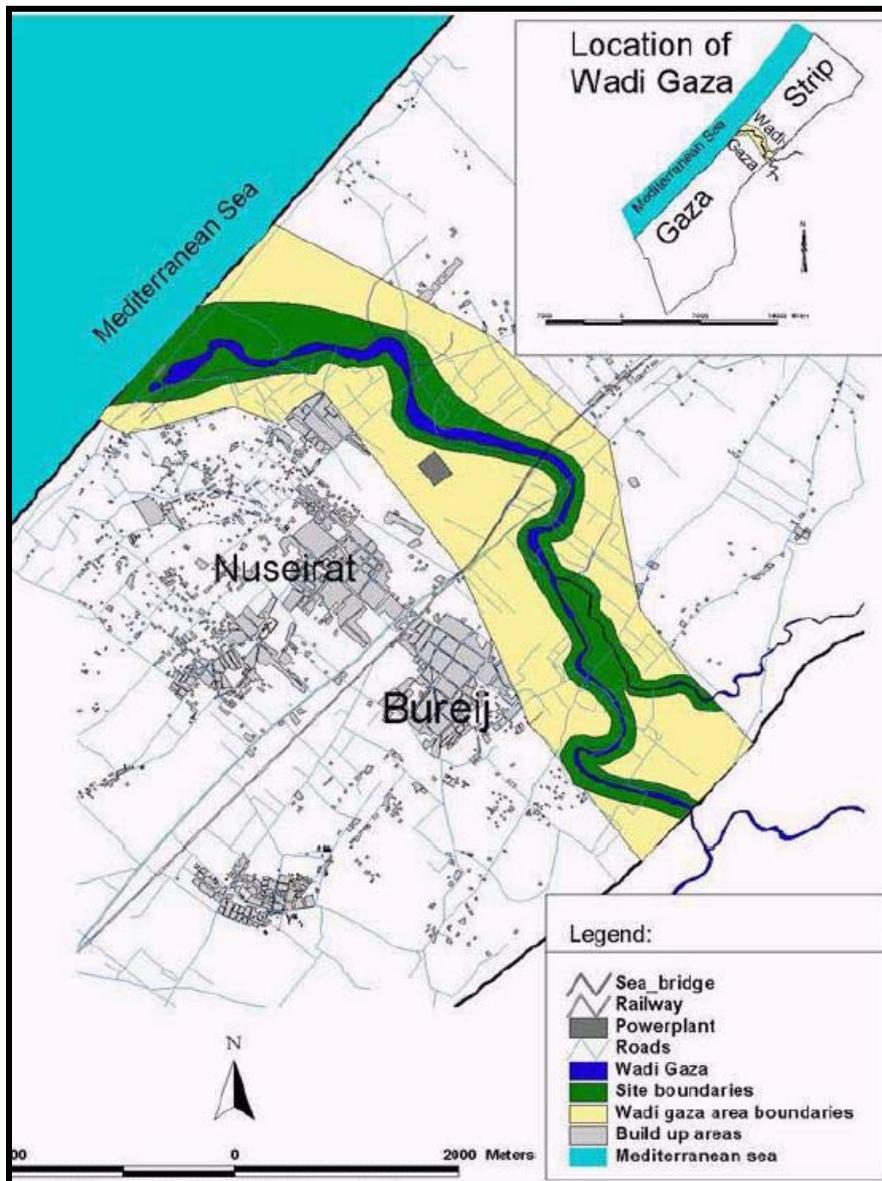


Figure 1: Wadi Gaza and its site boundaries

3. Results

A total number of 15 mammalian species belonging to 11 families and 5 orders was recorded in Wadi Gaza and other areas of the Gaza Strip; they were listed in **Table 1**. Most recorded species were of small size. Rodentia was the biggest order and comprised 6 (40.0%) of the recorded species of which one species was new to the area and happened once (N=3). It was followed by Carnivora which comprised 4 (26.7%) species of which two species were considered extinct from the area. The other three orders each comprised of one or two species. Twelve of the mammals recorded were resident and mostly found throughout the year. The other three species (one rodent and two carnivore species) were new to the area, i.e. entering the area by mistake. At least 5 out of 15 are considered pests to farmers and people, as they may cause harmful losses to their cash crops as well as stored products. During 1980s, two whales were thrown by the Mediterranean Sea waves at the beach of the Gaza Strip after being shot by the Israeli Army. No records or data were available about whale occurrence in the area before. Dolphins were also mentioned by Gazan fishermen to occur in the sea waters of the Gaza Strip. They ensured that they saw them while fishing in the Mediterranean with no further details.

Seven mammalian species (**Table 2**) were mentioned by Gazans as disappeared including two of the carnivorous species listed in Table 1. The main causes contributed to the disappearance of large and medium-sized mammals in the Gaza Strip as said by local people were the limited area of the Gaza Strip, the political borders surrounding the Strip, population overcrowding which was accompanied by residential and agricultural expansions and habitat loss, modification and destruction. Herewith are general notes of the species recorded in the area:

Table 1: Wild Mammals Recorded in the Gaza Strip; Particularly Wadi Gaza

Family	Scientific Name	Common Name	Status*	Arabic or Local Name
Order Insectivora				
Erinaceidae	<i>Hemiechinus auritus</i>	Long-eared Hedgehog	R	
	<i>Paraechinus aethiopicus</i>	Ethiopian Hedgehog	R	

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Family	Scientific Name	Common Name	Status*	Arabic or Local Name
Order Chiroptera				
Pteropodidae	<i>Rousettus aegyptiacus</i>	Egyptian Fruit-Bat	R	
Vespertilionidae	<i>Pipistrellus kuhlii</i>	Kuhl's Pipistrelle Bat**	?	()
Order Carnivora				
Canidae	<i>Canis lupus</i>	Wolf***	-	
	<i>Canis aureus</i>	Golden Jackal***	-	
Felidae	<i>Felis silvestris</i>	Wild Cat	R	
Herpestidae	<i>Herpestes ichneumon</i>	Egyptian Mongoose	R	
Order Rodentia				
Spalacidae	<i>Spalax leucodon ehrenbergi</i>	Palestine Mole-Rat	R	
Muridae	<i>Mus musculus</i>	House Mouse	R	
	<i>Rattus rattus</i>	House (Black) Rat	R	
	<i>Rattus norvegicus</i>	Norway (Brown) Rat	R	()
Dipodidae	<i>Jaculus jaculus</i>	Lesser Egyptian Jerboa	R	
Myocastoridae	<i>Myocastor coypus</i>	Coypu Nutria***	- ?	
Order Lagomorpha				
Leporidae	<i>Lepus capensis</i>	Cape Hare	R	

* Status: R = Resident; ? = Unknown

** Further studies are needed to know more about the occurrence of other existing nocturnal bat species.

*** Rare mammals: They are either reported to be seen by locals or seen by the surveyor with people hunting them.

Table 2: Disappeared Wild Mammals in the Gaza Strip

Family	Scientific Name	Common Name	Arabic or Local Name
Order Carnivora			
Hyaenidae	<i>Hyaena hyaena</i>	Striped Hyena	
Canidae	<i>Vulpes vulpes</i>	Red Fox	
	<i>Canis lupus</i>	Wolf	
	<i>Canis aureus</i>	Golden Jackal	
Order Rodentia			
Hystricidae	<i>Hystrix indica</i>	Indian Crested Porcupine	-
Order Artiodactyla			
Bovidae	<i>Gazella dorcas</i>	Dorcas Gazelle	
	<i>Gazella gazella</i>	Mountain Gazelle	

Long-eared Hedgehog *Hemiechinus auritus*: The Long-eared Hedgehog (Figure 2A) inhabits agricultural fields, fruit orchards, semi-deserts and sometimes the shrubby area of the Wadi Gaza wetland ecosystem. It lives near available water sources and usually attracts insects as a source of food. It has relatively long ears, hence its name. About six specimens were seen throughout the study period as they went foraging in the early hours of night. In one visit conducted in 19.9.2004 to Wadi Gaza, one Long-eared Hedgehog was found trapped inside a ground mist-net erected for migratory birds. Due to the spiny cover of the animal, it was not easy task to release it from the net. Additionally, three adults and one baby of the animal were stuffed at the BD/IUG. The animal is usually caught and sometimes eaten by the local people especially Bedouins, and thus it is threatened.

Ethiopian or Desert Hedgehog *Paraechinus aethiopicus*: This species is distinguished from the previous species by its dark color that may extend to the anterior part of the face. It inhabits agricultural fields, vegetated areas and semi-deserts and only 3 specimens were collected in spring months from Wadi Gaza area with the help of locals who knew how to capture these animals. Due to their more nocturnally than diurnally habits, the surveyor could not catch any

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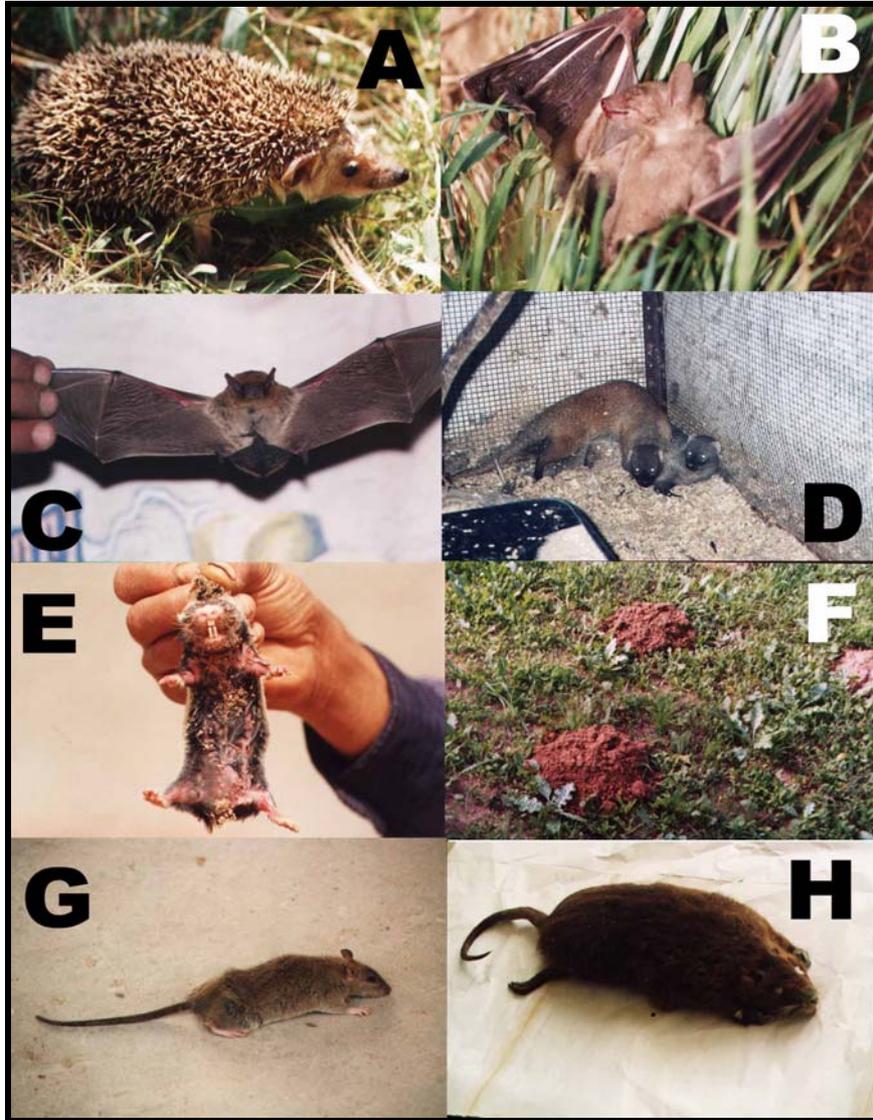


Figure 2: Mammals of the Gaza Strip and Wadi Gaza
(A) Long-eared Hedgehog *Hemiechinus auritus* (B) Egyptian Fruit Bat *Rousettus aegypticus*
(C) Kuhl's Pipistrelle Bat *Pipistrellus kuhlii* (D) Egyptian Mongoose *Herpestes ichneumon* caged in the Rafah private zoo (E-F) Palestine Mole-rat *Spalax leucodon ehrenbergi* and its fresh soil heaps in Wadi Gaza (G) Norway Rat *Rattus norvegicus* after being immobilized by poisons (H) Coypu (Nutria) *Myocastor coypus* preserved at the Biology Department, Islamic University of Gaza.

individually. In one visit, a dead and swelled specimen was found in a small citrus orchard in Al-Mugragha village near Wadi Gaza. Like the long-eared hedgehog, the animal is sometimes eaten by locals and hence is threatened also.

Egyptian Fruit Bat *Rousettus aegypticus*: Fruit Bats are the largest bats comprising the suborder Megachiroptera, found in Palestine. They have prominent eyes and small ears compared to other bats. Single specimens (N=5) of the Egyptian Fruit-bat were found killed inside fruit orchards containing trees of *Morus spp.* and figs in the area of Wadi Gaza. One of the dead bats was photographed at the site and then taken for preservation (Figure 2B). However, as many as three specimens were brought to the BD/IUG for stuffing purposes. Approximately 300 fruit-bats were seen roosting on a *Morus* tree in a total darkness on May 2004 in a local orchard not far from Wadi Gaza. By attacking a variety of fruit trees, the farmers usually complain about their damage and the difficulty to control them.

Kuhl's Pipistrelle Bat *Pipistrellus kuhlii*: Only one live specimen of the species *Pipistrellus kuhlii* was found regarding the suborder Microchiroptera, where a farmer from Wadi Gaza area brought it to the surveyor (Figure 2C). It is worth mentioning that small bats are very common in the Palestinian environment, and specialized studies regarding bats taxonomy, ecology and biology are highly needed.

Wolf *Canis lupus*: This large mammal seemed to enter the Gaza Strip through gaps or burrows in the Israeli electronic fence surrounding the Gaza Strip. Only one individual of this species was captured in 2003 by a local youth who was able to chase and catch it alive near the eastern borders of the Gaza Strip with Israel. Finally, he sold it with U.S. \$40 to a local small and private zoo. Due to poor veterinary and nutritional care in the non-qualified zoo, the animal died after some time.

Golden Jackal *Canis aureus*: Like the Wolf, this mammal seemed to enter the Gaza Strip through the Israeli electronic fence. During the last three years, three jackals were captured by the local people in the Gaza Strip using special metal traps usually used for hunting hares. These animals were seen in the local private zoos in the Strip. Two of the jackals seen in the private zoos of Rafah

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and Jabalia were found losing one of their legs and after 1-2 months they died due the lesions and poor care. Due to the great similarity between wolves and jackals, the local people were not able to distinguish among them, and they sometimes called them foxes.

Wild Cat *Felis silvestris*: Of the 5-6 species of cats inhabiting Palestine, the Wild Cat *Felis silvestris* seems to be the only cat found in the Gaza Strip and Wadi Gaza. This species lives in agricultural fields not far a way from residential dwellings and poultry runs, where it can easily capture its preys. Like the domestic cat, this wild or feral species was seen singly (N=2) in two separate visits to Wadi Gaza on 17.2. 2003 and 2.6.2003 during early mornings, though the species is mostly nocturnal. Road kills of the species also document its presence in the area, where only one specimen was found dead on 1.10.2003 in the eastern part of Wadi Gaza opposite to Al-Bureij Camp. The cause of death was probably poisoning.

Egyptian Mongoose *Herpestes ichneumon*: Egyptian Mongoose (Figure 2D) is common in Wadi Gaza and the eastern parts of the Gaza Strip, as it was seen many times throughout the study period and year round (N=13). Though it is active by night, the animal was seen at day as singles (N=8) and sometimes as small groups (N=5). It is very shy and escaped once facing or seeing the surveyor. The Egyptian Mongoose was found among clumps of small reeds in Wadi Gaza wetland and in the shrubby fences of many citrus, almond, olive and other vegetated fields. The animal was also seen in small tributaries (wadis) nourishing the main duct of Wadi Gaza. Once, the animal was noticed when going down a hill as a group of 5 individuals, but in a single file, meaning that each individual almost holding on to the tail of the one in front. The animal seemed to dig its own burrows for resting and breeding purposes. There were incidents of the Mongoose attacking domestic poultry at Wadi Gaza.

Palestine Mole-rat *Spalax leucodon ehrenbergi*: The Palestine Mole-rat (Figure 2E) is an actual pest species found countrywide. Though live specimens (N=6) of the species were seen by the surveyor in few occasions, the fresh and old soil heaps caused by the animal were seen everywhere in the Gaza Strip and Wadi Gaza in a variety of agricultural fields (Figure 2F). These soil heaps have never been seen in close contact with the wetland ecosystem of Wadi Gaza. The

animal seems to be active both day and night, spending its life building tunnels and underground burrows and almost never going into the open. This was evident as the surveyor were able to identify new soil heaps that never found in the early hours of the day. The tunnels run among roots, tubers and bulbs of plants on which the animal feed. However, as many as four dead specimens were seen in the fields due to the action of killing exerted by the locals and farmers to protect their agricultural crops. Local people were found to have their own methods to trap the Palestine Mole-rat and kill it. In one occasion, a farmer trapped the Mole-rat in his vineyard while the surveyor was in the area, and of course it was a good opportunity to photograph the animal (Figure 2E) and to take it for further preservation at the BD/IUG. It is worth mentioning that about seven stuffed samples of the species were found at the BD/IUG. The animal has a cylindrical body with short legs and lacks a tail. The eyes are atrophied and covered with fur. The head is thick and strong, with powerful incisors used as tools for the animal's digging behavior.

House Mouse *Mus musculus*: The House Mouse, Norway (Brown) Rat and the House (Roof or Black) Rat are all collectively known as commensal rodents in the sense that they live commensally at the expense of humans. Universally, they are considered as pests causing damage to humans, domestic animals, agricultural products and other human properties. The House Mouse *Mus musculus* is the smallest of these commensal rodents, and found everywhere in the Gaza Strip. It lives in a variety of agricultural fields including olive, citrus, almond, grape and fig orchards, among bushes and in woodland, but it is also lives in homes, stores and buildings. It was extensively trapped by locals by a variety of traps including live and dead traps. Other plastic or metal commercial traps were also applied. A variety of rodenticides was used by the community despite of their harmful impacts on humans and biota. As many as tens of these mice were trapped in the fields using live night traps. The animal is nocturnal most of the time and eats anything available. It reproduces as a hell year round. Nests in the field are usually built from fine fiber from plants or other sources. In homes, it nests in cracks, spaces between walls and even inside electrical devices such as refrigerators and ovens.

House (Black – Ship - Roof) Rat *Rattus rattus*: This nocturnal species is found in places where human beings are present. It is omnivorous feeding upon

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a variety of animal and plant materials. It breeds several times a year. The species was easily trapped or killed by the community using different traps and means including rodenticides. The control of these pest species imposes such significant losses in domestic poultry and non-target animals as well. This species creates major economic and health problems to people because it destroys foodstuffs and human properties and transmits infectious diseases. One of the differences between *Rattus rattus* and *Rattus norvegicus* is the length of tail proportional to the head and body length. In the latter, the tail is relatively shorter. Accordingly, this character was applied locally to distinguish between the species.

Norway (Brown) Rat *Rattus norvegicus*: The habitat of the Norway Rat (Figure 2G) is similar to that of the House Rat, being in close contact with human beings. This nocturnal species is omnivorous and excellent swimmer as it may live in sewers. As many as tens if not hundreds of both rat species were seen killed in the fields and the roads of the Gaza Strip.

Lesser Egyptian (Desert) Jerboa *Jaculus jaculus*: This nocturnal species seems to occur in agricultural fields mainly grapevine fields which are located in the coastal sand dunes surrounding the western parts of Wadi Gaza. With the help of locals who trapped them, the surveyor was able to see only one live sample of the species. The species has long hind legs as well as a long tail which ends with a tuft of white hairs at the tip. Its damage to agricultural crops is mild compared to the other rodent species.

Coypu (Nutria) *Myocastor coypus*: The Coypu or Nutria is a large rodent species (Family Myocastoridae). Three individuals of the species were singly found to fall in the fishing nets of Gaza fishermen in 1997, while they were fishing in the Mediterranean Sea. One of the animals was brought to the BD/IUG for preservation (Figure 2H). The body of the animal is covered with a soft and dense fur. The incisors are large, conspicuous and yellow. No data were available on its presence neither in the Gaza Strip nor in the West Bank before.

Cape (Brown) Hare *Lepus capensis*: This relatively big wild mammal faces the danger of disappearance in the whole Gaza Strip and Wadi Gaza in

particular due to habitat destruction and over-hunting and trapping. It is found throughout the year in flat areas and terrain near agricultural lands in the two banks of Wadi Gaza and even the Wadi bed. Many metal traps implanted on the ground were seen by the surveyor in the purpose of hunting of the Cape Hare. The animal is somewhat brown in color, very fast and is usually hunted for meat. As many as seven individuals were seen as singles mainly at the dusk in Wadi Gaza. Moreover, the animal was seen in different occasions in other areas of the Gaza Strip (N=3).

4. Discussion

The location of Palestine at the terrestrial meeting point between Asia, Europe and Africa and the diversity of the country's climatic zones facilitate the interaction and spread of plants and animals of the three continents (Qumsiyeh, 1996 and Ali-Shtayeh and Hamad, 1997). The Gaza Strip which is located at the southern portion of the Palestine coast along the Mediterranean Sea harbors a variety of wildlife including terrestrial and aquatic forms. Wadi Gaza with its wetland ecosystem provides habitats for a variety of fauna as indicated by Abd Rabou (2005).

The ever-increasing human impact on the existing natural resources in the Gaza Strip has caused the extinction of many wildlife species, e.g. Gazelles, Porcupines and large carnivores and others have become endangered, e.g. Wild Hares and Wild Cats. The present field study or survey revealed the presence 15 mammalian species, most of which were small in size. This figure could be attributed to ecosystem and landscape diversity in Wadi Gaza and the whole Gaza Strip. The various ecosystems included the sea coast, wetlands, sand dunes, natural vegetation and agricultural orchards. These ecosystems provide wild species with all needs; shelter, fuel, breeding and resting sites. The results reinforce the necessity of long-term inventories in order to understand the dynamics of animal communities in the study area. It is expected that the population over-crowding, the residential and agricultural expansions, the intensive and extensive infrastructural and developmental projects and the poor implementation of environmental laws and legislations are major factors contributing to the gradual decline of biodiversity in the area. Massive deterioration and destruction to ecosystems were carried out by the Israeli forces and Israeli settlers in the Gaza Strip for claimed Israeli security reasons, where the uprooting of vast areas whether natural or cultivated had its major

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impact on wildlife ecology in the area. Habitat modification and fragmentation which was apparent in Wadi Gaza and other areas of the Gaza Strip may have a capital role in changing animal composition and distribution. Gaines *et al.* (1994) indicated that habitat loss and increased insularity can reduce population sizes to such low levels that species go extinct. With regard to mammals, D'Andrea *et al.* (1999) pointed out that the replacement of natural ecosystems by cultivated areas and other human-made environments has been changing the structure of animals and plant communities.

The Gaza Strip, which is totally fenced by the Israeli authorities and subjected to various anthropogenic disturbances, suffers the absence of large mammals except the vagrant species such as Jackals *Canis aureus* and Wolves *Canis lupus* which seem to enter the area from Israel through gaps or burrows in or beneath such fences. No records of their occurrence since decades were present (Abd Rabou, 2005). The large home ranges of big mammals (Wilson and Delahay, 2001) made the presence of large mammals in a very small and crowded area like the Gaza Strip impossible. In contrast, the rest of Palestine including the West Bank seems to harbor a diversity of mammalian fauna of different sizes (Qumsiyeh, 1996 and Ali-Shtayeh and Hamad, 1997). This was attributed to the relatively big area and the natural landscapes the country possesses. Such similar large mammals; particularly carnivores were recorded in close countries like Jordan (Qumsiyeh, 1996; Bunaian *et al.*, 2001 and Abu Baker *et al.*, 2004) and Egypt (Hoath, 2003). Studies in Israel showed such anthropogenic impacts on wild mammals, e.g. the intentional poisoning of the Golden Jackal *Canis aureus* due to its predation on livestock (Yom-Tov *et al.*, 1995).

The illegal hunting of Wild Hares *Lepus capensis* and Hedgehogs (*Hemiechinus auritus* and *Paraechinus aethiopicus*) for meat consumption in Wadi Gaza and the Gaza Strip are common practices that could hurt the populations of these mammals to low levels that species may go extinct. In contrast, wildlife hunting is not a common practice in Israel and this could be attributed to the fact that all wildlife in Israel has legal protection and hunting is allowed only for animals that are either classified as agricultural pests or are common (Mendelessohn and Yom-Tov, 1988). Yom-Tov (2003) highlighted the serious deleterious effects of illegal hunting and poaching on wildlife including mammals in Israel, and indicated that such illegal hunting or over-hunting in developing countries has resulted in that many wildlife species are threatened. In the light of these findings, it is the responsibility of the

Palestinian authorities to regulate such hunting activities through posing environmental laws and legislations in order to protect wildlife resources in Palestine.

Small mammals especially rodents were found in large populations and were considered pests threatening agricultural production and other human properties in the area. These results seem to be consistent with the findings of Mutze (1990) and Galante and Cassini (1994) who revealed that some opportunistic species, such as herbivorous and graminivorous small mammals, might become agricultural plagues with extreme population peaks. As Wadi Gaza comprises overlapping heterogeneous natural and human-made ecological habitats, it attracts more small mammals (hedgehogs, bats, rats, mice and gerbils). Similar findings were pointed out by D'Andrea *et al.* (1999) who studied the ecology of small mammals in a Brazilian rural area and pointed out that the configuration of heterogeneous habitats probably allowed the occurrence of small marsupials and more rodent species when compared to studies in monoculture areas.

Because of the geographical position of the Gaza Strip in bordering the Negev Desert from the west and the Sinai Peninsula from the north, transfer of small mammals; particularly rodents from these areas to the Gaza Strip and vice versa is expected. Accordingly, continuous surveys for mammals in the Gaza Strip are highly needed. It is worth mentioning that the Negev Desert was continuously surveyed for small mammals (Kransov *et al.*, 1996) and new records of small mammals added every time (Shenbrot and Kransov, 1997).

The presence of the large rodent; Coypu (Nutria) *Myocastor coypus* where only three individuals were recorded in the area made them considered as vagrant in the sense that no previous records were known for the species in the Gaza Strip. According to Boitani and Bartoli (1983), the species is native to South America and it was introduced to many countries for economic purposes. The species was introduced to and reared in Israel for its fur which has good commercial values (Qumsiyeh, 1996). The only interpretation for its presence in the Gaza Strip was its entrance to the Strip from Israel via the Mediterranean Sea where it was captured by fishermen.

The two bat species; *Rousettus aegypticus* and *Pipistrellus kuhlii* recorded in the present study could be a fraction of what is really found in Palestine, which harbors more than 30 bat species (Qumsiyeh, 1996 and Korine *et al.*, 1999). In Jordan, 24 bat species were recorded among which the previously mentioned species were part (Qumsiyeh *et al.*, 1998). No previous investigations for bat

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species were conducted in the Gaza Strip and this necessitates further works to investigate more about bat species inhabiting the area. Taxonomical and karyological studies are highly required for bats in this regard. The Egyptian Fruit Bat *Rousettus aegypticus* is the most common bat in the Gaza Strip. It is found in cities, fruit orchards and Wadi Gaza. The presence of thousands of Date Palm *Phoenix dactylifera* trees in Deir Al-Balah; a big city in the mid of the Gaza Strip, attracts big populations of this common bat to forage and feed upon their fruits as was told by Palestinians (Personal Communication). Hence, it was considered as an agricultural pest by Gazans. Similarly, the species was considered as a major agricultural pest in neighboring and Middle East countries, e.g. Israel (Moran and Keidar, 1993 and Korine *et al.*, 1999), Egypt (Madkour, 1977), Jordan (Qumsiyeh *et al.*, 1998) and Turkey (Albayrak, 2003). Globally, fig-eating by vertebrate frugivores including the *Rousettus* species (Pteropodidae) was also reported (Shanahan *et al.*, 2001).

As far as marine mammals are concerned, the data obtained were fragmentary. One of the two whales was seen by the surveyor and Gazans during 1980s, and parts of its skeleton were brought to the BD/IUG at that time, which did not stay for long. Although the data on the occurrence of dolphins were uncertain and gained from Gazan fishermen, the Ministry of Environmental Affairs – Palestine reported the presence of two dolphin species; the Bottlenose Dolphin *Tursiops truncatus* and the Common Dolphin *Delphinus delphis* (Ministry of Environmental Affairs – MENA, 2001). It is worth mentioning that studies on marine biota were lacking in the OPTs, and more focus should be paid on marine biology and ecology topics to complete the picture of the Palestinian terrestrial and aquatic wildlife resources.

The current unstable political situation in Palestine impedes sustained implementation of wildlife management plans. Overcrowding, residential and agricultural expansion and poverty are actual obstacles to any progress in wildlife conservation and reintroduction. Reintroduction of wildlife particularly large mammals in particular habitats and nature reserves was successfully applied in many developed and developing countries. Examples were the reintroduction of the Fox *Vulpes vulpes* in the Isle of Man, Britain (Reynolds and Short, 2003), the Arabian Sand Gazelle *Gazella subgutturosa marica* in Saudi Arabia (Haque and Smith, 1996), the Mhorr Gazelle *Gazella dama mhorr* in Tunisia and Morocco (Wiesner and Muller, 1998) and Oryxes and Asses in both Jordan and Israel (Qumsiyeh, 1996). Finally, enforcement of wildlife

protection laws is urgently needed in the OPTs. Such laws were imposed in Israel and lead to good conservation strategies (Yom-Tov, 2003) and rapid build-up of the previously declining populations of the Mountain Gazelle *Gazella gazella* (Kaplan, 1994). Finally, the authors recommend carrying out more studies regarding wildlife and biodiversity topics in both the terrestrial and marine environments. They also recommend improving cooperation of different parties to enhance the public awareness and to implement environmental laws and legislation to conserve nature and to protect wildlife.

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