

The Palestinian Terrestrial Vertebrate Fauna Preserved at The Biology Exhibitions of The Universities of The Gaza Strip

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ABSTRACT

The Gaza Strip (365 km²) of historical Palestine (27,000 km²) is home to a wealth of terrestrial vertebrate fauna. Some of these faunistic species were preserved at local universities. Hence, the current study comes to document the Palestinian terrestrial vertebrate fauna acquired by the biology exhibitions (BEs) of Al-Azhar University, Islamic University of Gaza and Al-Aqsa University that are located at the Gaza City of the Gaza Strip. The amphibians, reptiles, birds and mammals preserved at BEs of the universities in question were surveyed and scientifically classified during a three-month period extending from January to March, 2012. The study showed that all BEs of local universities are underdeveloped, lacking attention and suffer from specimen scarcity and good preservation. A total number of 200 specimens belonging to 54 terrestrial vertebrate species, 39 families and 17 orders was recorded at BEs. Reptiles constituted 40.7% of the total species recorded, followed by birds (38.9%), mammals (14.8%) and amphibians (5.6%). The Islamic University of Gaza was considered the best in terms of the number of preserved species (39.8%), followed by Al-Azhar University (36.3%) and Al-Aqsa University (23.9%). The Common Toad (*Bufo viridis*) was the most preserved among the amphibian species recorded. Squamata was the biggest reptilian order, comprising 20 species (8 lizard and 12 snake species), with the Syrian Black Snake (*Dolichophis jugularis asianus*) was the commonest. The Palestine Viper (*Daboia palaestinae*) is most venomous and dangerous to human health. The Great White Pelican (*Pelecanus onocrotalus*) was the largest migratory bird preserved at BE of Al-Azhar University. The Egyptian Mongoose (*Herpestes ichneumon*) and the Common Badger (*Meles meles*) were the biggest mammalian specimens preserved, while the Palestine Mole-rat (*Spalax leucodon ehrenbergi*) was the only Palestine endemic species encountered among the preserved mammals. Finally, the improvement of BEs of local universities and the construction of a central museum of natural history is highly recommended in order to change people's attitudes toward biodiversity in the Gaza Strip.

Introduction

The strategic position of Palestine (27,000 km²) at the meeting point of the three continents; Asia, Africa and Europe encourages the diversity of vertebrate fauna of Afrotropical, Oriental and Palaearctic origins [1]. Palestine is home to 540 bird, 100 mammalian, and 120 reptilian and amphibian species [2,3]; The Palestinian Central Bureau of Statistics – PCBS, 2000, United Nations Environment program – UNEP, 2003; Environment Quality Authority – EQA, 2006 and Perlman and Meyrav, 2009). A lot of studies concerning the terrestrial vertebrate fauna have been carried out in the Palestinian Territories (West Bank and Gaza Strip) [4,5] Project for the Conservation of Wetland and Coastal Ecosystems in the Mediterranean Region [6-10]. All these studies ensured the role of the Palestinian ecosystems and habitats in introducing mating, nesting, resting, roosting, mimicry, protection and food sites for vertebrate wildlife.

Natural history museums and biology exhibitions (BEs) with their animal collections provide the scientific parties and societies with current and historical records to best understand the biodiversity and the value of the natural world surrounding them [11-15]. The Palestine Museum of Natural History was established in 2014 at the Bethlehem University, southern West Bank of Palestine in order to change human attitudes toward the environment and to encourage biodiversity preservation [16-18]. The situation in the Gaza Strip was and is still very dramatic with regard to museums and biology exhibitions.

The Gaza Strip has many universities and colleges offering different programs in a variety of disciplines. Most of these educational institutions have some sort of under-developed BEs providing educational biodiversity services to school and university students. Different poorly-preserved zoological collections and mounted skeletons are commonly found at these BEs. Most of these collections came through donations by various members of the Palestinian community including scientific professionals, students, hunters and the public. University students, laboratory technicians and/or teaching assistants, mostly make taxidermy and preservation processes. The current study aimed at documenting the Palestinian terrestrial vertebrate fauna acquired by the BEs of some selected universities of the Gaza Strip.

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 (Figure 1). It represents the northern link between the Sinai and the Negev deserts (UNEP, 2003). About 2.0 million residents, of whom the majority is 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 (UNEP, 2003). They are, from north to south, Wadi Beit Hanoun, Wadi Gaza and Wadi Al-Salqa. The Gaza City, which is home to the majority of universities and colleges, is the largest city in the Gaza Strip. It has a total area of about 56 km², and a population of about 700,000, making it one of the most densely populated cities in the world [19].



Figure 1: Location of the Gaza Strip.

Universities of the Gaza Strip

The Gaza Strip is host to many universities and higher education institutions. Three of these universities, which have departments of biology, have been selected to carry out the current study. They were Al-Azhar University, Islamic University of Gaza, and Al-Aqsa University. The universities are supervised by the Ministry of Higher Education. Nowadays, they offer B.A., B.Sc., M.A., M.Sc., and sometimes Ph.D. programs in addition to many diplomas and higher diplomas in a variety of disciplines.

Biology Exhibitions (BEs) of Local Universities

The Departments of Biology of local universities are host to BEs of different spaces, qualities and animal collections that are commonly mounted or preserved in formalin. In order to exhibit their specimens, BEs are commonly equipped with reservoirs, shelves and display cabinets of different sizes. The dry mounts or the specimen-containing bottles were sometimes labeled with the Arabic, common and scientific names. BEs are commonly accessed by school and university students and researchers who have interests to explore such preserved animals.

Procedure, Photography and Statistical Analysis

The current study was based on continuous visits to BEs supervised by the Departments of Biology of the three universities; namely Al-Azhar University, Islamic University of Gaza and Al-Aqsa University. The terrestrial vertebrate fauna specimens (amphibians, reptiles, birds and mammals) preserved at these BEs were surveyed during a three-month period (January – March, 2012). The identification process of the preserved species was made easy using published local, regional and international keys and guidebooks [20-35]. Professional digital cameras were used throughout the study period and photos were taken for documentary and confirmatory purposes. The data collected throughout the study were statistically analyzed using SPSS computer program version 18.0 for Windows (Statistical Package for Social Sciences Inc, Chicago, Illinois). Graphs were plotted using Microsoft Excel program 2010.

Results

The current study dealt with the Palestinian terrestrial vertebrate fauna (Amphibia, Reptilia, Aves and Mammalia) preserved at BEs of the Al-Azhar University, Islamic University of

Gaza and Al-Aqsa University, which are located at the Gaza City of the Gaza Strip. A lot of the biological specimens preserved in formalin solutions and placed in cupboards, cabinets or shelves. The specimens suffer from deformation, decomposition, or color change. Most preserved specimens, have not been scientifically classified. The BE at Al-Azhar University is considered the best museum in terms of arrangement and preservation of specimens, especially for bird specimens. A retired kind professor known to the authors embalmed the bulk of the well-stuffed bird specimens, encountered throughout the current study. A total number of 200 specimens belonging to 54 terrestrial vertebrate fauna species, 39 families and 17 orders of the classes Amphibia, Reptilia, Aves and Mammalia was recorded at three BEs of the local universities (Tables 1 & 2) (Figures 2 & 3). In terms of species identified, reptiles constituted 40.7% of the total species recorded, followed by birds (38.9%), mammals (14.8%) and Amphibians (5.6%) as shown in (Tables 3) (Figure 3). In terms of the number of preserved species, the Islamic University of Gaza and Al-Azhar University were represented by 39.8% and 36.3% respectively. Al-Aqsa University was the lowest as it was represented by 23.9% (Table 3) (Figure 4). The details of each vertebrate class are described as follows:

Table 1: Number of terrestrial vertebrate fauna specimens per class preserved at BEs of local universities.

Classes	Azhar	Islamic	Aqsa	TOTAL	Percentage of specimens (%)
Amphibia (Amphibians)	5	12	9	26	13.0
Reptilia (Reptilians)	38	46	31	115	57.5
Aves (Birds)	28	7	2	37	18.5
Mammalia (Mammals)	8	9	5	22	11.0
TOTAL	79	74	47	200	100%

Table 2: Numbers of orders, families and species of terrestrial vertebrate fauna preserved at BEs of local universities.

Classes	Orders	Families	Species	Percentage of species (%)
Amphibia (Amphibians)	1	3	3	5.6
Reptilia (Reptilians)	2	13	22	40.7
Aves (Birds)	10	17	21	38.9
Mammalia (Mammals)	4	6	8	14.8
TOTAL	17	39	54	100%

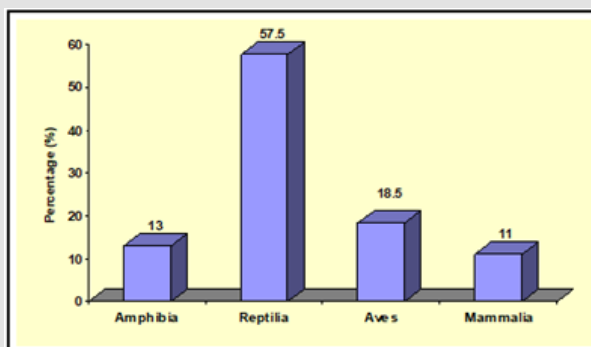


Figure 2: A graphic model showing the percentages of specimens of each terrestrial vertebrate class preserved at BEs of local universities.

Table 3: Number and frequency of species of each terrestrial vertebrate fauna preserved at BEs per university.

Classes	Azhar	Islamic	Aqsa
Amphibia (Amphibians)	2	3	3
Reptilia (Reptilians)	10	20	14
Aves (Birds)	17	6	1
Mammalia (Mammals)	3	6	3
TOTAL	32	35	21
Percentage of species per university (%)	36.3	39.8	23.9

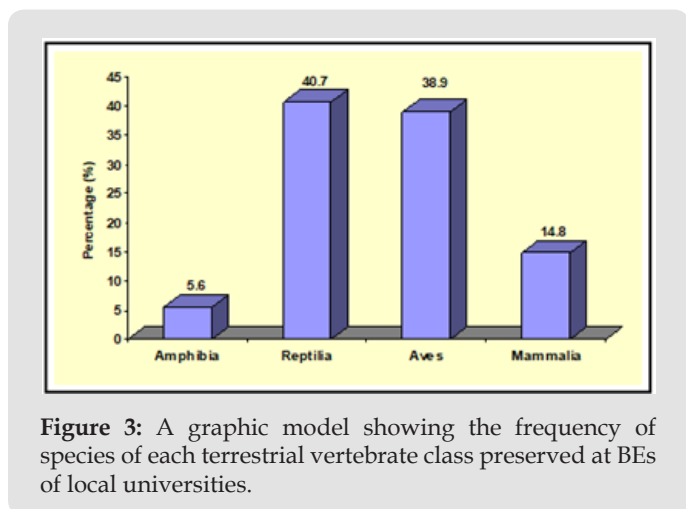


Figure 3: A graphic model showing the frequency of species of each terrestrial vertebrate class preserved at BEs of local universities.

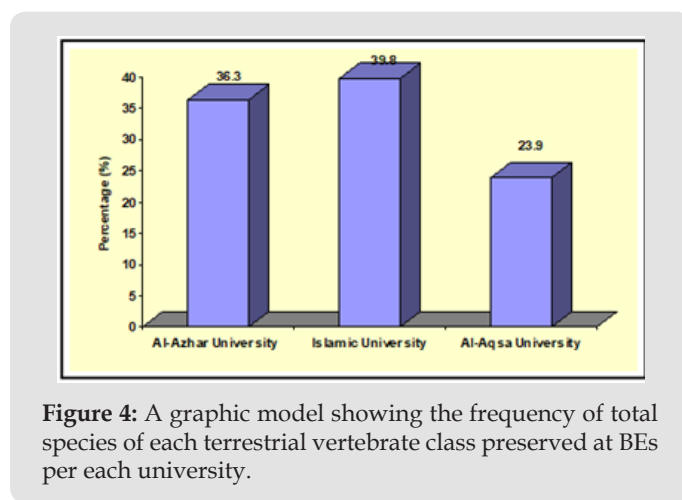


Figure 4: A graphic model showing the frequency of total species of each terrestrial vertebrate class preserved at BEs per each university.

Amphibians

The current study recorded three amphibian species belonging to three families and one order (Anura or tailless amphibians) preserved at BEs of the three local universities (Table 4) (Figure 5). All amphibian species are resident and found throughout the

year in the Gaza Strip. They inhabit various ecosystems in the Gaza Strip including wadis (valleys), rainwater pools, irrigated canals and agricultural fields. The Common Toad (*Bufo viridis*) was by far the most preserved among the frog species recorded. This species is commonly used for dissection purposes in the general and vertebrate zoology laboratories at local universities.

Table 4: The Palestinian Amphibian Fauna Preserved at the Biology Exhibitions of Local Universities – Gaza Strip.

Arabic Name	Common Name	Scientific Name	Family	Number of specimens per species preserved at Gaza Universities			Total
				Al-Azhar	Islamic	Al-Aqsa	
Order Anura (ليدنا قم يدع ستاي لي ذاللا)							
Bufonidae (True Toads) (تيفي يقي حل امي جال عالا)	Bufotes variabilis (Bufo viridis)	European Green Toad	وأ عدفضلا يبوروالا موي جال عالا عياشلا	3	6	4	13
Ranidae (Riparian Frogs) (تيفي طاشملا تاي عدفضلا)	Rana bedriagae (Pelophylax bedriagae)	Levant Water Frog	ءاملا عدفض رض عالا	0	2	2	4
Hylidae (Tree Frogs and Allies) (تيفي رجشلا عدافضلا)	Hyla savignyi	Savigny's Tree Frog	يرجشلا عدفضلا	2	4	3	9
Total				5	12	9	6

Reptiles

A total number of 22 reptilian species belonging to 12 families and two orders was preserved at BEs of local universities (Table 5) (Figure 5). All reptilian species are resident and found

throughout the year in the Gaza Strip. Squamata was the biggest order, comprising 20 species (8 lizards and 12 snakes). The Desert Monitor (*Varanus griseus*) was, by far, the biggest lizard species preserved at BEs of local universities. Among the lizard species

preserved, the Agama (*Stellagama stellio*) and the Ocellated Skink (*Chalcidae ocellatus*) were the most common preserved lizards. With regard to snakes, the family Colubridae was the biggest among the snake species listed in Table 5. It was represented by 7 species. The Syrian Black Snake or Arbeed (*Dolichophis jugularis asianus*), The Coined Snake (*Hemorrhhois nummifer*) and the Palestine Viper (*Daboia palaestinae*) were, by far, the most common preserved snakes. The latter is endemic in the Palestine environment. Most

snake bites are attributed to this venomous species. The Testudines order was represented by two a terrestrial and a freshwater species. Local inhabitants are fond of collecting the juveniles and adults of the Greece Turtle or Spur-thighed Tortoise (*Testudo graeca*) and Caspian Turtle or Striped-neck Terrapin (*Mauremys caspica*) to keep them as pet animals at homes, gardens or to sell them to local animal trade shops.

Table 5: The Palestinian Reptilian Fauna Preserved at the Biology Exhibitions of Local Universities – Gaza Strip.

Family	Scientific Name	Common Name	Arabic Name	Number of specimens per species preserved at Gaza Universities			Total
				Al-Azhar	Islamic	Al-Aqsa	
Order Testudines تاي فحلسلا							
Testudinidae تاي فحلسلا	<i>Testudo graeca</i>	Greece Tortoise (Spur-thighed Tortoise)	تاي فحلسلا (كروا تاي فحلسلا)	5	1	1	7
Geoemydidae تاي فحلسلا	<i>Mauremys caspica</i>	Caspian Turtle (Striped-neck Terrapin)	تاي فحلسلا (تاي فحلسلا)	0	1	0	1
Order Squamata تاي فحلسلا							
Varanidae لاروالا	<i>Varanus griseus</i>	Desert Monitor	يوار حلسلا لاروالا	2	2	0	4
Chamaeleonidae يبارحلا	<i>Chameleo chameleon</i>	Mediterranean Chameleon	تاي فحلسلا (يبارحلا)	5	3	0	8
Geckonidae (تاي فحلسلا)	<i>Hemidactylus turcicus</i>	Turkish Gecko	تاي فحلسلا (تاي فحلسلا)	0	2	2	4
	<i>Ptyodactylus hasselquistii</i>	Light Fan-footed Gecko	تاي فحلسلا (تاي فحلسلا)	0	2	0	2
Lacertidae (تاي فحلسلا)	<i>Acanthodactylus boskianus</i>	Bosc's Lizard	تاي فحلسلا (تاي فحلسلا)	0	3	1	3
Agamidae اياضعلا	<i>Stellagama stellio</i> (Laudakia stellio)	Starred Agama	تاي فحلسلا (تاي فحلسلا)	4	2	7	13
13Scincidae (تاي فحلسلا)	<i>Chalcidae ocellatus</i>	Ocellated Skink	تاي فحلسلا (تاي فحلسلا)	6	2	4	12
	<i>Trachylepis vittata</i> or <i>Mabuya vittata</i>	Bridled Mabuya	تاي فحلسلا (تاي فحلسلا)	0	0	1	1
Typhlopidae تاي فحلسلا	<i>Xerotyphlops vermicularis</i>	Eurasian Blind or Worm Snake	تاي فحلسلا (تاي فحلسلا)	0	1	0	1
Boidae تاي فحلسلا	<i>Eryx jaculus</i>	Sand Boa	تاي فحلسلا (تاي فحلسلا)	0	3	0	3
4Colubridae (تاي فحلسلا)	<i>Coluber jugularis asianus</i>	Syrian Blake Snake (Arbeed)	تاي فحلسلا (تاي فحلسلا)	5	6	2	13
	<i>Coluber rubriceps</i>	Red Whip Snake	تاي فحلسلا (تاي فحلسلا)	0	3	1	4



Figure 5: Herpetofauna (Amphibians and reptiles) preserved at the biology exhibitions of local universities - Gaza Strip:

- A. European Green Toad (*Bufo viridis*)
- B. Greece or Spur-thighed Tortoise - Juvenile (*Testudo graeca*)
- C. Ocellated Skink (*Chalcidaeocellatus*)
- D. Agama (*Laudakiaor Agamastellio*)
- E. European Cat or Soosan Snake (*Telescopusfallax*)
- F. Cliffored's Royal Snake (*Spalerosophisdiademaciffordi*)
- G. Syrian Black Snake or Arbeed - Juvenile (*Coluberjugarisasianus*)and
- H. Palestine Viper (*Viperaor Daboiapalaestinae*).

Birds (Aves)

A total number of 21 bird or avian species belonging to 17 families and 10 orders was preserved at BEs of local universities (Table 6) (Figure 6). The bird species encountered were either residents or migrants. Passeriformes, which forms the passerine birds, was, by far, the largest order comprising 6 species (28.6%). The non-passerine birds, which form the rest of bird orders, comprised 15 species (71.4%). The Great White Pelican (*Pelecanus onocrotalus*) was the largest bird and represented by a single specimen at the BE of Al-Azhar University.

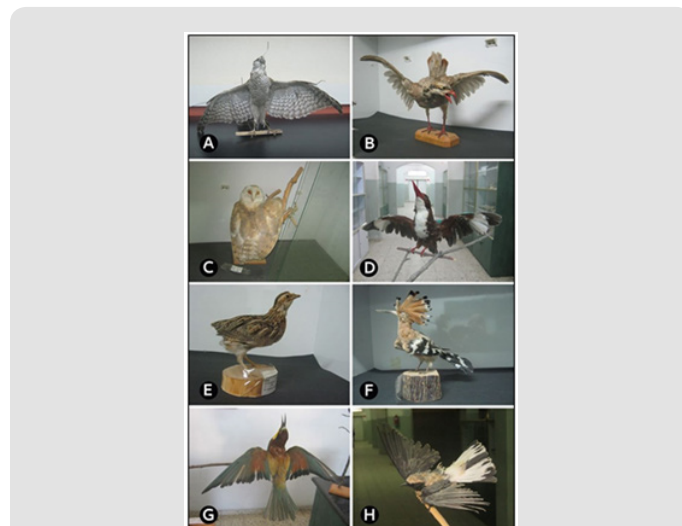


Figure 6: Bird fauna preserved at the biology exhibitions of local universities - Gaza Strip:

- A. Eurasian Sparrowhawk (*Accipiter nisus*)
- B. Chukar (*Alectoris chukar*)
- C. Barn Owl (*Tyto alba*)
- D. White-breasted Kingfisher (*Halyconsmyrnensis*)
- E. Common Quail (*Coturnix coturnix*)
- F. Hoopoe (*Upupa epops*)
- G. European Bee-eater (*Meropsapiaster*) and
- H. Black-eared Wheatear (*Oenanthe melanoleuca*).

Table 6: The Palestinian Avian (Bird) Fauna Preserved at the Biology Exhibitions of Local Universities - Gaza Strip.

Family	Scientific Name	Common Name	Arabic Name	Number of specimens per species preserved at Gaza Universities			Total
				Al-Azhar	Islamic	Al-Aqsa	
Great White Pelican (تاي عجبلا)							
Pelecanidae تاي عجبلا	<i>Pelecanus onocrotalus</i>	Great White Pelican	ضربال عجبلا	1	0	0	1
(ةيشاملا نوشللب) نادرق وبأ	Cattle Egret	Bubulcus ibis	Ardeidae ةينوشللبلا	1	0	0	1
(تاي عجبلا) Order Accipitriformes (قربال عراجلا)							
Accipitridae رس اولقلا	<i>Accipiter nisus</i>	Eurasian Sparrowhawk	يساروالا قشابلا	1	0	1	0

	Buteo vulpinus	Steppe Buzzard	لومسلا ماوح رقصلا	1	0	0	1
		Order Galliformes (
Phasianidae في جردنتلا	Chukar	Alectoris chukar	(لججلا) رانشلا	2	0	0	2
	Common Quail	Coturnix coturnix	– نامسل) رفل (يولسل)	2	0	1	1
	Numida meleagris	Helmeted Guinea-fowl	ينوع رفل اججدلا	1	0	0	1
Order Charadriiformes (تاي قازقزلا)							
Charadriidae في طاقطولا	Vanellus spinosus	Spur-winged Plover	يماشلا قازقزلا حانجل يزامم وأ (اطقلا)	1	0	0	1
Order Columbiformes (
Columbidae في مامحلا	Columba livia	Rock or Feral Pigeon	يرخصلا مامح	5	2	2	1
Order Strigiformes (
Strigidae في موبلا	Tyto alba	Barn Owl	موبلا) نرجلا موب (عاض يبل)	4	0	0	4
Caprimulgidae في دبسل	Caprimulgus europaeus	European Nightjar	يبوروال دبسل (ليللا رقص)	1	0	1	0
Order Coraciiformes (
Alcedinidae في دنواقلا	Halycon smyrnensis	White-breasted Kingfisher	ضيب لكامل (دنواقلا) رقصلا	2	0	0	2
Meropidae في راورولا	Merops apiaster	European Bee-eater	يبوروال راورولا	4	0	0	4
Order Bucerotiformes (
Upupidae في دمدلا	Upupa epops	Hoopoe	يروسلا بشخل راق	1	0	0	1
Order Passeriformes (مشاوچلا و تاي روفصعلا)							
Alaudidae في ريبقلا	Galerida cristata	Crested Lark	عجوتمل اقربقلا	1	0	0	1
Hirundinidae في ونونسل	Hirundu rustica	Barn Swallow	روفصع ونونسل (قنجل)	1	0	0	1
Muscicapidae (تاي بابذملا) بابذلا تافطاخ	Luscinia svecica	Bluethroat	(لجدلا) رصملا	1	0	0	1
	Oenanthe melanoleuca	Black-eared Wheatear	لحكال يمال (نذال دوسا قلبال)	1	0	1	0
Turdidae تادرغمل	Turdus philomelos	Song Thrush	في نغمل قنمسل (نمسل)	1	0	1	0
Fringillidae ني ساسحلا	Carduelis carduelis	Goldfinch	يبذلا نوسحلا	1	0	1	0
Total				37	2	7	28

Mammals

A total number of 8 Palestinian mammalian species belonging to 6 families and 4 orders was preserved at BEs of local universities (Table 7) (Figure 7). All mammalian species are resident and mostly found throughout the year in the Gaza Strip. Rodentia was the biggest order, comprising 3 species. The Palestine Mole-rat (*Spalax leucodon ehrenbergi*) was the only Palestine endemic

species encountered throughout this study. The order Insectivora was represented by two nocturnal hedgehog species; namely the Long-eared Hedgehog (*Hemiechinus auritus*) and the Ethiopian Hedgehog (*Paraechinus aethiopicus*). Specimens belonging to orders Carnivora were restricted to two single species; namely the Egyptian Mongoose (*Herpestes ichneumon*), which is common in the Gaza Strip and the Common Badger (*Meles meles*) which is common in the West Bank of Palestine.

Table 7: The Palestinian Mammalian Fauna Preserved at the Biology Exhibitions of Local Universities – Gaza Strip.

Family	Scientific Name	Common Name	Arabic Name	Number of specimens per species preserved at Gaza Universities			Total
				Al-Azhar	Islamic	Al-Aqsa	
Order Carnivora (يرواضلا وأ موحللا تالكأ)							
Herpestidae تايرومسل	Herpestes ichneumon	Egyptian Mongoose	يرصملا سمنل	0	0	1	1
Mustelidae تايسرعل	Meles meles	Eurasian Badger	(ءاري رعل) ءري رعل	1	0	0	1
Order Insectivora (تارشل تالكأ)							
Erinaceidae تايذفنقلا	Hemiechinus auritus	Long-eared Hedgehog	نذال ليوظذفنقلا	5	2	0	7
	Paraechinus aethiopicus	Ethiopian Hedgehog	يبويشال ذفنقلا	0	1	1	1
Order Chiroptera (تايظوطل وأ تايشافخلا)							
Pteropidae رامشل تلكأ شيفافخلا	Rousettus aegyptiacus	Egyptian Fruit Bat	ءكافلا شافخ يرصملا	0	3	3	6
Order Rodentia (ضراوقلا)							
Muridae تايرافلا	Mus musculus	House Mouse	يلزنملا رافلا	0	1	1	2
	Gerbillus pyramidis	Greater Egyptian Gerbil	يرصملا عوبريلا ريبيلا	0	1	0	1
Spalacidae تايذلخلا	Spalax leucodon ehrenbergi	Palestine Mole-rat	دنلخلا وأ دلخلا وبا) ينيطسلفلا (ءيامع	2	1	0	3
Total				8	9	5	22

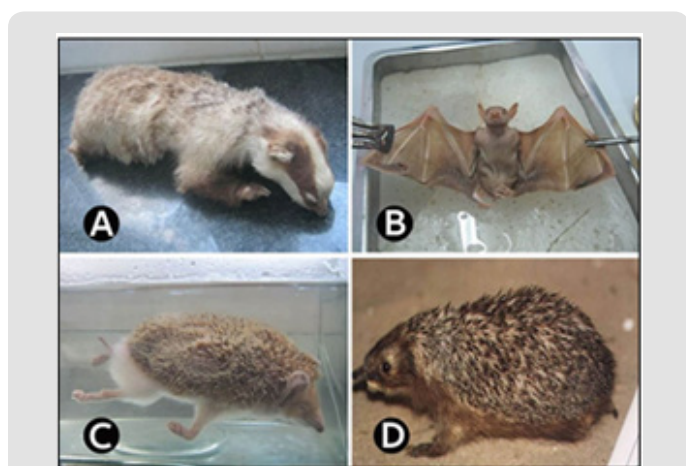


Figure 7: Mammalian fauna preserved at the biology exhibitions of local universities – Gaza Strip:

- A. Common Badger (*Melesmeles*)
- B. Egyptian Fruit Bat (*Rousettus aegyptiacus*)
- C. Long-eared Hedgehog (*Hemiechinusauritus*), and
- D. Ethiopian Hedgehog (*Paraechinus aethiopicus*).

Discussion

Palestine is a unique Middle East country in having a wealth of terrestrial vertebrate categories representing the classes of Amphibia, Reptilia, Aves and Mammalia. Many factors enhanced its biodiversity including the climate, topography, habitats, ecosystems and geographic position [36,37]. Urbanization, desertification, pollution and habitat alteration, modification and destruction are common threats to the diversity of Palestine’s biota. The construction of the apartheid isolation wall in the West Bank of Palestine has dramatic consequences on biodiversity as well [38]. The Israeli metal fences separating the Gaza Strip from the whole Palestinian lands occupied in 1948 played a crucial role in preventing the natural flow of large and medium-sized mammals to the Gaza Strip [39]. Wadi Gaza is a main nature reserve in the Gaza Strip; having rich fauna, including globally threatened, endemic, and rare species [40-45]. The escalating deterioration of Wadi Gaza in the middle of the Gaza Strip has negatively impacted wildlife ecology of the Gaza Strip [46].

The current study investigated the Palestinian terrestrial vertebrate fauna preserved at BEs of Al-Azhar University, Islamic

University of Gaza, and Al-Aqsa University. They are the oldest and largest universities in the Gaza Strip. The BEs of the universities in question were described as underdeveloped in the sense that they were and are still primitive; having a few stuffed and preserved animals, most of which were not scientifically classified. During visits conducted by some of the authors of the current work to BEs and small museums of many Arab universities including Khartoum University in Sudan, Jordanian University in Jordan, Cairo University in Egypt and King Abdulaziz University in Saudi Arabia (Figure 8), the situation there was incomparable with that of the Palestinian universities of the Gaza Strip in the sense that these universities have been host to well-organized biology museums or exhibitions. The three species of amphibians (order Anura) recorded throughout the current study at BEs of local universities were the same to those encountered in other local studies [47-52]. The easy catch of frogs and toads in their aquatic or semi-aquatic habitats promoted their high preservation level among the zoological specimens.



Figure 8: The BEs of Arab universities are totally better than and incomparable with the BEs of Gaza universities [The Biology Museum of the King Abdulaziz University (KAU), Jeddah, Saudi Arabia, 2012].

The current declines of amphibian populations in the Gaza Strip are highly expected because of habitat alteration, modification and destruction, heavy use of chemical pesticides, raw wastewater discharges into wadis or valleys, pollution of water courses and pools, water and soil salinities and the ongoing global climate change conditions. More or less threatening factors to amphibians have been suggested globally [53-55]. The apparent absence of salamanders (order *Urodela*) like the Banded Newt (*Triturus vittatus*) among the amphibians preserved at BEs could be attributed to the aridity conditions of the Gaza Strip. The species is well known to occur in north Palestine which is characterized by rainfall levels exceeding the threshold of 500 mm annually [56]. Reptiles were the most common preserved animals at BEs of the local universities. Such results are expected because the climate, topography and diversity of habitats and ecosystems of Palestine,

and hence the Gaza Strip, are very attractive to the different categories of reptiles such as turtles, lizards and snakes [57-61]. All reptilian species preserved at BEs were of Mediterranean affinities and most of them were encountered in studies carried out in Palestine, Jordan and Egypt [62-70].

The two recorded turtles of the current study face elevating threats because of their ease hunting and anthropogenic disturbance to their habitats. The Greece Turtle was reared by Gazans at homes and yards and this simply could be attributed to the herbivorous feeding habit in the sense that it can feed on a wide range of plant materials and residuals [71-73]. The majority of reptiles recorded at BEs were lizards and snakes. The Desert Monitor (*Varanus griseus*) is the largest among the lizards preserved at BEs. In fact, the species is highly endangered locally due to habitat alteration and destruction, intentional killing by Gazans because of the claim that the animal attacks their domesticated animals and eggs. Many studies confirmed the predation of the Desert Monitor on both wild and domesticated animals [74-76]. Colubridae is the biggest family of snake species encountered at BEs of local universities. Such a result comes as a reflection of the fact the family itself is the biggest in Palestine [78,79]. The two colubrids; the Syrian Black Snake (*Coluber jugularis asianus*) and the Coined Snake (*Coluber nummifer*), were the commonest among snake species preserved at BEs of local universities.

The commonality of these species was confirmed in local herpetological studies [78-80]. Another common preserved snake species at BEs was the Palestine Viper (*Vipera palaestinae*), which is endemic to Palestine and its neighboring countries especially Jordan [75,18,20]. In fact, Palestine is home to more than 40 snake species, with one-fourth of these snakes are poisonous [81-84]. Most of the snakes preserved at BEs of local universities were found having lesions in their bodies. These lesions came as a result of the intentional killing exerted on these animals by Gazans. In fact, both poisonous and non-poisonous snakes are sometimes intentionally killed because of fear with no regard to their ecological roles [85].

Although previous and current studies revealed a considerable number of both resident and migratory bird species occurring in the various ecosystems of the Gaza Strip [86-88], only 21 species were stuffed at BEs of local universities. Al-Azhar University was and is still the best in preserving and stuffing bird species. Each stuffed bird was found to be labeled and all data concerning its classification were present. Such a modest effort at the Department of Biology of Al-Azhar University could be attributed to a professor there who was and is still well known to the authors of the current work. That professor took the mummification of the bird specimens himself and directed them with the good appearance they enjoyed. The Great White Pelican (*Pelecanus onocrotalus*) was one of the largest Palestinian birds [89] and it was represented by a single specimen only at the BE of Al-Azhar University. In fact, the Great

White Pelican is a migratory bird sometimes seen in huge numbers soaring in the sky of the Gaza Strip [90]. The single specimen of the bird might come from the zoological gardens of the Gaza Strip, where tens of the species were caged there [91]. Many of the stuffed bird species are commonly hunted and trapped locally because of their delicious meat, with the Chukar (*Alectoris chukar*), Common Quail (*Coturnix coturnix*), and doves (*Streptopelia spp.*) are good examples [92]. Hunting of birds for meat and other purposes is also exerted in Jordan as a neighboring country to Palestine [81]. In fact, bird hunting seems to be common practice and a threatening factor to wildlife worldwide [84].

The current study revealed only 8 mammalian species preserved at BEs of local universities, all of them were of small sizes with the single specimens of the Egyptian Mongoose (*Herpestes ichneumon*) and the Common Badger (*Meles meles*) were the biggest. The Egyptian Mongoose is a common carnivore in the Gaza Strip and its zoological gardens [93] According to Abd Rabou (2019e), the Mongoose is sometimes poisoned or killed because of its attack to poultries. The Common Badger seems not to exist in the Gaza Strip. Its presence among the preserved mammals at Al-Azhar University could be attributed to the zoological gardens where the animal was found to be caged in Rafah Zoo since 15 years [14]. Medium-sized mammals like the Red Fox (*Vulpes vulpes*) and the Jungle Cat (*Felis chaus*) were common carnivores of Gaza zoological gardens [20]. Although these animals have been trapped in the Gaza Strip, none of them have been found preserved at BEs of local universities. It is worth mentioning that the order Carnivora is well represented of the class Mammalia in the Palestine and Jordan environments [60-69].

The easy catch of the Long-eared Hedgehog (*Hemiechinus auritus*) and the Ethiopian Hedgehog (*Paraechinus aethiopicus*) in the Gaza Strip promoted their preservation at BEs of local universities. Although the European Hedgehog (*Erinaceus europaeus*) was recorded among the insectivores of the West Bank of Palestine, it seems to be totally absent in the Gaza Strip, and as a result, there was no chance to find it preserved at BEs. The roosting behavior and the frugivorous feeding habit of the Egyptian Fruit Bat (*Rousettus aegyptiacus*) make it easy for Gazans to trap, hunt and kill it. Although other bat species are very common in Palestine and its neighboring countries [51-56], they were not presented among the preserved mammals of BEs of local universities. The interest to study bats in the Gaza Strip has not yet matured, but when they are studied in the field, many species will inevitably be spotted and monitored. In fact, the Egyptian Fruit Bat is a vertebrate pest, attacking fruit plantations in the Gaza Strip including the Date Palm orchards. In Israel, programs were adopted and applied to combat the species in its feeding and roosting locations.

Rodentia is the largest mammalian order in Palestine [1]. Bottles containing preserved specimens of the Palestine Mole-rat (*Spalax leucodon ehrenbergi*), which is an endemic species, were

common at BEs. The species and its soil heaps are well known to the Palestinians [10-16]. The ability of the Palestine Mole-rat to make its tunnels among roots, tubers and bulbs of plants on which the animal feed (Boitani and Bartoli, 1983) imposes threats to local farmers to the extent that they have innovative control means to combat the animal in its habitats (Personal Communications and Observations). In fact, all rodents of the Gaza Strip especially the House Mouse (*Mus musculus*) and the Black Rat (*Rattus rattus*) are pests causing harm to human health, agriculture and other properties.

Conclusion

In conclusion, the Palestinian terrestrial vertebrate fauna preserved at BEs of Al-Azhar University, Islamic University of Gaza and Al-Aqsa University, represented a fraction of what the Gaza Strip actually harbors. Most of the preserved or stuffed animals at these universities were poorly dealt with, and managed. Therefore, the improvement of the local BEs is of utmost priority to the universities themselves and the public. The construction of a central Museum of Natural History in the Gaza Strip is highly recommended in order to enhance the public awareness and educational level on the fauna of the Gaza Strip in particular and Palestine in general.

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