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The Palestinian Marine and Terrestrial Vertebrate Fauna Preserved at the Biology Exhibition, Islamic University of Gaza, Bombarded by the Israeli Army in December, 2008

Abdel Fattah N. Abd Rabou [*1]

[1]Department of Biology – Faculty of Science – Islamic University of Gaza

Email: arabou@iugaza.edu.ps

Abstract

Palestine is home to a diversity of marine and terrestrial vertebrate fauna of Afrotropical, Oriental and Palaearctic origins. Such vertebrate fauna species are commonly preserved at the biology exhibitions of universities of the Gaza Strip. The biology exhibition of the Islamic University of Gaza (BE-IUG); which was a reservoir of preserved vertebrate fauna of various categories, was totally bombarded and destroyed by the Israeli F-16 war crafts on December 28, 2008. Hence, the current study comes to document the marine and terrestrial vertebrate fauna specimens preserved at BE-IUG. The fellow up and survey period of zoological specimens covered 10 years extending from 1999 to 2008. The findings of this work revealed a considerable diversity of marine, freshwater and terrestrial vertebrate fauna, where a total number of 139 species belonging to 81 families and 35 orders was recorded .The Osteichthyes constituted 36.7% of the total species recorded, followed by Aves (34.5%), Reptilia (12.9%), Mammalia (7.2%), Chondrichthyes (6.5%) and Amphibia (2.2%). The number of specimens of each preserved species ranged between one and twenty depending on the availability and size of the animals. Among the exotic species, two of them have considered as ones of the worst invading species worldwide, Silver-cheeked Toadfish (Lagocephalus sceleratus) and Common or Indian Myna (Acridotheres tristis). Three endemic species were encountered; Palestine Viper (Vipera palaestinae), Palestine Sunbird (Nectarinia osea) and Palestine Mole-rat (Spalax leucodon ehrenbergi). Unique single specimens of the Coypu or Nutria (Myocastor coypus), mutant House Mouse (Mus musculus) and mutant Black Rat (Rattus rattus) were encountered at BE-IUG as well. The study recommends the improvement of the current biology exhibitions and small museums of local universities in a way ensuring good preservation and arrangement of zoological specimens in order to benefit the Palestinian community in a sustainable fashion.

Keywords: *Vertebrate fauna, exotic species, preservation, biology exhibitions, Israeli War Crafts, Islamic University of Gaza, Gaza Strip, Palestine*

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 (Qumsiyeh, 1996 and Ministry of Environmental Affairs – MEnA, 1999). More than 540 bird, 100 mammalian, and 100 reptilian and amphibian species inhabit the terrestrial habitats of Palestine. Moreover, more than 400 freshwater and marine fish species occur in the Palestinian waters (Ali Shtayeh and Hamad, 1997; Qumsiyeh, 1996; The Palestinian Central Bureau of Statistics – PCBS, 2000, United Nations Environment program – UNEP, 2003; Environment Quality Authority – EQA, 2006 and Perlman and Meyrav, 2009). Terrestrial biodiversity studies in the Palestinian Territories (West Bank and Gaza Strip) preceded the studies concerning the marine biodiversity. Most of these studies flourished after the introduction of the Palestinian National Authority (PNA) in 1994. Because of political and geographical considerations, the terrestrial ecological studies were carried out in both the West Bank and the Gaza Strip, while the marine ecological studies, in spite of their rarity, were restricted only to the Gaza Strip which has a Mediterranean coast of about 42 km length. All Palestinian ecosystems and ecological habitats, if they are terrestrial or marine; introduce different values to vertebrate fauna including mating, nesting, resting, roosting, mimicry, protection and food sites.

A lot of studies, dissertations and reports targeting the occurrence, status, ecology, conservation and management of marine and terrestrial vertebrate fauna have carried out in the West Bank and the Gaza Strip of Palestine. The findings of these studies supported the succeeding stages of the current study. (Qumsiyeh, 1996; Ministry of Environmental Affairs – MEnA, 1999 and 2001; Project for the Conservation of Wetland and Coastal Ecosystems in the Mediterranean Region – MedWetCoast, 2002; Evans et al., 2005; Sabry et al., 2005; Abd Rabou, 2005; 2009; 2011 a, b, c and d; 2013; 2019a, b, c, d, e and f; Yassin et al., 2006; Abd Rabou et al., 2007 a, b, c and d; Abu Ouda et al., 2008; Salah and Abutair, 2010; Qumsiyeh et al., 2014; Salman et al., 2014; Dardona and Khalaf-von Jaffa, 2015; Albaba, 2016a and b; 2017a and b; Handal et al., 2016; Khalilieh, 2016; Shaheen, 2016 and Abu Amra, 2018).

It is well-known that natural history museums with their animal collections provide the scientific parties and the public with current and historical specimens to the best understanding of the biodiversity and the value of the natural world surrounding them (Hooper-Greenhill, 1992; Allmon, 1994; Davis, 1996; Lane, 1996 and Qumsiyeh et al., 2017). Suarez and Tsutsui (2004) pointed out that museum collections have played an important role in the study of biodiversity and its loss, biological invasions, and global climate change. Within the Palestinian Territories, a modest effort achieved in June 2014 by establishing the Palestine Museum of Natural History at the Bethlehem University, southern West Bank of Palestine. According to Qumsiyeh et al. (2017), the biggest goals of this museum are to change human attitudes toward the environment and to encourage biodiversity preservation.

As far as the biology museums or exhibitions of the Palestinian universities are concerned, they are homes to lots of preserved zoological and botanical collections. A number of mounted skeletons of some domestic and wild vertebrate species are usually present as well. The museum collections usually grow through donations by various members of the Palestinian community including scientific professionals, students, hunters and normal people. Taxidermy and preservation processes was mostly made by university students, laboratory technicians and teaching assistants. Local university museums can provide educational services to school students by introducing them to biodiversity issues of Palestine (Qumsiyeh et al., 2017).

The biology exhibition (BE) or small museum of the Department of Biology at the Islamic University of Gaza (IUG); which was established since 1980, is home to a variety of biological collections. Since 2000, the biology exhibition was located at the fifth floor of the Scientific Laboratory Building. Fishes, amphibians, reptiles, birds and mammals were almost well represented among the specimens preserved or stuffed at the biology exhibition of the Islamic University of Gaza (BE-IUG). The majority of vertebrate specimens was preserved in formalin, while the others were stuffed according to taxidermy principles. This BE was commonly accessed by researchers, university and school students, and members of the public.

Three unjust and brutal aggressions or wars have been launched by Israel on the Gaza Strip since 2008. These wars produced thousands of martyrs and tens of thousands of

wounded and homeless Palestinian people. In addition, tens of thousands of buildings, houses, police stations, factories, mosques, farms, roads and others have been completely or partially destroyed during the successive wars. The first Israeli war was a three-week armed war. It began on 27 December 2008 and ended on 18 January 2009 in a unilateral ceasefire. During this war and exactly on December 28, 2008, the Israeli F-16 war crafts bombarded and destroyed the Scientific and Engineering Laboratories Buildings of IUG. These buildings included at that time seventy-four scientific and engineering laboratories equipped with several state-of-the-art equipment. The buildings were transformed into a pile of rubble and molten iron. The Department of Biology of IUG along with its laboratories, experimental animal room and permanent exhibition (the museum) was completely bombarded and destroyed during the war. All the reservoirs, shelves and display tables of BE were destroyed. No traces of the stuffed or preserved zoological (vertebrate and invertebrate) samples existed, and all the possessions of the BE-IUG became part of the past.

Shortly and during the years preceded the bombarding of BE-IUG, all the preserved specimens of marine and terrestrial vertebrate fauna were documented and sometimes photographed prior or post to preservation. Accordingly, the current study aimed at documenting the biological specimens of the Palestinian cartilaginous and bony fish, amphibian, reptilian, bird and mammalian fauna preserved at BE-IUG, before being bombarded; and totally destroyed by the Israeli Army in late December, 2008. This study is the first of its kind and style in the Gaza Strip in the sense that it carries both scientific and political implications. It illustrates the role of the Israeli occupation in the destruction of the Palestinian entity and life. The Israeli aggression reached all the joints of the Palestinian life, including BE-IUG and many zoological gardens in the Gaza Strip.

2. Methods

2.1. The Study Area

The Gaza Strip (31°25′N, 34°20′E) is a 365 km^2 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

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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. The Gaza City is the largest city in the Gaza Strip (UNEP, 2003). It has a total area of about 56 km^2, and a population of about 700,000 people, making it one of the most densely populated cities in the world.

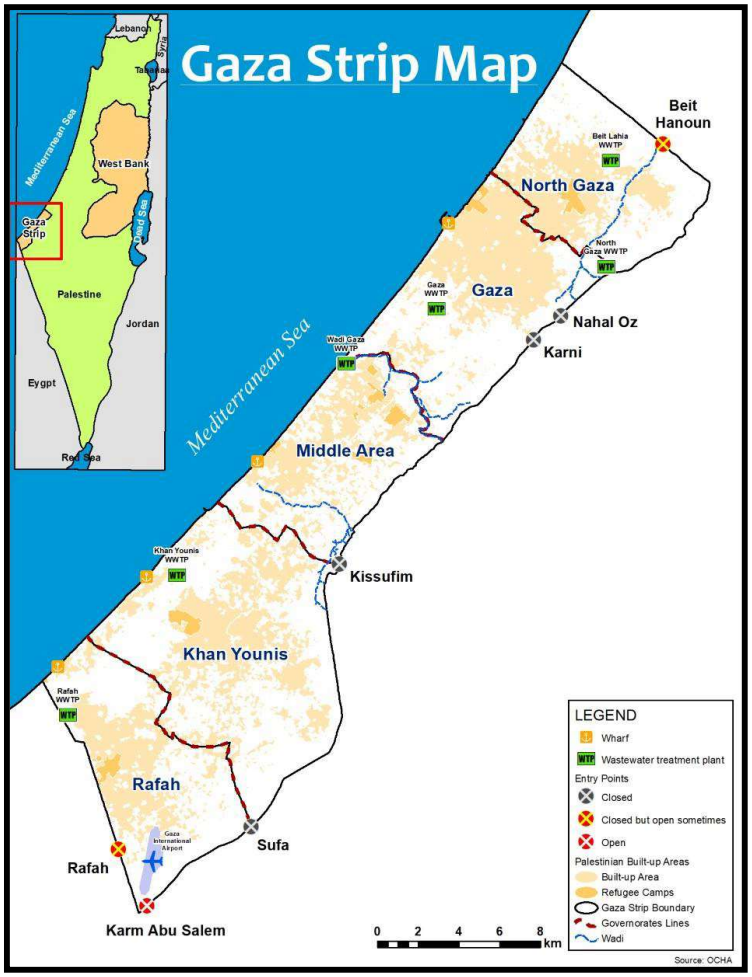

Figure 1: Map of the Gaza Strip

2.2. The Islamic University of Gaza (IUG)

The Gaza Strip is host to many universities and higher education institutions. The Islamic University of Gaza (IUG), which is an independent academic institution supervised by the Ministry of Higher Education, is the oldest and it was established in 1978. The IUG is a member of four associations: Association of Arab Universities, Federation of the Universities of the Islamic World, Community of Mediterranean Universities, and International Association of Universities. In addition, the IUG works

closely with numerous universities around the world. Today, the IUG is a vibrant community of more than 20,000 students and about 600 academic staff members, comprising 11 major faculties, including the Faculty of Science. Nowadays, the IUG offers B.A., B.Sc., M.A., M.Sc., and Ph.D. programs in addition to many diplomas and higher diplomas in a variety of disciplines.

2.3. Department of Biology (BD) and Biology Exhibition (BE) of IUG

The Faculty of Science was found in 1980-1981, starting with many basic departments including the Department of Biology (BD). In addition to its B.Sc. program, BD has launched with a M.Sc. program since 2004. Alumni of the bachelor and master programs of BD have made their mark in academia and the public and private sectors in Palestine and abroad. BD has an outstanding track's record in research with a high level of success in securing national competitive grants and other publicly funded grants. The BE-IUG was equipped with many reservoirs, shelves and display tables of different sizes, containing hundreds of zoological samples stuffed or preserved in formalin. The bottles containing the preserved specimens; were sometimes labeled with the Arabic, common and scientific names of the specimens, BE-IUG was commonly accessed by school and university students and many researchers; who have the interest to know such preserved animals as a means to raise their awareness toward the biodiversity of Palestine. On December 28, 2008, the Israeli occupation warplanes bombed the laboratories buildings of IUG where they turned into a pile of rubble and molten iron (Figure 2).

Figure 2: The buildings of the scientific and engineering laboratories of IUG, bombarded by the Israeli army in December; 2008: (A) Before bombing and (B) After bombing.

2.4 Procedure

The current study was based on continuous direct fellow up of marine and terrestrial vertebrate fauna specimens (fishes, amphibians, reptiles, birds and mammals) preserved at BE-IUG. The survey period covered 10 years extending from the beginning of 1999 to late 2008. Many wildlife hunters and local people were good contributors to this work through their provisions to live and dead specimens to BD-IUG. All preserved zoological specimens were scientifically classified shortly after introducing to BD-IUG. Identification of preserved vertebrate species was made easy; using published local, regional and international keys and guidebooks. (Boitani and Bartoli, 1983; Qumsiyeh, 1985; Amr and Disi, 1988 and 2011; Capula, 1989; Harrison and Bates, 1991; Harrison and Greensmith, 1993; Porter et al., 1996; Qumsiyeh 1996; Amr, 2000 and 2012; Disi et al., 2001; Disi, 2002 and 2011; Hoath, 2003; Baha El-Din, 2006; Cox, 2006; Galil, 2007; FishBase, 2008 and 2019; Golani and Appelbaum-Golani, 2010; IUCN, 2012; Salah and Abutair, 2012; Bar and Haimovitch, 2012; Bariche, 2012; Otero et al., 2013; El-Moghrabi, 2013 and Escoriza and Ben Hassine, 2019).

2.5. Photography and Statistical Analysis

Professional digital cameras were used throughout the study period and photos of preserved 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.

3. Results

The findings of the current study revealed a considerable diversity of marine, freshwater and terrestrial vertebrate species coming as a reflection of the vertebrate fauna inhabiting the various ecosystems of the Gaza Strip. A total number of 139 species; belonging to 81 families and 35 orders of the classes mentioned; was recorded (Table 1). The Osteichthyes or bony fish species constituted 36.7% of the total species recorded, followed by Aves or birds (34.5%), Reptilia (12.9%), Mammalia (7.2%), Chondrichthyes or cartilaginous fishes (6.5%) and Amphibia (2.2%). The details of each vertebrate class is described as follows:

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Table 1: Numbers of orders, families and species of vertebrate fauna preserved at BE-IUG, bombarded by the Israeli army in December; 2008

Classes	Orders	Families	Species	%
Chondrichthyes (Cartilaginous Fishes)	5	6	9	6.5
Osteichthyes (Bony Fishes)	12	25	51	36.7
Amphibia	1	3	3	2.2
Reptilia	2	12	18	12.9
Aves (Birds)	12	28	48	34.5
Mammalia (Mammals)	3	7	10	7.2
TOTAL	35	81	139	100%

3.1. Cartılagınous Fıshes (Chondrıchthyes)

The current study recorded nine cartilaginous fish species belonging to six families and five orders preserved at BE-IUG (Table 2 and Figure 3). They inhabit the marine ecosystem of the Gaza Strip. Because of the large sizes of the Mediterranean cartilaginous fish species, only the small-sized specimens were preserved. The Rajiformes, which has flattened bodies and large, wing-like pectoral fins that attached to the side of their heads and run the length of their body, was the biggest order. The Common Guitarfish (Rhinobatos rhinobatos), which belongs to the order Rajiformes, was by far the most preserved cartilaginous fish among the species recorded. It is worth mentioning that the Common Guitarfish is the most cartilaginous fish species commonly used for dissection purposes in the vertebrate zoology laboratories at IUG. The availability and cheap prices of the fish were two capital factors encouraging its use as an ideal cartilaginous model for dissection. By contrast, the endangered Devil Fish or Giant Devil Ray (Mobula mobular), which was known to be hunted sometimes in big quantities in certain seasons in the Gaza Strip, was totally absent among the preserved cartilaginous fish species.

Table 2: Cartilaginous fish species preserved at BE-IUG, bombarded by the Israeli army in December; 2008

Family	Scientific Name	Common Name	Arabic / Local Name
Order: Squaliformes			
Squalidae قروش كلاب البحر	Squalus blainville	Longnose Spurdog (Dogfish Shark)	الفتال أبو شوكة

Family	Scientific Name	Common Name	Arabic / Local Name
Order: Carcharhiniformes			
Carcharhinidae كواسح الترتيلة	Carcharhinus plumbeus	Sandbar Shark	القرش الرمادي
	Carcharhinus limbatus	Blacktip Shark	القرش ذو الزعنفة السوداء
Order: Torpediniformes			
Torpedinidae الراي الكهربائي	Torpedo torpedo	Common Torpedo (Ocellated or Eyed Electric Ray)	الرعاش العيون
Order: Rajiformes			
Rhinobatidae السلفوحيات	Rhinobatos rhinobatos	Common Guitarfish	السلفوح
Rajidae الورانك	Raja asterias	Mediterranean Starry Ray	البسة المنمشة
	Raja miraletus	Brown Ray (Brown Skate)	البسة العيون
Order: Myliobatiformes			
Dasyatidae الراي اللاسع	Dasyatis pastinaca	Common Stingray	البرشة أو الدهنية الصفراء
	Dasyatis chrysonota	Blue Stingray	البرشة أو الدهنية الزرقاء

3.2. Bony Fıshes (Osteıchthyes)

The current study recorded 51 bony fish species belonging to 25 families and 12 orders preserved at BE- IUG (Table 3 and Figure 3). They inhabit the marine ecosystem of the Gaza Strip. It is well-known that the Mediterranean bony fish species have different forms, shapes, colors and sizes. Accordingly, most of the preserved specimens had medium or small sizes. The large specimens were commonly excluded from such a preservation process at BE- IUG. Because of the small sizes of many bony fish species, they preserved in multiple copies in the same bottle; some bottles contained 10 – 20 individuals of same or different species. Many marine as well as farmed fish species including the Tilapia (Oreochromis niloticus and Oreochromis hybrids), Gilthead Seabream (Sparus aurata) and Common or Grey Mullet (Mugil cephalus) were commonly used for dissection purposes in the vertebrate zoology laboratories at IUG. These fish species; which were found, preserved in considerable numbers at BE-IUG. The availability, considerable size and cheap prices of these fishes were three capital factors encouraging their use as ideal bony models for dissection.

Of the 51 recording species, 15 species (29.4 %) described as exotic (denoted to with asterisks in Table 3) in the sense that they have moved to areas outside of their native

ranges. One of the exotic species is the Silver-cheeked Toadfish (Lagocephalus sceleratus) which was and is still one of the most poisonous fish species throughout the world. This species is commonly characterized by its grey or brown back that owes darker spots, while the belly is white. As far as the sardine fishes are concerned, they make up a priority of the Gazan food table. Some sardine fish species; namely the Madeiran Sardinella (Sardinella maderensis) and Round Sardinella (Sardinella aurita), were highly encountered among the preserved fish species.

Table 3: Bony fish species preserved at BE-IUG, bombarded by the Israeli army in December; 2008

Family	Scientific Name	Common Name	Arabic / Local Name
Order: Perciformes شوكية الزعانف			
Sparidae الأسبوريات (أسماك الشانك)	Sparus aurata	Gilthead Seabream	الدنيس
	Pagrus pagrus	Red Porgy	الفريدن أبو طاحونة
	Pagrus auriga	Red-banded Seabream	العروس / الفريدن
	Diplodus vulgaris	Common Two-banded Seabream	الصروص المكحل
	Diplodus sargus	White Seabream	الصروص الأصلي
	Diplodus cervinus	Zebra Seabream	الحداد
	Boops boops	Bogue	الغبس
	Pagellus erythrinus	Common Pandora	الجربيدن
	Lithognathus mormyrus	Sand Steenbras	المرمير
	Sarpa salpa	Salema (Cow Bream)	الصلبية
	Spicara smaris	Picarel	أنديرا غاندي
Carangidae الشيميات (الحاميات)	Trachinotus ovatus	Pompano	العريان
	Alepes djedaba	Shrimp Scad*	الطرخون الأصفر العريض
	Decapterus punctatus	Round Scad*	الطرخون المبروم
	Caranx crysos	Blue Runner	الطرخون الباغة
Echeneidae اللشكيات	Echeneis naucrates	Live or Slender Sharksucker*	قملة الدرفيل / القرادة
Serranidae ذئاب البحر	Mycteroperca rubra	Mottled Grouper	القريدية
	Epinephelus costae	Goldblotch or Golden Grouper	الياسينة (لوقس صخري)
Mullidae السلطانيات	Mullus barbatus	Red Mullet	السلطان الأحمر
	Mullus surmuletus	Striped Red Mullet (Surmullet)	السلطان الأحمر المخطط
	Upeneus moluccensis	Goldband Goatfish*	البربونيا الصفراء

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Family	Scientific Name	Common Name	Arabic / Local Name
Siganidae الأرنبيات	Siganus rivulatus	Marbled Spinefoot (Rivulated Rabbitfish)*	القراص الأبيض
	Siganus Luridus	Dusky Spinefoot*	القراص الأسود
Trichiuridae شعريات الذيل	Trichiurus lepturus	Largehead Hairtail (Beltfish)	السيف
Pomatomidae القنبريات	Pomatomus saltatrix	Bluefish	المياس
Sciaenidae اللوتيات	Umbrina cirrosa	Shi Drum	اللبط
	Argyrosomus regius	Meagre (Croaker or Shade-fish)	الجرع المسقار
Lobotidae ثلاثيات الذيل	Lobotes surinamensis	Atlantic Tripletail	الشبارة
Order: Kurtiformes أسماك الكارديال			
Apogonidae عديمات اللحى	Apogon poecilopterus	Pearly-finned Cardinalfish*	أبو جنيد
	Apogon imberbis	Mediterranean Cardinalfish	أبو جنيد أحمر
Order: Scombriformes أسقمريات الشكل			
Scombridae الأسقمريات	Scomberomorus commerson	Narrow-barred Spanish Mackerel*	الكنعن
	Scomber scombrus	Atlantic mackerel	السكمبلة
	Thunnus thynnus	Atlantic Bluefin Tuna	التونا الصفراء
Sphyraenidae الباراكودا (الاسفرنيات)	Sphyraena obtusata	Obtuse Barracuda*	المليطة السمراء
	Sphyraena chrysotaenia	Yellowstripe Barracuda*	المليطة الصفراء
Order: Clupeiformes الصابوغيات			
Clupeidae الرنكيات (الصابوغيات)	Sardinella maderensis	Madeiran Sardinella	السردينة العريضة
	Sardinella aurita	Round Sardinella	السردينة المبرومة الرشيدية
Order: Pleuronectiformes الأسماك المسطحة (المفلطحات)			
Soleidae اللسان الأيمن	Solea solea	Common Sole (Black Sole)	الصول / سمك موسى
	Microchirus ocellatus	Foureyed Sole	الصول العيون
Order: Mugiliformes أسماك البوري			
Mugilidae البوريات	Mugil cephalus	Flathead Grey Mullet (Common or Grey Mullet)	البوري
	Liza aurata	Golden Grey Mullet	الذهبان
	Liza ramada (Chelon ramada)	Thinlip Mullet (Thinlip Grey Mullet)	الطوبارة
Order: Beloniformes الخرمانيات			
Hemiramphidae نصفيات المنقار	Hemiramphus far	Halfbeak (Black-barred Halfbeak)*	الإسفرنة

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Family	Scientific Name	Common Name	Arabic / Local Name
Exocoetidae القنبروريات	Hirundichthys rondeletii	Black Wing Flyingfish*	العصفور الأزرق
Order: Tetraodontiformes (رباعيات الأسنان) المنافخ			
Tetraodontidae رباعية الأسنان	Lagocephalus sceleratus	Silver-cheeked Toadfish*	الأرنب المرقط السام
Balistidae الفنطريات	Balistes capriscus	Grey Triggerfish	الخنزيرة
Order: Beryciformes الأسماك السنجابية			
Holocentridae السنقفيات	Sargocentron rubrum	Redcoat*	الحموري
Order: Aulopiformes (ذوات العيون الخضر) أسماك السحالي			
Synodontidae ملتحمات الاسنان	Saurida undosquamis	Brushtooth Lizardfish*	السويسي
Order: Anguilliformes ثعابين السمك			
Muraenidae الشيقيات	Muraena helena	Mediterranean Moray (Roman Eel)	ثعبان البحر موراي
Anguillidae الأنقليسيات	Anguilla anguilla	European Eel	الأنقليس
Order: Syngnathiformes (ملتحمة الفك) الأسماك الأنبوبية			
Syngnathidae زمارات البحر	Hippocampus hippocampus	Short-snouted Seahorse	حصان أو فرس البحر

Note: Fishes with a asterisks (*) are exotic.

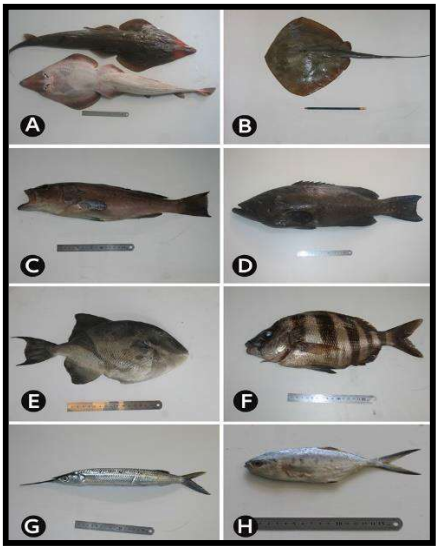

Figure 3: Cartilaginous and Bony Fish Species preserved at BE-IUG bombarded by the Israeli army in December; 2008. (A) Common Guitarfish (Rhinobatos rhinobatos), (B) Common Stingray (Dasyatis pastinaca), (C) Mottled Grouper (Mycteroperca rubra), (D) Goldblotch or Golden Grouper (Epinephelus costae), (E) Grey Triggerfish (Balistes capriscus), (F) Zebra Seabream (Diplodus cervinus), (G) Halfbeak or Black-barred Halfbeak (Hemiramphus far), and (H) Pompano (Trachinotus ovatus).

3.3. Amphıbıans

The current study recorded three amphibian species belonging to three families and one order (Anura) preserved at BE-IUG (Table 4 and Figure 4). All amphibian species are resident in the Gaza Strip environment and found throughout the year. They inhabit the wadis (valleys), temporary rainwater pools, irrigated canals and agricultural fields of the Gaza Strip. The Common Toad (Bufo viridis) was by far the most preserved species among the frog species recorded. This toad species is commonly used for dissection purposes in the vertebrate zoology laboratories at IUG.

Table 4: Amphibian fauna species preserved at BE-IUG, bombarded by the Israeli army in December; 2008

Family	Scientific Name	Common Name	Arabic / Local Name
Order Anura (عديمة الذيل) اللاذيليات			
Bufonidae (True Toads) (العلاجيم الحقيقية)	Bufo viridis	European Green Toad	الضفدع أو العلجوم الشائع
Ranidae (Riparian Frogs) (الضفدعيات المشاطئة)	Rana bedriagae (Pelophylax bedriagae)	Levant Water Frog	ضفدع الماء الأخضر
Hylaidae (Tree Frogs and Allies) (الضفادع الشجرية)	Hyla savignyi	Savigny's Tree Frog	ضفدع الأشجار

3.4. Reptıles

A total number of 18 reptilian species belonging to 12 different families and two orders; was recorded to be preserved at BE- IUG (Table 5 and Figure 4). All reptilian species are resident in the Gaza Strip environment and found throughout the year. Squamata was the biggest order, comprising 14 species (7 lizards and 7 snakes). The Desert Monitor (Varanus griseus) was, by far, the biggest lizard species preserved at BE-IUG. The Bosc's Lizard (Acanthodactylus boskianus) and the Agama (Laudakia stellio) were the most common preserved species; they found in tens. With regard to snakes, the family Colubridae; which was represented by three species, was the biggest among the snake species. The venomous Palestine Viper (Vipera palaestinae) and the non-venomous Syrian Black Snake or Arbeed (Coluber jugularis asianus) were, by far, the most common preserved snakes at BE-IUG. The Palestine Viper is endemic in the Palestine environment. Most snakes' bites have been attributed to this dangerous and

venomous species. The Testudines order represented by four turtle species (one terrestrial, one freshwater and two marine). All turtle species are resident and mostly found throughout the year. The Greece Turtle or Spur-thighed Tortoise (Testudo graeca) is the only terrestrial species representing the Order in question. It was the most preserved turtle species at BE-IUG. According to the IUCN Red List, the Greece Turtle listed as a vulnerable species. Local inhabitants are fond of collecting the juvenile and adult individuals of the species to keep them as pet animals at homes and gardens. As many as 34 individuals; were noted by the author to be caged at the zoological gardens or pet shops prevailing in the Gaza Strip.

Table 5: Reptilian fauna species preserved at BE-IUG, bombarded by the Israeli army in December; 2008

Family	Scientific Name	Common Name	Arabic / Local Name
Order Testudines السلحفيات			
Cheloniidae السلاحف البحرية	*Caretta caretta*	Loggerhead Sea Turtle	السلحفاة ضخمة الرأس البحرية
	Chelonia mydas	Green Sea Turtle	السلحفاة الخضراء البحرية
Testudinidae السلاحف الأرضية	*Testudo graeca*	Greece Tortoise (Spur-thighed Tortoise)	السلحفاة اليونانية (السلحفاة مهمازية الورك)
Geoemydidae سلاحف المياه العذبة	*Mauremys caspica*	Caspian Turtle (Striped-neck Terrapin)	سلحفاة الماء العذب القزوينية
Order Squamata الحرشفيات			
Varanidae الأورال	*Varanus griseus*	Desert Monitor	الورل الصحراوي

Agamidae العضايا	*Laudakia (Agama) stellio*	Agama	الحردون
Scincidae السقفورات (السحالي الناعمة)	*Chalcides ocellatus*	Ocellated Skink	الدفان
Chamaeleonidae الحرابي	*Chameleo chameleon*	Mediterranean Chameleon	الحرباة المتوسطية
Geckonidae الأبراص (الوزغيات)	*Hemidactylus turcicus*	Turkish Gecko	أم بريص التركية
	Ptyodactylus hasselquistii	Light Fan-footed Gecko	أم بريص مروحية القدم
Lacertidae السقايا (السحالي الحقيقية)	*Acanthodactylus boskianus*	Bosc's Lizard	سحلية بوسك هدبية الأصابع
Boidae العاصرات	*Eryx jaculus*	Sand Boa	البوا الرملية
Colubridae الأحناش (الثعابين الحقيقية)	*Coluber jugularis asianus*	Syrian Black Snake (Arbeed)	العربيد
	Coluber nummifer	Coined Snake	الثعبان النقدي
	Coluber rubriceps	Red Whip Snake	الثعبان أحمر السوط
Lamprophiidae حيات الرمل	*Psammophis schokari*	Schokari Sand Racer	ثعبان أبو السيور (الزاروق)
	Malpolon monspessulanus insigitus	Arabian Rear-fanged Snake	أفعى الفئران (الثعبان الخضاري)
Viperidae الأفاعي	*Vipera palaestinae*	Palestine Viper	الأفعى الفلسطينية

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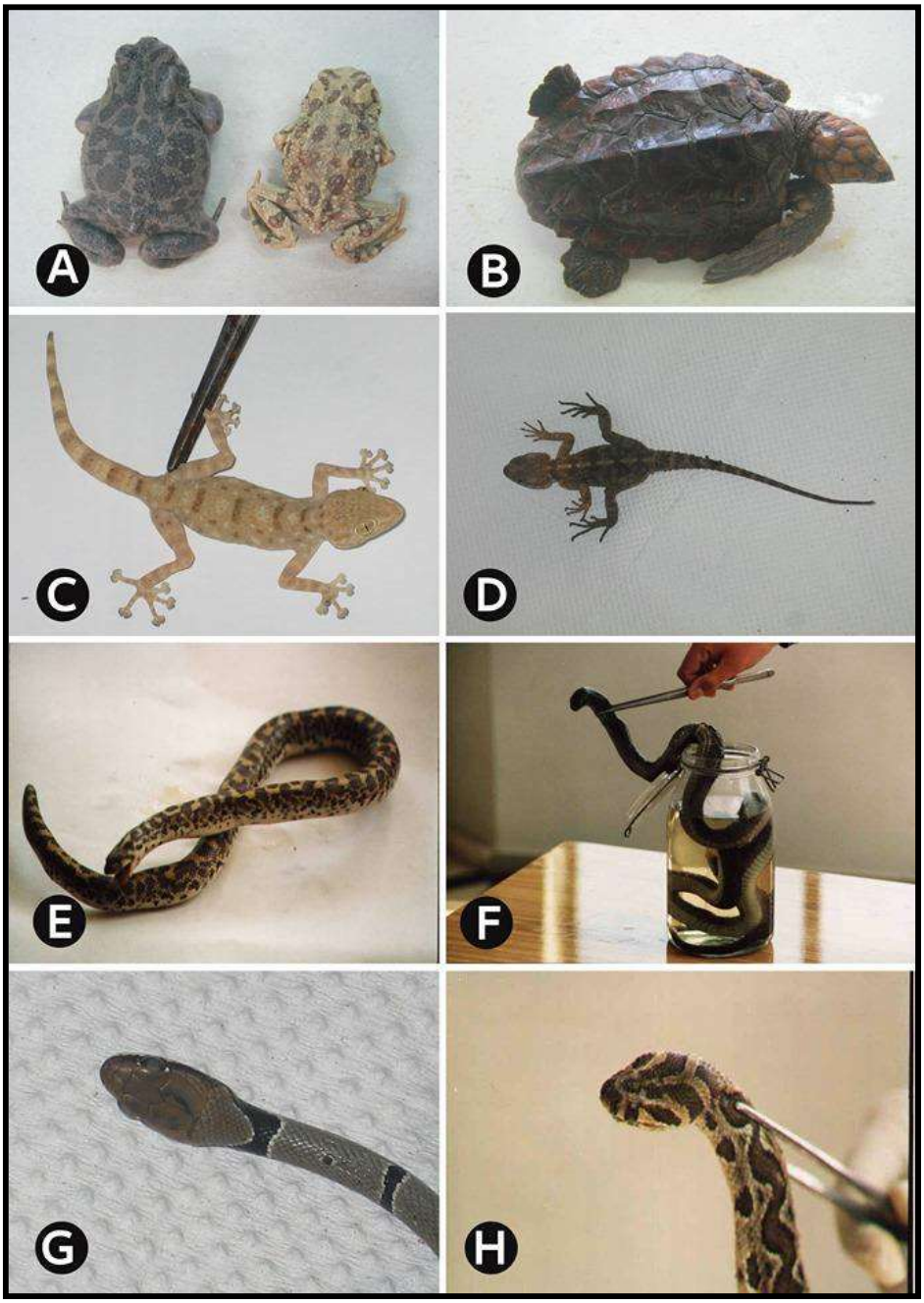

Figure 4: Herpetofauna (Amphibians and reptiles) species preserved at BE-IUG, bombarded by the Israeli Army in December; 2008. (A) European Green Toad (Bufo viridis), (B) Loggerhead Sea Turtle - Juvenile (Caretta caretta), (C) Light Fan-footed Gecko (Ptyodactylus hasselquistii), (D) Agama (Laudakia or Agama stellio), (E) Sand Boa (Eryx jaculus), (F) Syrian Black Snake – Arbeed (Coluber jugularis asianus), (G) Red Whip Snake (Coluber rubriceps), and (H) Palestine Viper (Vipera palaestinae).

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3.5. Bırds (Aves)

A total number of 48 bird or avian species belonging to 28 different families and 12 orders was recorded to be preserved at BE-IUG (Table 6 and Figure 5). The bird species encountered was either residents or migrants. Passeriformes, which forms the passerine birds, was, by far, the largest order comprising 18 species (37.5%). It was followed by the Strigiformes, which comprises 6 species (12.5%), and the Columbiformes and Coraciiformes, which were represented by 4 species (8.3%) for each. The Palestine Sunbird (Nectarinia osea) was the only endemic Palestinian bird encountered throughout the current study. The Common or Indian Myna (Acridotheres tristis) was the only exotic bird encountered throughout the study as well.

Table 6: Bird fauna species preserved at BE-IUG, bombarded by the Israeli army in December; 2008

Family	Scientific Name	Common Name	Arabic / Local Name
رتبة الجوارح العابرةAccipitriformes			
Accipitridae الكواسر	Buteo buteo	Common Buzzard	الصقر الحوام
	Buteo rufinus	Long-legged Buzzard	الصقر طويل الساقين
	Milvus migrans	Black Kite	الحدأة السوداء
رتبة الصقريات Falconiformes			
Falconidae الصقرية	Falco naummani	Lesser Kestrel	العويسق
	Falco tinnunculus	Common Kestrel	العوسق
	Falco subbuteo	Eurasian Hobby	الكونج (الشويهين)
رتبة الدجاجيات Galliformes			
Rallidae التفلقية	Gallinula chloropus	Moorhen	دجاجة الماء
Phasianidae التدرجية	Alectoris chukar	Chukar	الشنار
	Coturnix coturnix	Quail	الفر (السمان)
رتبة الزقزاقيات Charadriiformes			
Burhinidae الكروانيات	Burhinus oedicnemus	Stone Curlew	الكروان الصحراوي
Charadriidae القطقاطية	Vanellus spinosus	Spur-winged Plover	الزقزاق الشامي (القطا)
Recurvirostridae النكاتية	Himantopus himantopus	Black-winged Stilt	أبو المغازل (الكرسوع)
رتبة الحماميات Columbiformes			
Columbidae الحمامية	Columba livia	Rock Dove (Pigeon)	الحمام الصخري
	Streptopelia decaocto	Collared Dove	اليمامة المطوقة
	Streptopelia turtur	Turtle Dove	اليمامة القمرية (الرقطية)
	Streptopelia senegalensis	Laughing (Palm – Senegal) Dove	اليمامة الضاحكة (فاختة النخيل)
رتبة الببغائيات Psittaciformes			
Psittacidae البَبّغاويّة	Psittacula krameri	Ring-necked Parakeet	ببغاء الدُرّة (الببغاء ورديّ الطوق)

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Family	Scientific Name	Common Name	Arabic / Local Name
رتبة الوقواقيات Cuculiformes			
Cuculidae الوقواقية	Clamator glandarius	Great Spotted Cuckoo	الوقواق المرقط الكبير
رتبة البوميات Strigiformes			
Strigidae البومية	Otus scops	European Scops Owl	بومة أذناء صغيرة
	Athene noctua	Little Owl	أم قويق (البومة الصغيرة)
	Asio otus	Long-eared Owl	البومة طويلة الأذن (البومة القرناء)
	Bubo bubo	Eurasian Eagle Owl	البومة النسرية الأوراسية
Tytonide بوميات الحظائر	Tyto alba	Barn Owl	بومة الجرن
Caprimulgidae السُّبَدِيّة	Caprimulgus europaeus	European Nightjar	السُّبَد الليلي الأوروبي
رتبة الشقراقيات Coraciiformes			
Alcedinidae القاوندية	Halycon smyrnensis	White-breasted (White-throated) Kingfisher	السماك أبيض الصدر (القاوند)
	Alcedo atthis	Common Kingfisher	السماك الشائع
	Ceryle rudis	Pied Kingfisher	السماك الأبقع
Meropidae الوروارية	Merops apiaster	European Bee-eater	الوروار الأوروبي
رتبة قرنيات المنقار Bucerotiformes			
Upupidae الهدهدية	Upupa epops	Hoopoe	الهدهد
رتبة النقاريات أو القرعيات Piciformes			
Picidae اللوائية	Dendrocopos syriacus	Syrian Woodpecker	نقار الخشب السوري
رتبة العصفوريات أو الجواثم Passeriformes			
Corvidae الغرابية	Garrulus glandarius	Eurasian Jay	الزريقي (أبو زريق)
	Corvus corone	Hooded Crow	الغراب البلدي الرمادي
Sturnidae الزرازير	Acridotheres tristis	Common (Indian) Mynah	المينا الهندية
Hirundinidae السنونية	Hirundu rustica	Barn Swallow	السنونو (عصفور الجنة)
Motacillidae الفتاحية (الذعريات)	Motacilla flava	Yellow Wagtail	الذعرة الصفراء
	Motacilla alba	White Wagtail	الذعرة البيضاء
Pycnonotidae البلبلية	Pycnonotus xanthopygos	Yellow-vented Bulbul	البلبل أصفر العجز
Muscicapidae خاطفات الذباب أو الشوربية (المذبابيات)	Erithacus rubecula	European Robin	أبو الحناء (الحمرية)
	Luscinia svecica	Bluethroat	المسهر (أزرق الزور)
	Oenanthe oenanthe	Northern Wheatear	الأبلق الصحراوي
	Muscicapa striata	Spotted Flycatcher	خاطف الذباب المنقط
	Turdus philomelos	Song Thrush	المغنية السمّنة

Family	Scientific Name	Common Name	Arabic / Local Name
Turdidae المغردات	Turdus merula	Blackbird	الشحرور (الدج)
Alaudidae القبرية	Galerida cristata	Crested Lark	القنبرة المتوجة
Nectariniidae المغثريات	Nectarinia osea	Palestine Sunbird	عصفور الشمس الفلسطيني
Passeridae العصفورية	Passer domesticus	House Sparrow	العصفور المنزلي (الدوري)
Fringillidae الحساسين	Carduelis carduelis	Goldfinch	الحسون الذهبي
	Carduelis chloris	Green Finch	الخضر (الخضيري)

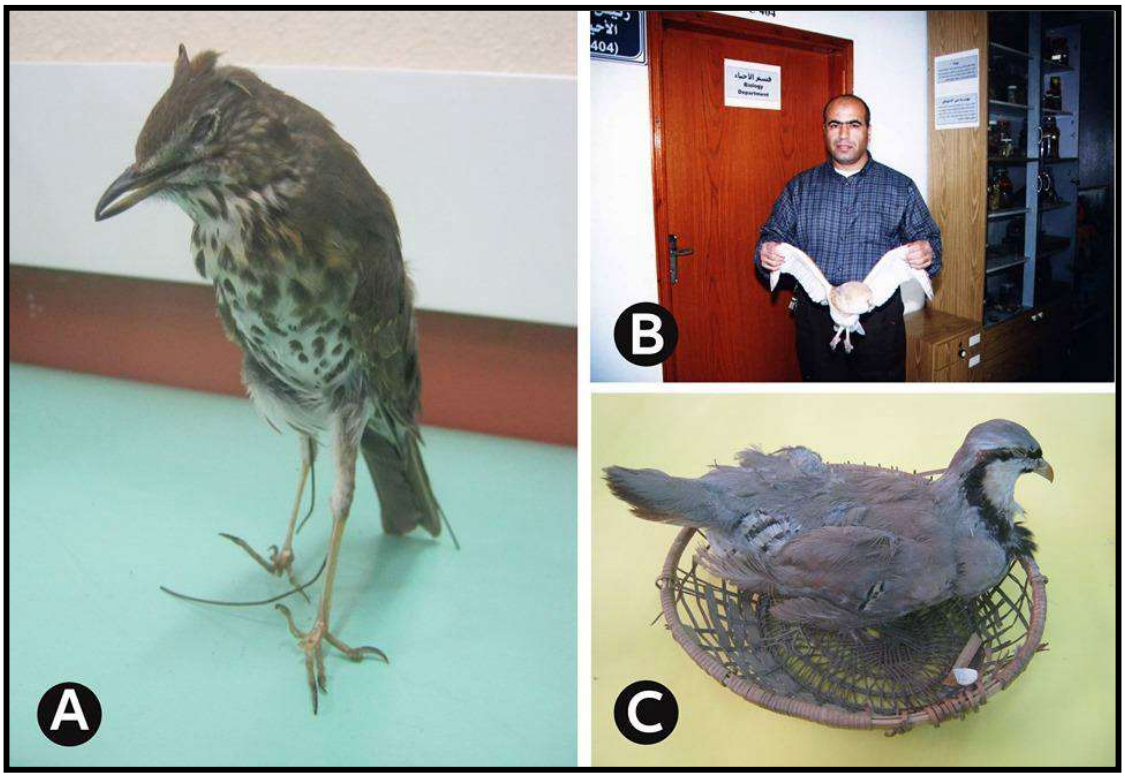

Figure 5: Bird or avian species preserved at BE-IUG, bombarded by the Israeli army in December; 2008: (A) Song Thrush (Turdus philomelos), (B) The author displaying a Barn Owl (Tyto alba) before being stuffed in 2003, and (C) Chukar (Alectoris chukar).

3.6. Mammals

A total number of 10 Palestinian mammalian species belonging to 7 different families and 3 orders was recorded to be preserved at BE-IUG (Table 7 and Figure 6). All mammalian species seemed to be resident in the Gaza Strip environment and mostly found throughout the year. Rodentia was by far the biggest order, comprising 6 species;

with the majority of them are agricultural pests causing harm to agricultural crops, public health and other human properties. The Palestine Mole- rat (Spalax leucodon ehrenbergi) was the only Palestine endemic species encountered throughout this study. In spite of its total absence in the Gaza Strip environment, the Coypu or Nutria (Myocastor coypus) was encountered as a single specimen at BE-IUG. It is; by far, the largest rodent recorded there.

Two strange rodent species were found among the preserved zoological species. The first rodent was a small mouse; which was characterized by its light and dark brown coloration with white big patches on its dorsal fur. The person, who introduced the live specimen to BD-IUG in 2005, claimed that he caught it in an agricultural field in northern Gaza Strip. Consultations made at that time with zoological specialists outside Palestine revealed that the specimen was a mutant House Mouse (Mus musculus). The second was an albino rat having a few scattered black hairs on the body and tail. The person, who introduced the live specimen to BD-IUG in 2007, claimed that he grabbed it in a large bag containing animal feed in northern Gaza Strip. Consultations were made at that time with zoological specialists outside Palestine too; who confirmed that this albino rat was a Black Rat (Rattus rattus) that was subject to a disease or mutation resulted in its albinism.

Bats were represented by only two species, with the Egyptian Fruit Bat (Rousettus aegyptiacus), which is the largest bat species in Palestine, was considered by local farmers as a pest because of its frequent attacks and damages to fruit orchards. 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 and Artiodactyla have never been recorded throughout the current study. Because of their large bodies, preserved specimens of marine mammals, which occur in the Palestinian waters of the Mediterranean Sea, have never been encountered at BE-IUG as well.

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Table 7: Mammalian fauna species preserved at BE-IUG, bombarded by the Israeli army in December; 2008

Family	Scientific Name	Common Name	Arabic / Local Name
Order Insectivora آكلة الحشرات			
Erinaceidae القنفذيات	Hemiechinus auritus	Long-eared Hedgehog	القنفذ طويل الأذن
	Paraechinus aethiopicus	Ethiopian Hedgehog	القنفذ الأثيوبي
Order Chiroptera الخفاشيات			
Pteropodidae الخفافيش آكلة الثمار	Rousettus aegyptiacus	Egyptian Fruit Bat	خفاش الثمار المصري
Vespertilionidae الخفافيش الشائعة أو الليلية	Pipistrellus kuhlii	Kuhl's Pipistrelle Bat	خفاش (وطوط) ليلي
Order Rodentia القوارض			
Spalacidae الخلديات	Spalax leucodon ehrenbergi	Palestine Mole-rat	الخلند الفلسطيني (أبو عماية)
Myocastoridae فأريات النهر	Myocastor coypus	Coypu (Nutria)	الكَيْب (الكويبو – الجرذ القندسي – فأر النهر)
Muridae الفأريات	Mus musculus	House Mouse	الفأر المنزلي
	Rattus rattus	Black Rat	الفأر الأسود (العرسة)
	Gerbillus pyramidum	Greater Egyptian Gerbil	الجربوع المصري الكبير
Dipodidae الجربوعيات	Jaculus jaculus	Lesser Egyptian Jerboa	اليربوع المصري الصغير

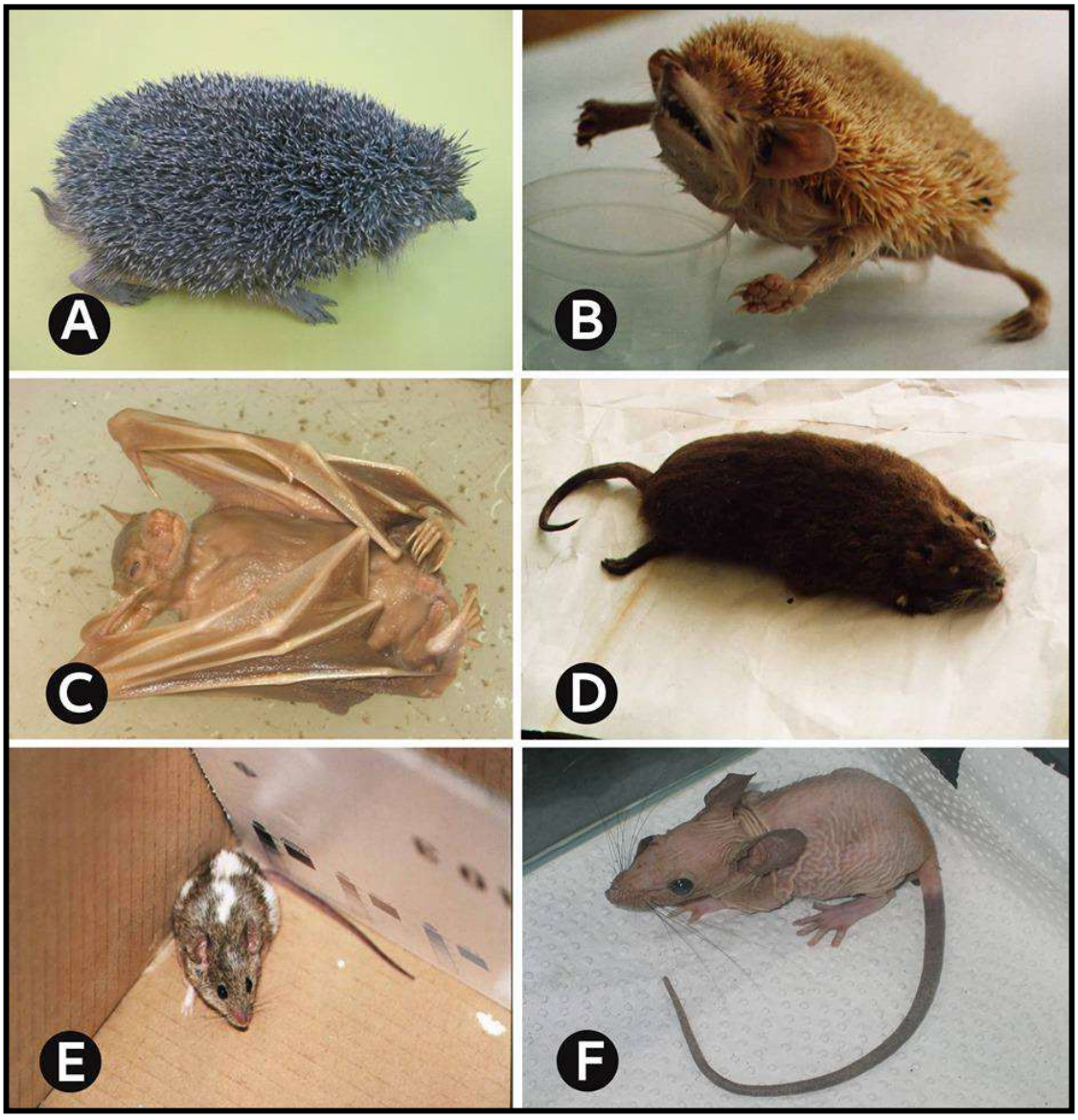

Figure 6: Mammalian fauna species preserved at BE-IUG, bombarded by the Israeli army in December, 2008: (A) Ethiopian Hedgehog (Paraechinus aethiopicus), (B) Long-eared Hedgehog (Hemiechinus auritus), (C) Egyptian Fruit Bat (Rousettus aegyptiacus), (D) Coypu or Nutria (Myocastor coypus), (E) Mutant House Mouse (Mus musculus), and (F) Mutant Black Rat (Rattus rattus).

4. Discussion

Palestine is home to a wealth of vertebrate fauna representing the classes of Chondrichthyes, Osteichthyes, Amphibia, Reptilia, Aves and Mammalia. The diversity of climates, topographies, habitats and ecosystems and the strategic geographic position of the country are crucial factors enhancing the occurrence of both resident and migrant

species (Qumsiyeh, 1996 and UNEP, 2003). This biodiversity suffers from anthropogenic threats represented here by urbanization, desertification, pollution, habitat alteration, modification and destruction, and weakness of environmental and ecological legislations and laws. The Israeli occupation to Palestine has changed the ecology and total environment. The construction of the Apartheid Isolation Wall in the West Bank of Palestine has dramatic consequences on biodiversity (Abdallah and Swaileh, 2011). Similarly, the Israeli metal fences around the Gaza Strip of Palestine have prevented the natural flow of wildlife; particularly large and medium-sized mammals from the occupied Palestinian territories to the Gaza Strip (Abd Rabou, 2005, 2009 and 2019e).

As far as Wadi Gaza Nature Reserve (WGNR) is concerned, it is one of the most significant natural reserves and the only wetland ecosystem in coastal Palestine. It lies in the middle of the Gaza Strip; separating the Gaza Strip into two halves, north and south. The WGNR (9 km within the Gaza Strip) is considered as a unique habitat characterized by rich biodiversity in terms of flora and vertebrate and invertebrate fauna, including globally threatened, endemic, and rare species (MedWetCoast, 2002; UNEP, 2003; Abd Rabou, 2005 and 2011d; Abd Rabou et al., 2007a, b and c; and 2008). The deterioration of WGNR started in the 1970s, when Israel constructed upstream dams and reservoirs; which deprived WGNR from the natural flow of waters coming from Hebron Mountains in the West Bank and the northern Negev Desert in southern Palestine (Zaineldeen and Aish, 2012). This catastrophic situation has negatively impacted wildlife ecology and total environment of WGNR and the Gaza Strip as a whole (MedWetCoast, 2002; UNEP, 2003 and Abd Rabou, 2005).

The wars and repeated invasions imposed by Israel on the Gaza Strip used various aircrafts, tanks and heavy weapons to shoot and destroy different targets. The targets included roads, mosques, institutions, schools, manufacturing workshops, zoos, parks and homes. The IUG buildings were not far away from destruction by the Israeli Army. In December 28, 2008, Israel used F-16 aircrafts to bombard and destroy the Scientific and Engineering Laboratories Buildings of IUG, which included the BD and BE at IUG. As a result, no traces of the stuffed and preserved zoological specimens at BE-IUG existed. Such Israeli attacks targeting the Palestinian environment, ecosystems,

biodiversity and educational and recreational institutions were well-known by most Palestinians. Abd Rabou (2005; 2011a and d and Khalaf-von Jaffa, 2005) documented the destruction of Rafah Zoo in southern Gaza Strip in 2004, which was at that time the only zoo providing knowledge on wildlife to the Palestinian community. Later, many private zoos have been established in the different governorates of the Gaza Strip. They gained most of their animals; particularly mammals (carnivores and artiodactyls); from the wild animals smuggled from Egypt via the earth tunnels connecting between Egypt and the Gaza Strip. Trapping of wildlife constituted another source of zoo animals in the Gaza Strip (Abd Rabou, 2009 and 2011a and b). The dependence on earth tunnels and local trapping for gaining such zoo animals absolutely attributed to the fact that Israel prevented and hindered the entry of animals and other goods through the official crossings because of the Israeli blockade imposed on the Gaza Strip since 2006. During the first war (2008/2009), Israel targeted the Gaza Zoo and killed most of its caged animals. Some predatory animals and monkeys escaped from their cages outside the boundaries of the Gaza Zoo and posed threats to public health in the Gaza Strip (Personal Communications).

As the current study discussed the Palestinian marine and terrestrial vertebrate fauna preserved at BE-IUG before it was bombarded by the Israeli warplanes in December; 2008, fishes (the master of water) and birds (the master of air) were the most common preserved animals. Such results were expected because fishes and birds are the most common vertebrate species in Palestine (Ministry of Environmental Quality – MEnA, 1999; UNEP, 2003; Environment Quality Authority – EQA, 2006 and Perlman and Meyrav, 2009). The current study showed that Chondrichthyes or cartilaginous fishes, preserved at BE-IUG, were represented only by 9 species compared to 51 species of Osteichthyes or bony fishes. Such a low number of cartilaginous fish species encountered at BE-IUG seems to be not surprising. In a very recent study carried out by Farrag et al. (2019) concerning the ichthyofauna (fish fauna) of the Alexandria area, southeastern Mediterranean Sea, Egypt, the Chondrichthyes was represented by 5 species (5.3% of the fish species), while the Osteichthyes was represented by 89 species (94.7%) belonging to 48 families and 72 genera.

In fact, the low number of cartilaginous fishes at BE-IUG could be attributed to multiple factors. The first is that there were no enough formalin, preservation vessels and exhibition places to support the preservation of the large species of cartilaginous fishes at BE-IUG, and as a result, the small-sized specimens of these fishes were preserved. Second, the availability of cartilaginous fishes throughout the year is opportunistic because fishing of these fishes is considered as low compared to that of bony fishes; which usually form the bulk of landed fishes. Third, cartilaginous fishes are expensive from a financial point of view. Finally, cartilaginous fishes are mostly threatened or vulnerable by international conservation agencies (Bariche, 2012 and Abd Rabou, 2013), and accordingly, they were respected by some Gazan fishermen from a conservation point of view, i.e., they were excluded them from their fishing efforts.

Along with cartilaginous fishes, bony fishes represent a main source of animal protein in the Gaza Strip. The deficiency of local marine fishes promoted the establishment of many pisciculture projects in the Gaza Strip, some of which closed their doors due to the many challenges that beset them (Shaheen, 2016). Globally, the class Osteichthyes (bony fishes) is the biggest of all vertebrate fauna, comprising more than 23,000 species belonging to about 435 families and 45 orders (Castro and Huber, 2008). The Mediterranean fish species constituted about 4 % of the marine fishes known worldwide (Bianchi and Morri, 2000; Bianchi, 2007 and Bariche, 2012). It was not surprising to encounter more than 50 bony fish species at BE-IUG. In fact, fish surveys in the Gaza Strip described as weak in the sense that a few works have been done (Abu Aouda et al., 2008; Shaheen, 2016 and Abu Amra, 2018). One of the main priorities for the scientific parties of the Gaza Strip is to focus on biodiversity studies concerning the marine biota, of which the bony fishes are a main part (Abd Rabou, 2013). Indeed, the Palestinian public and scientific communities should be aware of their maritime resources.

Although Abu Amra (2018) revealed 128 Mediterranean bony fish species in the Gaza Strip throughout a recent study, previous investigations on Mediterranean and Red Sea fishes in the Arab World countries revealed good contributions (Al-Hassan and El-Silini, 1999; Saad, 2005; Bogorodsky et al., 2014; Abziew, 2016; El Shehawy et al., 2016 and Haroun et al., 2017). According to the results illustrated in Table 3, the Sparidae family was the biggest among the bony fish families representing the preserved

bony fishes at BE-IUG. Such results coincided with the studies of Al-Hassan and El-Silini (1999) and Saad (2005) who pointed out that the Sparidae was the biggest family among the families of fishes surveyed at the Mediterranean coasts of Libya and Syria respectively. According to Haroun et al. (2017), the Sparidae was one of the biggest families of fishes surveyed at the Egyptian coasts of the Red and Mediterranean Seas.

The Gazans and Egyptians are fond of eating the Gilthead Sea Bream (Sparus aurata), which belongs to the Sparidae family, at restaurants and homes (Personal Communications). Accordingly, fish farming systems concerning the species have been established since 1976 in Egypt and recently in the Gaza Strip (Sadek, 2000; Mehanna, 2007; Abd Rabou, 2013 and Shaheen, 2016). The species was recorded among the fish species encountered at BE-IUG (Table 3). A good remark of the Gilthead Sea Bream is that its culture is notably adaptable to brackish and marine pond conditions that prevail in the Gaza Strip (Pavlidis and Mylonas, 2011 and Shaheen, 2016). In fact, the Sparidae, commonly known as breams and porgies, is a family of fishes of the order Perciformes, and includes about 115 species of mainly marine coastal fish of high economic value, exploited and farmed for human consumption, as well as for recreational purposes (Pavlidis and Mylonas, 2011). As a demersal fish species belonging to the Sparidae family, the Bogue (Boops boops) studied for its population dynamics and catch using bottom trawlers in the Gaza Strip (Sabry et al., 2005).

Sardine fishes have been considered as one of the main delicious food items for both rich and poor Gazans. Such a fact could be attributed to the fact that these fishes make up 60% of the total marine catch and the bulk of the income of fishermen in the Gaza Strip (Abd Rabou et al., 2007d and Abd Rabou, 2013). The sardine fish species; namely the Madeiran Sardinella (Sardinella maderensis) and Round Sardinella (Sardinella aurita), that were highly encountered among the preserved fish species at BE-IUG constituted a part of what the sardine stock actually has? Abu Amra (2018) listed as many as five sardine species belonging to the Clupeidae family caught from the Gaza marine environment. In this regard, Bayhan and Sever (2015) ensured the role of Round Sardinella (Sardinella aurita) as a main component of the food chains prevailing in the Turkish marine ecology. In spite of the fact that sardine species are commonly caught in an intensive and extensive way in the Gaza Strip, El-Haweet et al. (2004) pointed out

that the sardine stock was underexploited locally. This claim seems surprising and not acceptable locally because of the Israeli constraints imposed on the marine fish catch (Food and Agriculture organization of the United Nations – FAO, 2010) and the marine desertification which comes as a consequence of marine pollution and fishery overexploitation (MEnA, 2001; Abd Rabou et al., 2007d and Abd Rabou, 2013).

The Ocean Sunfish (Mola mola), which is the largest bony fish worldwide (Sims et al., 2009), formed a significant element of the Palestinian marine ecosystem, though it is not a commercial or an edible marine item (Abd Rabou et al., 2007d; Abd Rabou, 2013 and Abu Amra, 2018). The species is, in fact, a natural enemy of jellyfishes prevailing at seas and oceans and causing harm to swimmers. Specimens of the Ocean Sunfish, weighing from 500 to 2000 kg, were found dead at the beaches of the Gaza Strip or accidently fallen into the fishing nets of local fishermen (Figure 7). In fact, BE-IUG was and is still unable to install and preserve smaller bony and cartilaginous fish specimens, so how would it be to preserve the Ocean Sunfish; the world's largest specimen of bony fish? This denunciation question would stimulate reviews of the work of museums and biological exhibitions in the Palestinian universities in a way that makes preserving large and small samples easy to spread the biodiversity knowledge among the public and scientific parties of the Palestinians.

Figure 7: The author displaying a fresh caught specimen of the Ocean Sunfish (Mola mola); the largest bony fish worldwide, having a length and a width of nearly 3 m (The photo was taken in December; 2006).

As far as the exotic (alien or invasive or non-indigenous) bony fish species are concerned, they constituted 29.4 % of the preserved bony fish species encountered at BE-IUG. Such exotic species form a considerable deal of the Mediterranean fisheries (Golani and Appelbaum-Golani, 2010; Abdul Malak et al., 2011 and Otero et al., 2013) including the Egyptian and Palestinian waters (Galil, 2007; Salah and Abutair, 2012; Abd Rabou, 2013; Mahmoud et al., 2014; Samy-Kamal, 2015; Kara et al., 2015 and Abu Amra, 2018). It is well- known by the marine and fisheries scientific parties that the routes of exotic species into the Mediterranean include the Suez Canal, the Gibraltar Strait, ship ballast water and accidental release (EastMed, 2010). One of the most dangerous and poisonous exotic bony fish species preserved at BE-IUG was the Silver-cheeked Toadfish (Lagocephalus sceleratus) which belongs to the Tetraodontidae family (pufferfishes). Although many specimens of the species have been measured by the author to have lengths of 40 – 70 cm in the recent years, the lonely preserved specimen at BE-IUG was found to have a length of about 15 cm.

The three species of amphibians (order Anura) recorded throughout the current study in tens for each at BE-IUG were similar to those recorded in other local studies (MedWetCoast, 2002; Yassin et al., 2006; Abd Rabou et al., 2007c and Abd Rabou, 2019e). The easy catch of frogs and toads in their aquatic or semi-aquatic habitats promoted their high preservation level among the zoological specimens at BE-IUG. Declines of anuran populations in the Gaza Strip are highly expected because of multiple conditions including habitat alteration, modification and destruction, heavy use of chemical pesticides, raw wastewater discharges into valleys as the case of WGNR, pollution of water courses and pools, water and soil salinities and the ongoing global climate change catastrophe. More or less conditions of amphibian declines have been suggested globally. They included global climate change, rise in ultraviolet radiation, diseases, habitat loss and destruction, pollution, unsustainable use and invasive species (Wake, 1991; Stuart et al., 2004 and Cox et al., 2006). The apparent absence of salamanders (order Urodela) like the Banded Newt (Triturus vittatus) among the amphibians preserved at BE-IUG could be attributed to the aridity to semi-aridity conditions of the Gaza Strip (UNEP, 2003), where the species exists in north Palestine

which is characterized by rainfall levels exceeding the threshold of 500 mm annually (Disi, 2002).

The arid to semi-arid environmental conditions and the diversity of ecosystems and habitats within the Gaza Strip attract a relatively high occurrence of reptiles of different categories (turtles, lizards and snakes). Indeed, the species; which were preserved at BE-IUG, represented a fraction of what the Gaza Strip harbors?. All reptilian species; which were preserved at BE-IUG, are of Mediterranean affinities. And most of them were recorded in the available Palestinian, Jordanian and Egyptian studies (Amr et al., 1994; Al-Oran et al., 1997; Disi et al., 1999; Al-Oran, 2000; MedWetCoast, 2002; Abd Rabou, 2005; Yassin et al., 2006 and Abd Rabou et al., 2007b, Damhoureyeh et al., 2009; Amr and Disi, 2011; Albaba, 2016b; Handal et al., 2016, and Qumsiyeh, 2016).

The four terrestrial, freshwater and marine turtle species encountered at BE-IUG face actual threats because of their ease hunting by hand or by fishing nets and continuous human disturbance to their ecological habitats. The Greece Turtle or Spur-toughed Tortoise (Testudo graeca) was the commonest among the preserved turtle species at BE-IUG. Many Gazans rear juveniles and adults of the species as pet animals at their home (Abd Rabou et al., 2007c and Abd Rabou, 2019e). This is simply because the species is completely herbivorous, feeding on a wide range of plant materials and residuals (Capula, 1989 and El-Mouden et al., 2006). Similar to the Greece Turtle, the Caspian Turtle or the Striped-neck Terrapin (Mauremys caspica), which is the only freshwater terrapin living in the wetland ecosystem of Wadi Gaza, was easily trapped from its keystone habitat and sometimes reared at homes or even zoos in the Gaza Strip (Abd Rabou et al., 2007c). Only two juvenile individuals representing the Loggerhead Sea Turtle (Caretta caretta) and the Green Sea Turtle (Chelonia mydas) encountered among the zoological specimens stuffed at BE-IUG. Although the Leatherback Sea Turtle (Dermochelys coriacea) is a part of the marine biodiversity of the Gaza Strip (Abd Rabou, 2013), it has been never encountered at BE-IUG or any other biology exhibitions at the universities of the Gaza Strip. This could be attributed to its low occurrence in the marine waters of the Gaza Strip; compared to the above was mentioned two species of sea turtles.

Lizards and snakes encountered at BE-IUG were more or less similar to those recorded in other local studies (Abd Rabou, 2005 and 2019e and Abd Rabou et al., 2007c). In fact, Palestine and Jordan are two neighboring countries sharing somewhat analogous topographic, climatic and environmental conditions. They are very attractive to lizards and snakes among other reptilian categories. Such diversity in the two countries was deducted from the extensive works focusing on reptiles (Sivan and Werner, 1992; Amr et al., 1994; Al-Oran et al., 1997; Disi et al., 1999 and 2001; Al-Oran, 2000; Abu Baker et al., 2004; Albaba, 2016b and Handal et al., 2016). The Desert Monitor (Varanus griseus) is the largest among the lizards preserved at BE-IUG. The species often inhabits different varieties of substrates in the Gaza Strip as was stated by Abd Rabou et al. (2007c). The species was said to be highly endangered locally due to its intentional killing by Gazans including children for no clear reasons. Some Gazans claimed their killing to the Desert Monitor because of its predation on domesticated animals and their eggs. Various studies (Stanner and Mendlessohn, 1986; Tilbury, 1988 and Kumlutas et al., 2004) confirmed such predations of the Desert Monitor on both wild and domesticated animals.

Colubridae was the biggest family of snake species encountered at BE-IUG. This was not strange because the family is actually the biggest in Palestine (Abd Rabou et al, 2007c and Qumsiyeh, 2016). One clear example of this family is the Syrian Black Snake (Coluber jugularis asianus), which is locally known as Arbeed. It was the commonest among the non-poisonous snake species preserved at BE-IUG. According to Abd Rabou et al. (2007c) and Abd Rabou (2019e), the species may exceed two meters in length. By contrast, the Palestine Viper (Vipera palaestinae), which is endemic to Palestine and its neighboring countries (Abd Rabou et al., 2007c; Abd Rabou, 2019b and e), was the most poisonous snake encountered at BE-IUG. In fact, Palestine is home to more than 40 snake species, with one-fourth of these snakes are poisonous (Kochva, 1998; Bar and Haimovitch, 2011 and Abd Rabou, 2019b). Most of snakes' bites in Palestine and even Jordan were commonly attributed to the Palestine Viper as pointed out by many studies (Kochva, 1998; Disi, 2002; Abd Rabou et al., 2007c; Abd Rabou, 2011c and d; 2019b and e; Albaba, 2016b and 2017b and Handal et al., 2016). Unfortunately, both of the poisonous and non-poisonous snakes are sometimes intentionally killed by Gazans with

no regard to their ecological roles. Such behaviors and practices should be stopped in the Palestinian community through the application of effective ecological awareness campaigns adopted by the responsible environmental and educational authorities.

More than 540 of the 9600 bird species worldwide are known to occupy the different ecological habitats of Palestine. Previous and current surveys revealed a considerable number ranging between 100 and 150 resident and migratory bird species occurring in the Gaza Strip (Abd Rabou, 2005; 2011d and 2019d). Of these, only 48 species were encountered to be stuffed at BE-IUG. Most of the stuffed birds were introduced alive by biology students or by some bird hunters. In the practical lessons of the vertebrate zoology course, students have been asked to demonstrate their skills in stuffing many wild as well as domesticated animals. Such stuffing lessons increased the number of species, of which birds were a part. It is worth mentioning in this regard that poaching and hunting of birds like sparrows, quails, chukar, doves, waterfowls, waders and raptors is a common practice in the whole Gaza Strip (Abd Rabou et al., 2007a; Abd Rabou, 2019a and Abd Rabou and Abd Rabou, 2020) and other neighboring countries (Eid et al., 2011). There were no red lines concerning bird hunting in the area. For example, the Chukar (Alectoris chukar), Common Quail (Coturnix coturnix), the different species of doves (Streptopelia spp.) and many others have been commonly hunted for their delicious meat in the Gaza Strip (Abd Rabou et al., 2007a; Abd Rabou, 2020 and Abd Rabou and Abd Rabou, 2020).

The Palestine Sunbird (Nectarinia osea) is the only endemic bird species of Palestine that was preserved at BE-IUG. It was the smallest preserved bird as well, weighing just a few grams (Abd Rabou, 2019a). It inhabits different natural, rural and urban habitats rich in flowering plants (Porter et al., 1996 and Abd Rabou, 2019a). In fact, many sunbirds of the Nectariniidae family are involved in seed dispersal as pointed out by Corlett (2017). As far as the Common or Indian Myna (Acridotheres tristris) is regarded, it was the only exotic or alien bird species recorded at the BE-IUG. This species seemed to invade the Palestinian environment 15 years ago. Holzapfel et al., (2006) pointed out that the Common Myna was listed as one of the 100 worst invading species worldwide. The massive spread of the bird in the area could be attributed to deliberate introductions or to accidentally escaping cage birds from zoos or due to natural range expansion from

proximate countries (Richardson, 1992 and Gregory, 2002). Nowadays, the Common Myna is very common everywhere in the Gaza Strip.

Although the Gaza Strip is home to more than more than 20 species of wild mammals representing many key orders (Abd Rabou, 2005, 2009, 2011a and d, 2019e and Abd Rabou et al., 2007b), the current study revealed only 10 species preserved at BE-IUG. Nearly, all the preserved mammalian species were of small sizes. Such a result could be attributed to the fact that medium-sized mammals were commonly trapped or hunted for feeding purposes as the case of the Cape Hare (Lepus capensis), or to be sold to the local zoos scattered within the governorates of the Gaza Strip, with the Red Fox (Vulpes vulpes), Jungle Cat (Felis chaus) and Egyptian Mongoose (Herpestes ichneumon) are just examples (Abd Rabou, 2009 and 2019e and f). Although the orders of Carnivora and Artiodactyla are well presented in Palestine and Jordan (Amr et al., 1987 and 1996; Hatough-Bouran and Disi, 1991; Qumsiyeh, 1996 and 2016; Qumsiyeh et al., 1993 and 1996; Bunian et al., 2001; Abd Rabou, 2005, 2009 and 2019e and Albaba, 2016a), they were totally absent among the preserved mammals at BE-IUG. Such absence was expected because BE-IUG had modest possibilities in order to stuff large-bodied animals. Artiodactyls of the Gaza Strip are now represented by two gazelle species; namely the Dorcas Gazelle (Gazella dorcas) and the Palestine Mountain Gazelle (Gazella gazella), which are rarely seen near the northern and eastern borders of the Gaza Strip (Abd Rabou et al., 2007b and Abd Rabou 2019e). The rare hunting for these two gazelle species, if occurs, is often destined for dining tables, not for preservation at biology museums or exhibitions in the Palestinian universities of the Gaza Strip.

The two hedgehog species; namely the Long-eared Hedgehog (Hemiechinus auritus) and the Ethiopian Hedgehog (Paraechinus aethiopicus) encountered at BE-IUG are common nocturnal mammals of the Gaza Strip (Abd Rabou, 2005 and 2019e and Abd Rabou et al., 2007b). The easy catch of these creatures facilitated their introduction and preservation at all biology exhibitions of the local universities (Personal Observations). Although the European Hedgehog (Erinaceus europaeus) is recorded among the insectivores of the West Bank of Palestine (Qumsiyeh, 2016), it seems to be totally absent in the Gaza Strip, and as a result, there was no chance to find it preserved at BE-IUG. The two mentioned hedgehog species are now under real threats because of habitat

destruction, killing for no clear reasons and rare consumption as food by a few Bedouin families in the margins of the Gaza Strip (Abd Rabou et al., 2007b). In Israel, hedgehogs were poached and hunted among other wildlife species by Thai guest workers for food purposes (Yom-Tov, 2003).

The two species of bats preserved at BE-IUG, namely the Egyptian Fruit Bat (Rousettus aegyptiacus) and the Kuhl's Pipistrelle (Pipistrellus kuhli) seemed to be a fraction of bat species prevailing in the Gaza Strip. In fact, more studies are needed to survey bat diversity of the Gaza Strip in order to close the gap regarding the mammalian fauna locally. Palestine and Jordan are two neighboring countries having tens of bat species (Qumsiyeh, 1996; Qumsiyeh et al., 1992 and Amr et al., 2006). The frugivorous feeding habit of the Egyptian Fruit Bat makes it a common vertebrate pest, threatening fruit plantations in the Gaza Strip including the Date Palm orchards (Radwan, 2017 and Abd Rabou and Radwan, 2017). In Israel, the species was considered an agricultural pest and programs were adopted and applied to combat the species in its feeding and roosting places (Moran and Keidar, 1993).

Rodentia is the largest mammalian order in Palestine (Qumsiyeh, 1996). Many studies carried out in the Gaza Strip revealed a relatively high occurrence of rodents in various ecosystems (Abd Rabou et al., 2007b and Abd Rabou, 2005 and 2019e). These rodents are more or less similar to that found in the rest of Palestine, Jordan and Egypt (Qumsiyeh, 1996 and Hoath 2003 and Abu Baker and Amr, 2003 and 2004). Bottles containing preserved specimens of the Palestinian Mole-rat (Spalax leucodon ehrenbergi) were common at BE-IUG and other educational institutions in the Gaza Strip. This could be interpreted by the fact that the Palestinian Mole-rat and its soil heaps occur in most regions and soil types of the Gaza Strip (Abd Rabou et al., 2007b) and Palestine as a whole (Qumsiyeh, 1996 and 2016, and Qumsiyeh et al., 2014). The ability of the species 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 many innovative control means have been adopted by farmers to combat the animal (Personal Communications and Observations).

The non-indigenous Coypu or Nutria (Myocastor coypus) is a large rodent species inhabiting various ecosystems in Palestine and Jordan (Qumsiyeh, 1996; Roll et al.,

2008 and Khoury et al., 2012). In fact, the only one preserved specimen of the Coypu at BE-IUG dated back to 1997 when fishermen caught three individuals fallen in their fishing nets. One was brought for mummification at BE-IUG at that time. Such a sudden occurrence of the Coypu in the Gaza Strip could be attributed to the fact that the three individuals of the species lost their way and entered the Mediterranean Sea from one of the rivers or valleys of Palestine to eventually settle in fishing nets in the Gaza Strip. The occurrence of two rodent individuals; namely the House Mouse (Mus musculus) and the Black Rat (Rattus rattus), having certain morphological mutations was strange in the Gaza Strip environment. The phenomenon was once and not repeated for each of the two rodents locally. No one can say for sure where or why the mutations occurred. The two rodents may have come through feed bags coming from abroad to the Gaza Strip. The lack of specialized laboratories at local universities investigating genetic mutations reduced the understanding of what happened to rodents or other animals having abnormal morphologies.

Although the marine mammals form a significant part of the Mediterranean coast of Palestine (Goffman et al., 2000 and Kerem et al., 2012), they have never been studied locally or preserved at the biology museums and exhibitions of the local universities. This could be attributed to different factors including the ill-equipped marine fishing fleet and the lack of marine scientific technology of the Palestinians, lack of specialists of marine warm-blooded fauna, and the restrictions made by Israel on the right of the Palestinians in discovering and exploiting their marine resources in the high and deep waters of the Mediterranean Sea because of claimed security and political reasons. In fact, all what was known about marine mammals came from sightings of fishermen who practiced fishing in the fluctuating accessible marine area in the Gaza Strip or from the beaching cetaceans (toothed and baleen whales).

In this regard, two dolphin species were recorded to beach on the Gaza Strip. The Common Bottlenose Dolphin (Tursiops truncatus) was and is still the commonest, while the Short-beaked Common Dolphin (Delphinus delphis) was and is still the rarest (Personal Communications and Observations). The first is a familiar dolphin occurring around the Mediterranean Sea and oceans worldwide (Castro and Huber, 2008). Those two mentioned dolphins were recorded among six dolphin species occurring in the

Mediterranean coast of Israel (Goffman et al., 2000). During the last 30 – 40 years, a few beachings of baleen whales were recorded by the Gazan public. The identification process of beaching whales was impossible due to the lack of specialists of marine mammals and sciences. In 2014, the author was able to identify a semi-decomposed beaching whale in southern Gaza Strip in 2009 as a Fin Whale (Balaenoptera physalus) (Abd Rabou, 2014). Stranding and open sea sightings of the species were reported in Israel as well (Kerem et al., 2012). It is worth mentioning that all cases of beaching whales in the Gaza Strip were hit by the Israeli military ships after mistaking them for a submarine (Khalaf-von Jaffa, 2019).

5. CONCLUDING REMARKS

In conclusion, the Palestinian marine and terrestrial vertebrate fauna preserved at BE-IUG represented a fraction of what the Gaza Strip actually harbors. Most of the preserved or stuffed animals at local universities were poorly dealt with. Even, the labels containing the scientific classification of preserved species were commonly misleading or lost. Cupboards and shelves that contain stuffed samples appeared to be few and inconsistent in most Gaza Strip universities. It is of an utmost priority and importance that large areas be devoted to the creation of well-ventilated and well-lit exhibitions or animal museums with well-preserved and sustainable animal samples of all habitats, categories and sizes. The thought of constructing a central Museum of Natural History supervised by a responsible body will be a scientific and educational tributary that serves academics and scientific parties specialized in environmental and biological disciplines.

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CONFLICTS OF INTEREST

The author declares that there are no conflicts of interest regarding the publication of this article.

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