

The Palestinian mammalian fauna acquired by the zoological gardens in the Gaza Strip

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Abstract. *Abd Rabou AFN. 2011. The Palestinian mammalian fauna acquired by the zoological gardens in the Gaza Strip. Nusantara Bioscience 3: 82-91.* The Gaza Strip, which is an arid strip of the Palestinian land along the southeastern Mediterranean, harbors a considerable number of mammalian fauna due to its eco-geo-strategic position. Prior to 2006, the establishment of zoological gardens in the Gaza Strip was a sort of imagination due to Israeli constraints. These constraints were nurtured by the total Israeli destruction and demolition of the Rafah and Gaza private zoological gardens in 2004 and 2009 respectively, using heavy tanks and bulldozers. The establishment of many zoological gardens following the Israeli evacuation from the Gaza Strip in late 2005 encouraged wildlife trading. Hence, the current study comes to document the Palestinian mammalian faunistic species acquired by the zoological gardens in the Gaza Strip through frequent visits to Gaza zoological gardens and meetings with local people, wildlife hunters, and zoo owners. A total number of 17 Palestinian mammalian faunistic species belonging to 12 families and 5 orders was encountered in the zoological gardens throughout the study period. The encountered species represent a good mix of the families and sizes of mammals generally found in other parts of Palestine. Order Carnivora represents 52.94% of the caged mammals, while the orders Rodentia, Lagomorpha, Artiodactyla and Insectivora represent 47.06%. The study documented the first sight of the Greater Egyptian Gerbil *Gerbillus pyramidis* in the Gaza Strip. Local hunting, tunnel trade and delivery were the lonely sources of the mammals encountered in the zoological gardens. The economic deprivation under the current Israeli blockade and the poor implementation of environmental laws and legislation concerning wildlife protection have made wildlife trading as a common practice. Finally, The author recommends to improving the management process of Gaza zoological gardens under the care of the governmental authorities and the cooperation of the different parties in the Gaza Strip to enhance public ecological awareness to protect and conserve wildlife; especially mammals.

Keywords: mammals, carnivores, zoological gardens, wildlife hunting, tunnel trade, Gaza, Palestine

Abstrak. *Abd Rabou AFN. 2011. Fauna mamalia Palestina yang dipelihara kebun binatang-kebum binatang di Jalur Gaza. Nusantara Bioscience 3: 82-91.* Jalur Gaza, yang merupakan jalur tanah kering bagian negara Palestina di sepanjang tepi Laut Tengah bagian tenggara, menjadi tempat tinggal sejumlah hewan mamalia karena posisi eco-geo-strategisnya. Sebelum tahun 2006, pendirian kebun binatang di Jalur Gaza hanyalah sebuah impian karena larangan Israel. Hal ini tampak dari penghancuran dan pembongkaran seluruh kebun binatang swasta di Rafah dan Gaza oleh Israel, secara berturut-turut pada tahun 2004 dan 2009, menggunakan tank dan bulldoser. Pembentukan kebun binatang banyak dilakukan setelah penarikan mundur Israel dari Jalur Gaza pada akhir tahun 2005, didorong oleh maraknya perdagangan satwa liar. Penelitian ini dilakukan untuk mendokumentasikan jenis-jenis hewan mamalia Palestina yang dipelihara oleh kebun binatang di Jalur Gaza dengan cara sering berkunjung ke kebun binatang serta pertemuan dengan masyarakat setempat, pemburu satwa liar dan pemilik kebun binatang. Sebanyak 17 jenis hewan mamalia Palestina dari 12 suku dan 5 bangsa ditemukan di kebun binatang selama periode penelitian. Jenis-jenis yang ditemukan mewakili keragaman suku dan kekayaan mamalia yang juga umum ditemukan di bagian lain Palestina. Bangsa karnivora mewakili 52,94% dari mamalia yang dipelihara, sementara bangsa Rodentia, Lagomorpha, Artiodactyla dan Insectivora mewakili 47,06%. Studi ini mendokumentasikan untuk pertamakalinya keberadaan *Gerbillus pyramidis* di Jalur Gaza. Perburuan lokal, perdagangan melalui terowongan dan pengiriman merupakan sumber asal mamalia di kebun binatang. Kemunduran ekonomi akibat blokade Israel dan buruknya implementasi hukum lingkungan dan peraturan perundang-undangan tentang perlindungan satwa liar telah menyebabkan perdagangan satwa liar menjadi praktik yang umum dilakukan. Penulis menyarankan adanya peningkatan manajemen kebun binatang-kebum binatang di Gaza dengan bimbingan otoritas pemerintah dan kerjasama dari para pihak untuk meningkatkan kesadaran ekologi masyarakat dalam melindungi dan melestarikan satwa liar, terutama mamalia.

Kata kunci: mamalia, karnivora, kebun binatang, perburuan satwa liar, perdagangan melalui terowongan, Gaza, Palestina

INTRODUCTION

Mammals are one of the most diversified of all creatures on earth today. They range from tiny bat species to the largest Blue Whales. The overall mammalian species known worldwide is about 4,500 species (Boitani and Bartoli 1983). Globally, mammals are threatened by

destruction and degradation of ecological habitats, caused by a variety of factors including agricultural intensification, urbanization, pollution and climate change. Human disturbance, overexploitation of natural resources and invasive species are also major threats (Temple and Cuttelod 2008).

The small geographic area of Palestine harbors a rich

fauna and flora because of its strategic location at the juncture of the three continents (Asia, Africa, and Europe) and because of the large variety of its unusual topography that creates diverse ecological habitats, niches and climates (Qumsiyeh 1996). An approximate number of 120 mammalian species of the 4,500 species known worldwide inhabit Palestine (Yom-Tov 1988; PIALES 1996; Ali-Shtayeh and Hamad 1997; PCBS 2000). Qumsiyeh (1996) pointed out that most Palestinian mammalian fauna have Palearctic affinities and a few have affinities to the Ethiopian and Oriental realms.

Zoological gardens (zoos) are institutions or facilities in which animals are confined within enclosures, displayed to the public, and in which they may also be bred. The history of modern zoological gardens, however, started some 200 years ago with the creation of the first public zoological garden. Since that time, large numbers of zoological gardens have been established in all parts of the world (IUDZG/CBSG of IUCN/SSC 1993). Globally, zoological gardens are known to offer great opportunities for entertainment and education, and to contribute to wildlife conservation and promote scientific research, especially for environmentalists and conservationists, as the rate of extinction of wildlife increases.

During the Israeli occupation era, which started in 1967, no zoological gardens have been established in the Gaza Strip, with the exception of the Rafah private zoological garden which was established in 1999 and was by far considered as the first zoological garden in the Gaza Strip and the only place for entertainment in Rafah city that kids could escape the tense atmosphere. There is a total understanding among the Gazans that the Israeli occupation prohibited the establishment of such animal collections or zoological gardens in the Gaza Strip, in an attempt to impose what could be termed as "ecological illiteracy" among the Palestinians. This thought was nurtured by the total Israeli destruction and demolition of the Rafah zoological garden with the ground using heavy tanks and bulldozers on 21 May 2004, i.e. after 5 years of its establishment. All the existing zoo animals were either being killed or escaped. The targeted mammalian set included Wolves, Jackals, Foxes, Wild Cats, Mongooses, Raccoons, Badgers, Gazelles, Deer, Ibexes, and Kangaroos (Figure 1).

After the Israeli evacuation of the colonies in the Gaza Strip in late 2005, local hunting of wildlife was reestablished. The establishment of local private zoological gardens or animal collections in the Gaza Strip encouraged wildlife trading (Abd Rabou 2009a), especially for mammalian fauna. About eight private zoological gardens have been established since 2006 in the five governorates of the Gaza Strip (North Gaza, Gaza, Middle, Khan Younis and Rafah). However, many of these gardens have been closed in the last two years due to intrinsic factors. The area of these zoological gardens ranges from 1.5 to 8 dunums (dunum = 1000 square meters).

Apart from the judgment on their own merits, these zoological gardens were found to be (i) good private projects providing revenues to their owners especially in the current times where the Israeli blockade was and is still

imposed on the Gazans and the unemployment crisis which dominates the majority of the Gazan people, (ii) a good contributor to the knowledge of the Palestinians about their biodiversity items; especially vertebrate fauna, and (iii) a progressive challenging practice against the Israelis who prevented the establishment of such zoological gardens during its occupation era to the Gaza Strip which started in 1967. In non-war times of the Gaza Strip, these zoological gardens usually attract thousands of visitors a day, mainly families and pre-school and school children (Figure 2).

It is worth mentioning that the main zoological garden of the Gaza city was attacked by Israeli soldiers and tanks during the Israeli War of December 2008 – January 2009. According to local media reports, about 400 zoo animals were lost during that attack. The few zoo animals which survived the Israeli onslaught were left to starve just like the Gazans themselves. The repeated Israeli attack to zoological gardens of the Gaza Strip ensured a programmed policy adopted by the Israeli occupation aimed at destroying such zoological gardens in order to disseminate its strategy of "ecological illiteracy" among the Palestinians. The Israeli policy of vegetation clearance of many agro-ecosystems in the Gaza Strip further deteriorates wildlife ecology. For example, UNEP (2003) documented the destruction by Israeli forces of vast agricultural areas in Beit Hanoun, North Gaza. This large-scale modification of the landscape clearly would impact habitats, perhaps increase desertification, and at least effect human interactions with the remaining wildlife habitats.

Survey studies on the occurrence of mammals in various ecosystems are fundamental to the conservation, research, and management of wildlife populations. Accordingly, extensive work on mammals; particularly carnivores, was carried out in different important Middle East and North Africa countries. Amr et al. (1987) studied a set of Jordanian mammals with particular emphasis on the distribution of the endangered species *Gazella gazella*. Amr and Disi (1988) described the Jordanian mammals acquired by the Jordan University Natural History Museum. Hatough and Disi (1991) worked on the large mammalian species of Jordan in terms of history, distribution, and conservation, while Qumsiyeh et al. (1993) and Bunaian et al. (2001) worked on the local status and conservation strategies of the Jordanian carnivore species. In Syria, Masseti (2009) outlined the local occurrence and recent distribution of 15 carnivore species. In Turkey, the distributional records of 5 carnivore species were noted by Ozkurt et al. (1998). In Arabia, extensive work was taken place on mammalian species; particularly carnivores (Gasperetti et al. 1985; Nader 1989, 1990, 1996). Seddon et al. (1997) and Masseti (2010) have modest works carried out on the mammalian species occurring in the Harrat al-Harrah Protected Area and the Farasan Archipelago of Saudi Arabia respectively. Finally, Al-Jumaily (1998) reviewed the various mammals of the Republic of Yemen.

There have been a few studies of mammals in the Gaza Strip (Abd Rabou 2005, 2009a, 2011; Yassin et al. 2006; Abd Rabou et al. 2007a; Abu Taleb 2008). Collectively,



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Figures: 1. Palestinian children look at a raccoon killed during the Israeli destruction of the Rafah private zoo (21 May 2004); 2. Gaza zoological gardens attract thousands of visitors; mainly school children a day

these studies revealed the occurrence of more than 20 mammalian species in the Gaza Strip. Many of which, especially carnivores, were found to enter the area through gaps or ground burrows at the political borders separating the Gaza Strip from Israel.

A substantial interest was paid to the wild mammals caged in the zoological gardens of the Gaza Strip, where new species that were unknown to happen before in the Gaza Strip have been seen there. Accordingly, the current study comes to document the Palestinian mammalian faunistic species acquired by the zoological gardens in the Gaza Strip, which will benefit the Palestinians in the sense that they will be familiar with their mammalian fauna.

MATERIALS AND METHODS

The study area

The Gaza Strip (31°25'N, 34°20'E) is a 365 km² arid strip of the Palestinian land along the southeastern Mediterranean. It represents the northern link between the Sinai and the Negev deserts. About 1.7 million residents, of whom the majority are United Nations-registered refugees, are living in the five governorates of the Gaza Strip (North Gaza, Gaza, Middle, Khan Younis and Rafah). The annual rainfall ranges from 200 mm in the south to 400 mm in the north. Three dry to semi-dry wadis (valleys) dissect the Gaza Strip. They are, from north to south, Wadi Beit Hanoun, Wadi Gaza, and Wadi Al-Salqa.

Procedures

Frequent visits were carried out to the eight local zoological gardens of the Gaza Strip during a three-year study (October 2007 until September 2010) to record and determine the caged Palestinian mammalian species. Observations and interviews with tens of local people, wildlife hunters, and zoo owners were taken place in Gaza zoological gardens and hunting sites as well. The interviews involved different questions such as the sources

and costs of zoo animals, hunting sites and means, reasons for hunting and other aspects of zoo management. Digital cameras have been used throughout the study period and photos were taken for documentary and confirmatory purposes. Identification of mammalian species acquired by the zoological gardens follows published keys and guidebooks (Boitani and Bartoli 1983; Gross 1987; Harrison and Bates 1991; Qumsiyeh 1996; Hoath 2003).

RESULTS AND DISCUSSION

Sources of zoo mammalian fauna

The current study revealed that the mammalian fauna acquired by the zoological gardens of the Gaza Strip had three sources as follows:

Local hunting: It was found that the skilled local hunters used to prepare their own hunting tools mainly the metal live traps which include the leghold or foothold trap and wire cage traps (called locally as *Maltash*) with different sizes in the field by night to hunt mammals. The leghold trap is usually set on an animal trail. Compared to wire cage traps, the leghold traps are known among Palestinians for breaking animals' legs and leaving them in pain often for prolonged periods of time. Other hunting tools such as ground mist nets and spare guns were used as well.

Introduction from Egypt: Due to the reluctance of the Israeli occupation for any legal import of zoo animals, it was found that large mammals were commonly illegally introduced from Egypt through the earth tunnels connecting the Gaza Strip with the Egyptian territories. It is worth mentioning that these earth tunnels have been intensively established as a result of the Israeli blockade imposed on the Gaza Strip since 2006. The tunnel trade provides the Gazans with most of their needs including zoo animals such as lions, tigers, wolves, foxes, hyenas, deer, llamas, monkeys, ostriches, pheasants, peafowl, Flamingos, cranes, crocodiles, and pythons.

Delivery: According to zoo owners, many of the caged pairs of zoo mammals were known to reproduce and to give birth to babies, e.g., lions, foxes, jackals, and monkeys. Some of these babies were sold later to other zoological gardens in the Gaza Strip.

Zoo mammalian fauna in the Gaza Strip

A total number of 17 mammalian species belonging to 12 families and 5 orders was encountered in the zoological gardens of the Gaza Strip throughout the study period. Order Carnivora represents 52.94% of the caged mammals, while the orders Rodentia, Lagomorpha, Artiodactyla, and Insectivora represent 47.06% (Table 1). Herewith is a brief description of each recorded mammalian fauna in the zoological gardens of the Gaza Strip. Some documentary photos concerning certain mammalian species are also provided.

Table 1. Mammalian fauna documented at the zoological gardens of the Gaza Strip

Family	Common name	Scientific name
Order Carnivora		
Canidae	Golden Jackal	<i>Canis aureus</i>
	Grey Wolf	<i>Canis lupus</i>
	Red Fox	<i>Vulpes vulpes</i>
Felidae	Wild Cat	<i>Felis silvestris</i>
	Jungle Cat	<i>Felis chaus</i>
Herpestidae	Egyptian Mongoose	<i>Herpestes ichneumon</i>
Mustelidae	Marbled Polecat	<i>Vormela peregusna</i>
	Common Badger	<i>Meles meles</i>
Hyaenidae	Striped Hyena	<i>Hyaena hyaena</i>
Order Rodentia		
Gerbillidae	Greater Egyptian Gerbil	<i>Gerbillus pyramidis</i>
Hystriidae	Indian Crested Porcupine	<i>Hystrix indica</i>
Spalacidae	Palestine Mole-rat	<i>Spalax leucodon ehrenbergi</i>
Order Lagomorpha		
Leporidae	Cape Hare	<i>Lepus capensis</i>
Order Artiodactyla		
Bovidae	Dorcas Gazelle	<i>Gazella dorcas</i>
Camelidae	Dromedary Camel	<i>Camelus dromedarius</i>
Order Insectivora		
Erinacidae	Long-eared Hedgehog	<i>Hemiechinus auritus</i>
	Ethiopian Hedgehog	<i>Paraechinus aethiopicus</i>

Golden Jackal *Canis aureus* (Linnaeus 1758)

The Golden Jackal has a golden reddish-yellow fur with a white mark on the throat. The animal seems to be found in all climatic areas of Palestine including the open and woody areas. The species feeds on a variety of preys including rodents, hares and domestic sheep. Locals of eastern Gaza claimed that the Golden Jackals comes at night from Israel to attack their animal husbandries and to prey on their domestic animals such as chicken, rabbits, and young cattle. Due to the great similarities between the

Golden Jackal and the Grey Wolf, most of the Palestinians including some zoo owners cannot distinguish between the two species and they may give them the same local names (*Wawi* or *Deeb*).

As many as 24 individuals of the Golden Jackal were encountered in Gaza zoological gardens (Figure 3). Depending on frequent meetings with zoo owners and local hunters, trapped animals were apparently sold for approximately U.S.\$150-200 per live specimen. Wire cage and leghold traps are commonly used for hunting the Golden Jackal along with other mammals in the eastern parts of the Gaza Strip where fruit orchards and animal husbandries are common. Besides, the Golden Jackal was known to enter the Gaza Strip from Israel through burrows or gaps found beneath the political borders separating the two entities.

Grey Wolf *Canis lupus* (Linnaeus 1758)

The Grey Wolf is the largest member of the Canidae family and it inhabits different parts of Palestine especially the mountainous regions. It primarily feeds on domestic animals, ungulates, hares, rodents, birds, and reptiles such as lizards and snakes. Wolves are generally nocturnal but may sometimes hunt during the day. In spite of the debate concerning the occurrence of the Grey Wolf in the Gaza Strip, all the recent existing individuals (N = 13) of the species (Figure 4) in Gaza zoological gardens were known to be illegally imported from Egypt through the earth tunnels joining the Gaza Strip with the Egyptian territories. Prior to 2002, the animal was legally imported from Israel to be caged in the Rafah zoological garden. Finally, the free movement of the Grey Wolf in the Negev Desert suggest large home ranges (Afik 1983) and this may explain the occasional movement of the species across borders from the Negev Desert into the Gaza Strip.

Red Fox *Vulpes vulpus* (Linnaeus 1758)

The Red Fox is the most widely distributed carnivore in the world and is an adaptable species found in a variety of ecological habitats including that of Palestine and its neighboring countries (Bunaian et al. 2001 and Hoath 2003). The Red Fox is the largest fox in the genus *Vulpes* in Palestine. It is commonly found caged in Gaza zoological gardens (N = 17) (Figure 5). As many as six individuals were found losing one of their legs due to their capture using leghold traps. Meetings with both zoo owners and hunters revealed that the healthy Red Fox was sold for approximately U.S.\$100. Moreover, the poor care admitted to the caged injured individuals resulted in their death. The Red Fox is commonly hunted using the same methods applied for the Golden Jackal in the open areas of the eastern parts of the Gaza Strip where most animals husbandries are present. In parallel with that, many zoo owners claimed that they imported many individuals of the Red Fox from Egypt via the tunnel trade.

Wild Cat *Felis silvestris* (Schreber 1777)

The Wild Cat is a common felid species in Palestine. It feeds on small animals including rodents, lizards and insects. Due to the great similarities between the Wild Cat

and the Domestic Cat, most Palestinians in the Gaza Strip are unable to distinguish between them and they could not exclude their interbreeding as well. Palestinians inhabiting remote areas in the Gaza Strip including Wadi Gaza seem to be familiar with the species in question. They claimed that they poisoned or killed the species many times due to their opportunistic attack to their poultry husbandries. Meetings with many zoo owners revealed that the Wild Cat ($N = 4$) was opportunistically caged for short periods of time with no further details. They claimed that Wild Cats are more aggressive than Domestic ones. Meanwhile, caging of the Domestic Cat *Felis catus* (Linnaeus 1758) was a common practice in all Gaza zoological gardens. The Palestinian community totally accepted the scientific thought of Wild Cats as being as an ancestor of Domestic Cats. The way considers the species as the most common and the very desired vertebrate pet in the Gaza Strip.

Jungle Cat Felis chaus (Schreber 1777)

The Jungle Cat – as its name displays – is a riparian feline associated with dense vegetation encompassing water bodies and courses. It feeds on small animals including rodents, lizards, birds, and rodents. What characterizes the species are its grizzled gray color and its ears, which have black tufted tips. With regard to the Palestinian carnivore species, the Jungle or Swamp Cat (Figure 6) is the most occurring species in Gaza zoological gardens ($N = 38$). Meetings with both hunters and zoo owners indicated that the individual Jungle Cat is sold at U.S.\$ 70-100. In the Gaza Strip, the species is usually hunted along the eastern borders using wire cage traps. This belt of land is rich in cultivated and/or irrigated areas that are not far from the Gazan residential dwellings (perhaps hunting rodents that also increased in those areas, see Abu Baker et al. 2003) and in this it may be exceptional to other carnivores in the Gaza Strip. Along with other carnivores, locals usually treat the Jungle Cats as pests, and they were known to get rid of many of them through direct killing or poisoning.

Egyptian Mongoose Herpestes ichneumon (Linnaeus 1758)

Egyptian Mongoose is a common mammal in Palestine. In the Gaza Strip, the species prevails the eastern parts where many citrus, almond and olive orchards in addition to other agricultural fields are found. Locally, the animal is unloved by Gazans and they usually called it “Nims” or “Nisnas” and sometimes “Abu Al-Khesiat”. The author confirmed the presence of the Egyptian Mongoose among clumps of the small stands of the Common Reed *Phragmites australis* and Tamarisk *Tamarix nilotica* shrubs along the Wadi Gaza Nature Reserve in the middle of the Gaza Strip. To prevent the attack of the animal to their domestic poultry, many locals were found to kill the Mongoose using different means including rodenticides. As many as 26 individuals of the species were recorded in Gaza zoological gardens and all of them were hunted locally using wire cage traps. Hunters and zookeepers stated that the Egyptian Mongoose was sold at U.S. \$ 30-50 per live specimen.

Marbled Polecat Vormela peregusna (Guldenstaedt 1770)

The Marbled Polecat is the smallest and rarest among the carnivore species occurring in the Gaza Strip though it happens in diverse ecological habitats in Palestine. The animal is colorful in terms of having variegated brown and yellow patches and stripes of irregular shape on the back. It seems to feed on small rodents. Only eight specimens were encountered in a few zoological gardens throughout the survey period (Figure 7). Zoo owners claimed that they bought the animal with U.S. \$ 10-30 from local people capturing it by hand in cultivated fields or in the wild. However, most of the zoo specimens were able to escape from their cages due to their very low body weights that do not exceed 0.75 kilograms as estimated by zookeepers.

Common Badger Meles meles (Linnaeus 1758)

The Common Badger is a burrowing nocturnal animal found in the hilly, cultivated and woody parts of the Holy Land which includes Palestine and Jordan (Qumsiyeh 1996; Abu Baker and Amr 2002). It feeds upon rodents, reptiles, and insects. It builds extensive burrow systems using its well-clawed front legs. What characterizes the animal is the presence of a median white stripe on the head. No previous records are indicating that the animal was found in the Gaza Strip as an isolated geographical area. Nowadays, no Badgers are caged in Gaza zoological gardens, and the only sight of the Common Badger (Figure 8) was made in the Rafah private zoological garden during 2002-2004. According to the Rafah zoo owner, the specimen was imported from Israel at the beginning of the zoo establishment in 1999. It is worth mentioning that the Israeli tanks and bulldozers attacked the Rafah private zoological garden on 21 May 2004, and demolished it with the ground and most of the existing zoo animals including the Common Badger either escaped or died.

Striped Hyena Hyaena hyaena (Linnaeus 1758)

The Striped Hyena is the only contemporary Hyena in Palestine. Although it is common in various ecological habitats in the West Bank of Palestine, the species was not known to occur in the Gaza Strip since at least the last 7-8 decades as told by aged inhabitants. The Palestinians name the animal as “Abu El-Fatayes”; a name indicating that the species is a “scavenger”, feeding on carcasses or dead animals, in spite of its ability to kill large preys including domestic animals. Depending on stories drawn by aged Palestinians, the Striped Hyena was familiar in straying near their villages, rural dwellings and agricultural orchards searching for food and water. By its powerful jaws, the Striped Hyena can crack large bones. Different types of animal bones are usually encountered at the entrance of Hyena den (see Kerbis-Peterhans and Horwttz 1992; Qumsiyeh 1996; Qarqaz et al. 2004; Abi-Said and Marrouche 2007) and this bone collection is an actual sign of a Hyena den identification as indicated by aged Palestinians.

As many as 7 individuals of the Striped Hyena were encountered in the Gaza zoological gardens. All caged Hyenas were introduced from Egypt through tunnel trade. Although the species is unloved by the Palestinian

community, the caged species seemed to attract zoo visitors perhaps due to its strange physical appearance as well as its fear stories and films drawn by the locals. In parallel, one live caged specimen of the Spotted Hyena *Crocuta crocuta* (Erxleben 1777) was noticed in Khan Younis zoological garden. Although it is not a Palestinian carnivore, this imported specimen may give zoo visitors the opportunity to know more about Hyenas and their diversity in the wild of both Asia and Africa.

Greater Egyptian Gerbil *Gerbillus pyramidis* (Geoffroy 1825)

The Greater Egyptian Gerbil is the largest hairy-footed *Gerbillus* in the area. Although the upper color of the Gerbil varies from orange-brown to tawny-grey, the belly seems white. This nocturnal rodent is distributed mainly in North Africa, Sinai Peninsula, and Palestine in areas rich in cultivated and shrubby sandy soils and dunes. No recent scientific records indicated the occurrence of the Greater Egyptian Gerbil in the Gaza Strip (see Abd Rabou et al. 2007a). In a sudden event taken place in 2008, the author encountered 7 individuals of the species in a wire cage in a zoological garden in North Gaza (Figure 9). This was the first sight of the Greater Egyptian Gerbil in the Gaza Strip. Thence, many farmers confirmed the occurrence of the species in the cultivated sandy areas covering the western coastal belt of the Gaza Strip.

Indian Crested Porcupine *Hystrix indica* (Kerr 1792)

The Indian Crested Porcupine is the largest rodent species inhabiting the different ecological habitats of Palestine. It is a herbivore; feeding mostly on plant materials including roots and bulbs. The dorsal surface is covered with quills ranging from 25-35 centimeters in length. These quills are a good defense strategy for the animal when disturbed by enemies. Although it was considered as a disappeared animal in the Gaza Strip (Abd Rabou 2005; Abd Rabou et al. 2007a), recent meetings and discussions with locals inhabiting the eastern belt of the Gaza Strip revealed that the Indian Crested Porcupine is still found and is rarely seen. The presence of residual quills – picked up by the author himself and many other inhabitants in the area – may confirm such an occurrence of the species.

The Indian Crested Porcupine seemed to be found in all Gaza zoological gardens (N = 28). Such cages may harbor 3-6 individuals. No evidence indicating that the species was hunted in the Gaza Strip. Nevertheless, all the encountered individuals seemed to be introduced from Egypt through the tunnel trade. Successful deliveries of the Indian Crested Porcupine were documented in Gaza zoological gardens as well (Figure 10). One funny and risky aspect of the animals, attracting the eyes and hearts of zoo visitors, is their defense strategy, where they are known to charge backward towards visitors who disturbing them. Cages of Porcupines usually contain quills of different sizes and different developmental stages that may promote many zoo visitors to request them from zookeepers.

Palestine Mole-rat *Spalax leucodon ehrenbergi* (Nehring 1898)

The Palestine Mole-rat is a subterranean mammalian species having atrophied eyes. It is considered as an actual pest for farmers due to its continual feeding upon roots, bulbs, and tubers of the agricultural crops. In open fields, it is very difficult to see the animal outside because it spends its life building tunnels and burrows. As a result, the earth heaps made by the Palestine Mole-rat are commonly seen by the Palestinians in a variety of agricultural and open fields. The powerful incisors of the animal are used as major tools for its digging behavior (Figure 11). Although it is unusual to find local people trapping or holding the Palestine Mole-rat, it was a good opportunity by the author to attend a striking event of a farmer bringing a live specimen to a zoological garden in North Gaza. Zookeepers find it is impossible to cage live specimens of the species for long due to the animal's digging behavior and ultimate death. Instead, as many as 3 specimens of the species were found stuffed in formalin solutions at few zoological gardens in Gaza.

Cape Hare *Lepus capensis* (Linnaeus 1758)

The Cape or Brown Hare is a common and well-known mammalian species throughout Palestine. It inhabits various ecological habitats extending from the rocky mountains and deserts to coastal plains. It feeds on a variety of plant forms extending from grasses to shrubs. Currently, the Cape Hare is facing the danger of disappearance in the Gaza Strip due to over-hunting, overpopulation, and habitat destruction and modification. The use of ground mist nets, leghold metal traps, and sometimes spare guns to hunt the Cape Hare is a common practice in the Gaza Strip. Locals claimed that the Cape Hare is mainly hunted for its delicious meat. Other causes of hunting including game, sport, and trade could not be excluded as well. Single Cape Hares are occasionally seen by the Palestinian community in vegetated areas and sand dunes of the Gaza Strip. The author has never encountered live specimens of the Cape Hare in Gaza zoological gardens. In contrast, many zoo owners claimed that Cape Hares (N = 4) were bought and caged in their zoological gardens, but they did not stay for long because of their ultimate death. Two specimens of the Cape Hare were found poorly stuffed at two of the Gaza zoological gardens.

Dorcas Gazelle *Gazella dorcas* (Linnaeus 1758)

Two species of Gazelles occur in Palestine; they are the Dorcas gazelle and the closely related Mountain Gazelle *Gazella gazella*. The Dorcas Gazelle is widespread in a different variety of ecological habitats in Palestine, especially the arid and semi-arid environments. According to Qumsiyeh (1996), hunting and human activities have diminished the distribution of the species to desert and sub-desert areas where the disturbance is negligible. Before the Israeli settlement evacuation from the Gaza Strip in late 2005, there were signs of the roaming of the Dorcas gazelle near the northern borders of the Gaza Strip with Israel, where many residual forests were present. As many as 8



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5



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7



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9



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11



12



13



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Figures: 3. The Golden Jackal *Canis aureus*; 4. The Grey Wolf *Canis lupus*; 5. The Red Fox *Vulpes vulpus*; 6. The Jungle Cat *Felis chaus*; 7. The Marbled Polecat *Vormela peregusna*; 8. The only sight of the Common Badger *Meles meles* was made in the Rafah private zoological garden before its demolition by the Israeli tanks and bulldozers (21 May 2004); 9. Caged individuals of the Greater Egyptian Gerbil *Gerbillus pyramidis*; 10. A caged juvenile Indian Crested Porcupine *Hystrix indica*; 11. The Palestine Mole-rat *Spalax leucodon ehrenbergi*; 12. The Dorcas Gazelle *Gazella dorcas*; 13. The Domestic Camel *Camelus dromedarius* ranging freely in the Gaza Strip; 14. The Long-eared Hedgehog *Hemiechinus auritus*

individuals of the Dorcas gazelle were encountered in Gaza zoological gardens (Figure 12). They were imported from Egypt through tunnel trade. They are usually kept in the same cages harboring the imported Red Deer *Cervus elaphus* (Linnaeus 1758), which exists in tens in Gaza zoological gardens.

Dromedary Camel *Camelus dromedarius* (Linnaeus 1758)

The Dromedary or Arabian Camel is no longer exists in the wild in Palestine and neighboring countries, as it was probably domesticated some 3500 years ago in Arabia (Qumsiyeh 1996). It is a common scene for the Palestinians to find or watch herds of the Domestic Camels ranging freely in the Gaza Strip (Figure 13). In Gaza zoological gardens as well as in the beach belt of the Gaza Strip, the Dromedary Camel is commonly seen used as a recreation facility and a source of income for many subsistent Bedouin families. The meat and milk are consumed on a large scale especially among the Bedouin families inhabiting the Gaza Strip and the Negev desert of Palestine. The milk of Camels is said to have many healthful properties and as a result, it is commonly used as a cultural cure for different illnesses. As many as 11 individuals of the Dromedary Camel were encountered in Gaza zoological gardens. Along with the Dromedary Camel, many zoological gardens were found to import – through the tunnel trade – the Llama *Lama glama* (Linnaeus 1758), which belongs to the Camelidae family, in order to enrich their zoo animals and at the same time to show the characteristics of this wonderful mammal which lacks the hump compared to the Dromedary Camel.

Long-eared Hedgehog *Hemiechinus auritus* (Gmelin 1770)

The Long-eared Hedgehog inhabits different agro-ecosystems in Palestine. Singles of this species are seldom encountered by the author in the vegetated areas of the Gaza Strip (Figure 14). What characterize this species, compared to the Ethiopian Hedgehog *Paraechinus aethiopicus*, are its relatively long ears and its relatively small size. The two Hedgehog species of the Gaza Strip are known to be sometimes eaten by some locals, especially the Bedouin families, living in the margins. Thus, the two species are falling under an actual threat. They are usually caught either using ground mist nets or easily by hands. As many as 5 live specimens of the Long-eared Hedgehog were encountered in Gaza zoological gardens. Two specimens were also seen preserved in formalin solution.

Ethiopian Hedgehog *Paraechinus aethiopicus* (Ehrenberg 1832)

The Ethiopian or Desert Hedgehog seems to resemble the Long-eared Hedgehog in terms of its living conditions, as it may live in desert areas as well. Only 4 live specimens were encountered in Gaza zoological gardens.

Discussion

Our study was built on an earlier work in which Abd Rabou (2005, 2009a) and Abd Rabou et al. (2007a) reported about 20 mammalian species, some of them are included in the present study. The present study revealed

that the Gaza Strip (an area rarely surveyed by zoologists) is similar to other areas of Palestine in having a significant number of mammalian fauna. The 17 species we report in Gaza zoological gardens represent a good mix of the families and sizes of mammals generally found in other parts of Palestine (Qumsiyeh 1996) and the other neighboring countries of the Middle East (Serhal 1985; Yom-Tov 1988; Nader 1990; Harrison and Bates 1991; Hatough and Disi 1991; Amr et al. 1996; Seddon et al. 1997; Mendelssohn and Yom-Tov 1999; Amr 2000; Hoath 2003; Masseti 2004, 2009). This comes in accordance with Boitani and Bartoli (1983) who stated that about 78 % of the mammalian families of the Palearctic realm are shared with the Ethiopian realm and 70 % with the Oriental realm. The surprising diversity including the nine carnivore species (a total number of 16 carnivore species occurs in Palestine as a geographically diverse area) of our study could be attributed to ecosystem and landscape diversity combined with human development that supports the occurrence of such species.

Our study does raise serious questions about the future of the Gaza Strip. The Gaza Strip is located at the southern portion of the Palestine coast along the Mediterranean Sea and it harbors a variety of wildlife including terrestrial and aquatic forms as indicated by ongoing studies (Abd Rabou 2005, 2009a, 2011; Yassin et al. 2006; Abd Rabou et al. 2007a, b, c; and this study). The ever-increasing human impact on the existing natural resources in the Gaza Strip has caused the destruction of populations of many species including Gazelles, Porcupines, and large carnivores. There is strong evidence that the economic deprivation, political instability and lack of wildlife protection have made wildlife trading a common practice. With a per capita income for the minority with jobs (a mere 30% of the population) of less than U.S. \$ 1000 per year, a trapped carnivore selling at U.S. \$ 50-100 makes a compelling argument to families in crisis. Hunting of wild mammals for food in the Gaza Strip is restricted to Hares and Hedgehogs and does not involve carnivores, which are hunted for other reasons (Abd Rabou 2005, 2009a; Abd Rabou et al. 2007a).

Poisoning and poaching of mammals and other wildlife species by the Palestinian farmers and ranchers trying to protect their income is a common practice. In few field visit, dead Jackals (N = 1) and Egyptian Mongooses (N = 6) in addition to a considerable number of Domestic or Feral Cats *Felis catus* were noted by the author. Most of these dead animals were considered as vertebrate pests causing harm to livestock and husbandry animals and as a result, they were probably poisoned or killed by farmers and local people. The same situation was recorded in a neighboring country like Jordan where Abu Baker et al. (2003) pointed out that much mammalian fauna including the Jungle Cat, Red Fox and Wild Boar *Sus scrofa* (Linnaeus 1758) were regarded as vertebrate pests and they were found to be poisoned by the Jordanian villagers and farmers because of their attack to livestock and fruit trees. In Israel, the Golden Jackal *Canis aureus* was poisoned due to its predation on livestock (Yom-Tov et al. 1995).

The lack and poor implementation of environmental laws and legislation in the Occupied Palestinian Territories was reflected on practicing wildlife hunting in the Gaza Strip. The situation concerning wildlife protection in the Gaza Strip is deteriorating day by day in an alarming fashion, where the populations of some wildlife species could be declined to levels that species may go extinct. In Israel, all wildlife species have legal protection, though illegal hunting and poaching of mammals and other wildlife elements were documented to be practiced by Thai workers for food purposes (Yom-Tov 2003).

The withdrawal of the Israeli army and its settlements from the Gaza Strip in August 2005 further exacerbated the problem because of accessibility to the 40% of the land mass of Gaza that was previously forbidden to Palestinians. Nowadays, the situation is still risky especially near the borders with Israel; many hunters were mistaken for resistance fighters and killed (Personal Communications and Local Media Reports). The establishment of many zoological gardens in the Gaza Strip in the last few years was also directly related to the isolation of the Gaza Strip (zoological gardens provide a venue for recreational activities and revenue for their owners). Combined with poor resources to take care of and feed existing captured animals, this further promoted more wildlife hunting.

The import of zoo animals; particularly mammals, through the tunnels joining the Gaza Strip with the Egyptian territories could be justified because of the Israeli blockade imposed on the Gaza Strip since 2006, where all crossing points of the Gaza Strip with Israel and Egypt are tightly closed (Abd Rabou 2009b). The political, economic and psychological pressures imposed on the Palestinians living in the Gaza Strip during the ongoing Israeli blockade era promoted the establishment of private zoological gardens. From a recreational point of view, the local supply of zoological gardens with wildlife species hunted in the Gaza Strip cannot satisfy the desire of the Palestinians to know more about wild animals. Hence, such a tunnel trade was necessary to close the gap through importing key mammals from outside. In addition to the import of the mammalian species that have a wider distributional range through Palestine and the neighboring Middle East and North Africa countries, other non-Palestinian mammals have been introduced. These included the Lion *Panthera leo*, Tiger *Panthera tigris*, Spotted Hyena *Crocuta crocuta*, Fennec Fox *Vulpes zerda*, Savanna Monkey *Cercopithecus aethiop*, Llama *Lama glama*, Red Deer *Cervus elaphus*, and many others.

The veterinary treatment of zoo mammals in the Gaza Strip is poorly applied, and as a result, many individual mammals have passed away during the last four years. The health status of zoo animals usually varies with different factors such as management, feeding, environment, sanitation and seasonal variation (Shrikhande et al. 2008). In the light of this fact, the one capital point should be taken into consideration by zookeepers regarding better zoo management is that zoo animal; particularly mammals, need to be housed according to the species social system. The quality of the nutrition and housing provided for the mammals at the Gaza zoological gardens was in part

reflected by the good general conditions of the caged mammalian fauna. In the Republic of Yemen, De Haas van Dorsser et al. (2003) stated that animals of the Sana'a and Tai'z zoological gardens had reasonable diets and housing, but overstocking, poor handling and lack of preventive medicine were found to compromise the welfare of these zoo animals. Besides, deliveries among Palestinian and non-Palestinian mammals were recorded in Gaza zoological gardens e.g. Golden Jackals, Lions, Savanna Monkeys, and Red Deer. Such deliveries are considered as an important source of zoo animals to the other zoological gardens in the Gaza Strip. Scientific research on the developmental stages and the breeding behavior of certain zoo mammalian species could be achieved as well. From an educational point of view, zoological gardens were known as important sources of biological knowledge. They played an important role in the development of descriptive biological sciences in the 19th Century (Prince 2001). This may be translated in advanced research in Gaza zoological gardens concerning the biology, ecology, and behavior of wildlife.

CONCLUSION

In conclusion, common political, economic and social factors in addition to the poor implementation of environmental laws and legislation promoted wildlife hunting and trading in the Gaza Strip. Although, this could be considered as a negative sign by scientific parties, especially ecologists and conservationists, such hunting of key mammalian species could be a good tool in enriching Gaza zoological gardens with the demanded zoo animals. This could be rationalized for Gazans who are living under conditions having no similarities in other parts of the world. This is simply because of the Israeli occupation who spared no effort to destroy the total Palestinian environment under the claimed umbrella of security needs of the Israel State. In spite of this painful dilemma, the author recommends to improving the management process of Gaza zoological gardens under the care of the governmental authorities and the cooperation of the different parties in the Gaza Strip to enhance public ecological awareness to protect and conserve wildlife; especially mammalian fauna.

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