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The Herpetofauna of the Gaza Strip with Particular Emphasis on the Vicinity of Wadi Gaza

Abdel Fattah N. Abd Rabou[1 Ψ]; Maged M. Yassin[1]; Mohammed R. Al-Agha[2]; Dawi M. Hamad[3] and Abdel Karim S. Ali[4]

[1] Department of Biology, Islamic University of Gaza, Palestine
[2] Department of Environment and Earth Sciences, Islamic University of Gaza, Palestine (Currently acting as the Minister of Agriculture – Palestine)
[3] Department of Zoology, University of Khartoum, Sudan
[4] Department of Environmental Studies, Al-Neelain University, Sudan
[Ψ] Palestine Wildlife Society (PWLS), Beit Sahour, Palestine, www.wildlife-pal.org
[Ψ] The Palestinian Commission for Development and Environment Protection (PEDCOM), Beit Lahia, Gaza Strip, Palestine.

Correspondence should be addressed to:
Dr. Abdel Fattah N. Abd Rabou, e-mail: **arabou@iugaza.edu.ps**
Dr. Maged M. Yassin, e-mail: **myassin@iugaza.edu.ps**

Abstract: The reptiles and amphibians of the Gaza Strip and Wadi Gaza were surveyed during a period of two years (2002 – 2004). A total number of 21 herpetofaunistic species (2 turtles, 8 lizards, 8 snakes and 3 anurans) belonging to three orders and 15 families was encountered. The species described were all resident and were mostly found throughout the year. The diversity of terrestrial and aquatic ecosystems in the study area encouraged the occurrence of the species. However, the ever-increasing human impact on the existing natural resources in the Gaza Strip has threatened the ecology of wildlife, where the populations of frogs and many reptilian species are declining in an alarming fashion. The results reinforce the necessity of long-term inventories in order to understand the ecology and the dynamics of herpetofaunistic and other wildlife communities in the study area. Finally, the authors recommend improving cooperation of different parties to enhance the public awareness among the Palestinians and to implement environmental laws and legislation to conserve the sensitive and rare species of herpetofauna.

Key Words: Herpetofauna, reptiles, amphibians, survey, Gaza Strip, Wadi Gaza

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الزواحف و البرمائيات في قطاع غزة مع تركيز خاص على منطقة وادي غزة

ملخص: هدفت الدراسة المسحية الحالية إلى التعرف على أنواع الزواحف و البرمائيات في قطـاع غزة و خصوصا وادي غزة على مدار عامين (2002 – 2004)، حيث سجلت الدراسة 21 نوعـا من الزواحف و البرمائيات (نوعين من السلاحف، 8 أنواع من السحالي، 8 أنواع من الثعابين و 3 أنواع من الضفادع) تنتمي إلى 3 رتب و 15 عائلة. الأنواع المسجلة مقيمة و تتواجد غالبـا علـى مدار العام و يعزى حدوث هذا التنوع في الأنواع إلى تنوع النظم البيئية المائية و اليابسة في منطقة الدراسة. و مع ذلك فإن التأثيرات السلبية المتزايدة للإنسان على الموارد الطبيعية في قطاع غـزة هددت و ما زالت تهدد بيئة الحياة البرية إذ أن عشائر الضفادع و عدة أنواع من الزواحف تتـأخر بطريقة تدق ناقوس الخطر. أكدت الدراسة على ضرورة عقد مسوحات طويلة المدى لفهم بيئـة و ديناميكية أنواع الزواحف و البرمائيات و مجتمعات الحيوانات البرية الأخرى في منطقة الدراسـة. ختاما، يوصي الباحثون بضرورة تحسين مستوى التعاون بين مختلف المحافل بغرض زيادة الوعي البيئي بين الفلسطينيين و تفعيل التشريعات و القوانين البيئية لصون و حماية الأنـواع الحساسـة و النادرة من الزواحف و البرمائيات.

الكلمات المفتاحية: الزواحف، البرمائيات، مسح، المهددات، وادي غزة، قطاع غزة.

1. Introduction

Herpetofauna (sometimes referred to as herptiles) is a common name referring to both reptiles and amphibians. Reptiles are adapted to exist in the harsh climates of deserts and arid lands. Even in areas where other wildlife has become scarce, reptiles can still be abundant. They are more abundant in the tropics and subtropics than in the temperate zones. The reptile's dry, thickened and cornified skin is suitable for these climates and habitats and protects the animals from shocks and risks of dehydration (Capula, 1989). In contrast, amphibians usually seek water, wetlands and sometimes moist soils for egg deposition and for protection against water loss from their thin skin. However, amphibians can not tolerate the high salt content of sea water and are therefore the only vertebrates not to have colonized marine habitats (Collins, 1981 and Capula, 1989). There are apparent declines and extinction of the herpetofaunal communities throughout the world (Gibbons *et al.*, 2000). The causes may include habitat loss and degradation, unsustainable use, invasive species,

environmental pollution, disease and global climate change. Habitat loss appears to be the most serious threat to herpetofauna as they are the more affected than other vertebrates by serious human encroachment on their habitats (Capula, 1989 and Gibbons *et al.*, 2000). Habitat destruction, wetland draining and/or pollution represent actual threats to amphibian populations and their reproduction. For example, draining of the Hula Lake or wetland in Palestine resulted in the local extinction of many endemic species including the frog *Discoglossus nigriventer* (Skinner and Zalewski, 1995 and Gabbay, 1998).

A variety of herpetological surveys and studies has been conducted in different countries and environments worldwide. In an attempt to monitor herpetofauna in a managed forest landscape to study the effects of habitat types and census techniques, Ryan *et al.* (2002) recorded 72 herpetofaunistic species in five (2 wetlands and 3 terrestrial) habitats in the U.S.A.. These included 19 species of anurans, 8 salamanders, 8 lizards, 28 snakes in addition to many turtle species. They found that herpetofaunal communities in the two wetland habitats were clearly dissimilar from those in the three terrestrial habitats.

In Turkey, the survey of herpetofauna seems to be extensive as many studies have been conducted in different localities of the country. Kumlutas *et al.* (1998 and 2004a and b) recorded 17 and 22 reptile and amphibian species respectively in different ecosystems. The species included urodelans, anurans, lizards, snakes and tortoises. Similarly, Ugurtas *et al.* (2000), Baran *et al.* (2001) and Ozdemir and Baran (2002) recorded 27, 11, 15 species of reptiles and amphibians respectively. The previous studies showed that lizards were the most common group of reptiles in terms of species identified or the species caught. Three Anuran species (*Bufo viridis, Rana ridibunda* and *Hyla arborea*) that were investigated in the different areas of Turkey have a wide distribution throughout the Middle East countries (Baha El din, 1992; Disi *et al.*, 2001; Disi, 2002 and Al-Sorkhy and Amr, 2003).

In Israel, reptiles were surveyed in the Golan Plateau and Mount Hermon where 36 (2 turtles, 15 lizards and 19 snakes) species were recognized (Sivan and Werner, 1992). The two species of turtles (the Caspian Terrapin *Mauremys caspica rivulata* and the terrestrial Spur-thighed Tortoise *Testudo graeca terrestris*) occurring in the Golan Plateau were found to occur in most areas of the Mediterranean basin and the countries of the Middle East as well (Gasith and Sidis, 1983; Blasco *et al.*, 1986/87; Tok, 1999; Disi *et al.*, 2001; Disi, 2002 and Turkozan *et al.*, 2003). In spite of the threats facing freshwater turtles

worldwide, they have received relatively little attention in terms of stream and riparian wetland management (Bodie, 2001). With regard to poisonous snakes, Kochva (1998) recorded 10 species occurring in Israel and Jordan belonging to 3 families. The most dangerous and the most common snake is the Palestine Viper *Vipera palaestinae*. All these venomous snakes seem to pose a serious threat to humans, where several hundred bites are reported every year in Israel and Jordan (Kochva, 1998).

Herpetological surveys in the Occupied Palestinian Territories (OPTs) seemed unclear where no specific scientific literatures were available. Rough data on wildlife species indicated that approximately 500 birds, 100–120 mammals and 120 herpetofaunistic species, in addition to about 400 fish were known to inhabit Palestine (Ali-Shtayeh and Hamad, 1997; The Palestinian Institute for Arid Land and Environmental Studies – PIALES, 1996 and The Palestinian Central Bureau of Statistics – PCBS, 2000). In the Gaza Strip, work on herpetofauna was restricted only to two recent studies (Abd Rabou, 2005 and Yassin *et al.*, 2005). The scarcity of scientific literature concerning wildlife in general and herpetofauna in particular in specific regions of the OPTs promoted the conduction of the present work aiming at surveying and giving general observations on reptiles and amphibians in Wadi Gaza and its adjacent habitats, Gaza Strip.

2. Material and Methods

2.1. Study Area

Wadi Gaza or the Valley of Gaza is an indispensable part of natural life in Palestine and has an interesting history and rich vegetation. The variety of habitats and the location of Wadi Gaza in the coastal zone of the Mediterranean give the area a rich and varied fauna. In recognition to its importance as a natural area and as the only wetland in the Palestine coast, Wadi Gaza was declared a nature reserve in June 2000 by the Palestinian National Authority. Wadi Gaza springs from the Negev Mountains and the Southern Heights of Hebron City in Palestine. It is considered the biggest in Palestine, if the Jordan Valley is excluded. Its catchment or drainage area is about 3500 km^2 (The Project for the Conservation of Wetland and Coastal Ecosystems in the Mediterranean Region - MedWetCoast, 2003). The total length of the Wadi is 105 km from its source to its end. The final portion of the Wadi which lies in the Gaza Strip extends 9 km from the Truce line in East Gaza to the coast where

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

2.2. Field Methods

Frequent site visits and observations and discussions with local people were used to determine reptilian and amphibian species in Wadi Gaza and the whole Gaza Strip as well. The Israeli measures in the Gaza Strip largely affected night field works and accordingly, observations started at 8:00 and ended at 16:00. The survey period covered two years (October 2002 – September 2004), though old records of herpetofauna were considered. All data collected in the field were recorded in a special data sheet designed for this purpose. During field surveys, binoculars and cameras have been used throughout the study period and photos were taken in the field and sometimes in the laboratories of the Biology Department, Islamic University of Gaza (BD/IUG) for confirmatory purposes. Aquatic nets were used to collect aquatic species. Many hunters and

local people in the area were good contributors to this work through their provisions to live as well as dead specimens to the surveyor. Some people have good experience in dealing with both venomous and non-venomous snakes. Road kills are good indicators for identifying such herpetofauna and other vertebrate fauna occurring in the area. Most of the collected specimens were taken to the BD/IUG for further taxonomy and preservation. A variety of guide books and texts were used for the identification of herpetofaunistic species occurring in the area (Capula, 1989; Breen, 1994; Disi *et al.*, 2001 and Disi, 2002).

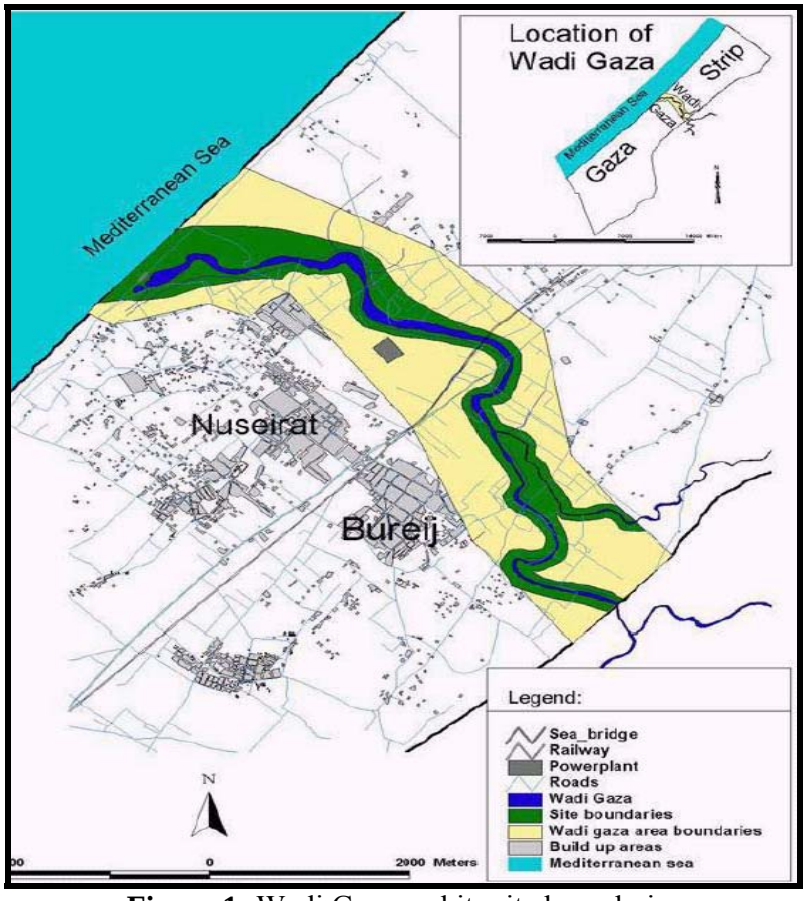

Figure 1: Wadi Gaza and its site boundaries

3. Results

A total number of 21 herpetofaunistic species (2 turtles, 8 lizards, 8 snakes and 3 frogs) belonging to 15 different families and three orders was recorded in Wadi Gaza and other localities of the Gaza Strip; they are listed in Tables 1 and 2. Squamata was the bigger of the two orders of reptiles comprising 16 species. The three amphibians belonging to one order and three families were recorded to inhabit wetlands, seasonal rainwater pools, rainwater harvesting schemes, irrigated canals and wastewater ponds of the study area. Reptiles and amphibians of the area were all resident and mostly found throughout the year. Some reptiles may cause harm to local people.

Table 1: Reptiles recorded in Wadi Gaza and other localities in the Gaza Strip

Family	Scientific Name	Common Name	Status*	Arabic or Local Name
Order Chelonia				
Emydidae	*Mauremys caspica rivulata*	Caspian Terrapin	R	سلحفاة الماء العذب
Testudinidae	*Testudo graeca*	Spur-thighed Tortoise	R	السلحفاة الأرضية
Order Squamata				
Varanidae	*Varanus griseus*	Desert Monitor	R	الورل الصحراوي
Chamaeleonidae	*Chameleo chameleon*	Mediterranean Chameleon	R	الحرباء
Geckonidae	*Hemidactylus turcicus*	Turkish Gecko	R	أم بريص
	Ptyodactylus hasselquistii	Light Fan-footed Gecko	R	أم بريص مروحية القدم
Lacertidae	*Acanthodactylus boskianus*	Bosc's Lizard	R	سحلية
Agamidae	*Laudakia (=Agama) stellio*	Agama	R	الحردون
Scincidae	*Chalcides ocellatus*	Ocellated Skink	R	الدفان
	Scincus scincus	Sand Skink (Sandfish)	R	سقنقور الرمل

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Family	Scientific Name	Common Name	Status*	Arabic or Local Name
Boidae	*Eryx jaculus*	Sand Boa	R	البوا الرملية
Elapidae	*Walterinnesia aegyptica*	Desert Black Snake	R	الثعبان الأسود الصحراوي
Colubridae	*Coluber jugularis asianus*	Syrian Black Snake - Arbeed	R	عربيد
	Coluber nummifer	Coined Snake	R	الثعبان النقدي
	Coluber rhodorhachis	Jan's Desert (Cliff) Racer	R	ثعبان
	Coluber rubriceps	Red Whip Snake – Red-headed Snake	R	ثعبان أحمر الرأس
Viperidae	*Echis coloratus*	Carpet Viper	R	حية السجادة
	Vipera palaestinae	Palestine Viper	R	الحية الفلسطينية

* **Status: R = Resident**

Table 2: Amphibians recorded in Wadi Gaza and other localities in the Gaza Strip

Family	Scientific Name	Common Name	Status*	Arabic or Local Name
Order Anura				
Bufonidae	*Bufo viridis*	Common (Green) Toad	R	علجوم شائع
Ranidae	*Rana bedriagae*	Levantine Frog	R	ضفدع
Hylidae	*Hyla savignyi*	Tree Frog	R	ضفدع شجري

***Status: R = Resident**

Caspian Terrapin *Mauremys (Clemmys) caspica rivulata*: This is the only freshwater reptilian species which lives in the wetland ecosystem and the other temporary and permanent freshwater or wastewater ponds of Wadi Gaza (Figure 2A). More than 23 individuals were seen throughout the study period either inside water or basking on the banks of the wetlands. In most times, the species was seen coming to water surface to take air for breathing. In one visit, more than 7 individuals were seen swimming in a shallow wastewater pond;

two juveniles were also seen dead on the pond banks. Local people who used to exploit the reeds of the wetlands usually catch many of them (Figure 2B). Some turtles were caught using aquatic nets for identification. In one visit, a roadkill of the species was found on the unpaved main road near the wetland of Wadi Gaza. The turtle has a relatively long tail and a neck characterized by the yellow stripes bordered in black. The species was under actual threat due to wetland drainage and hunting.

Spur-thighed Tortoise *Testudo graeca*: The Spur-thighed Tortoise (Figure 2C), which has a yellowish carapace with various balck spots, was found throughout the year in a vareity of habitats in Wadi Gaza and other localities in the Gaza Strip, with the exception of winter latent months. They inhabited various agricultural areas, tamarisk forests surrounding the wetland, citrus and olive orchards, the vineyards cultivated in the sand dunes characterizing the western side of Wadi Gaza and other woodlands. More than 25 individuals of the species were captured and released by the researcher during the study period. The time of capture for all turtles was at the morning hours. In addition, more than another 15 individuals were brought by students to the BD/IUG. In Wadi Gaza, some people were found to rear the species at home as pet animals. Compared to the previous turtle species, this species has a very short tail. It is also under threat due to their ease hunting and continuous human disturbance to their ecological habitats.

Desert Monitor *Varanus griseus*: This is the largest lizard species living in Wadi Gaza and the whole Gaza Strip. The species was seen once in Wadi Gaza hiding among the vegetation. In another occasion, a person living near Wadi Gaza captured the species and brought it to the surveyor at the BD/IUG (Figure 2D). Moreover, two individuals were seen kept in a cage in a private zoo in Rafah Governorate, Gaza Strip. The species is highly endangered due to its killing by farmers and local people.

Mediterranean Chameleon *Chameleo chameleon*: The Mediterranean Chameleon (Figure 2E) was rarely seen in the field, though it is present throughout the year inhabiting scrubs, thickets and bushy areas. During the study, only 11 individuals were seen as singles in different localities in the Gaza Strip; particularly Wadi Gaza. Four individuals were brought by students to the

BD/IUG as well for dissection and preservation purposes. The Chameleon was usually seen grasping branches of trees and shrubs with its feet and prehensile tail. The color often varies with the dominant background. The species is shy and threatened due to killing and habitat destruction.

Turkish Gecko *Hemidactylus turcicus*: This common species is found year round inhabiting all residential and public buildings in the study area and the whole Gaza Strip. The animal produces loud voices at night. Many individuals of the species were brought for preservation at the BD/IUG. It is worth mentioning that people usually kill the species when seeing it at night. When attacked, the species readily sheds part of its tail as a means for escape.

Light Fan-footed Gecko *Ptyodactylus hasselquistii*: This robust species is found year round inhabiting residential and public buildings in the study area. Only three individuals of the species were seen climbing the walls of buildings in Wadi Gaza. The species was known for its feet which have a fan-like fashion. Similar to the Turkish Gecko, many individuals of the species were brought for preservation at the BD/IUG.

Bosc's Lizard *Acanthodactylus boskianus*: It is one of the most common lizard species throughout the year in Wadi Gaza and the whole Gaza Strip. It is usually counted in tens rather than hundreds wherever somebody goes to Wadi Gaza. The species was found in the Wadi bed, agricultural lands, deserts and semi-deserts, earth cliffs and sedges of agricultural fields (Figure 2F). In one occasion, the animal was seen netted in a very complex way to the extent that the surveyor was unable to release it.

Agama *Laudakia (=Agama) stellio*: This species is common in every habitat in the Gaza Strip and hence Wadi Gaza. The species was commonly seen in relatively large numbers, sometimes exceeding 50 individuals, as singles or twos or even small groups in semi-arid areas of Wadi Gaza, agricultural fields, hills and earth banks, buildings, dump sites and gardens. The species used burrows, cracks or crevices as parts of its niche. In early morning, the species was usually seen standing on a hill or a solid object and basking to elevate the internal temperature of its body to a level making the animal active to resume its activities (Figure 2G). Although it was at present in reasonable numbers (roughly

100 individuals per km^2) in the region, the Agama is sometimes threatened by killing and human disturbance to its habitats. In the field, children were seen in more than 7 times capturing and killing the species.

Ocellated Skink *Chalcides ocellatus*: This fast-moving species was found throughout the year though it was rarely seen in the field. Only 7 individuals were seen separately and as singles in Wadi Gaza, mainly in agricultural lands, though it may occur in gardens and under bushes and *Cactus* plants. In one occasion, the species was noticed concealing itself under the fallen leaves and debris of a tree. As many as five samples were preserved at the BD/IUG (Figure 2H).

Sand Skink (Sandfish) *Scincus scincus*: This is a very rare species seen at morning hours in western Wadi Gaza where sand dunes are the dominant topographic feature. During the study period, only 3 individuals were seen as singles in a sandy area cultivated with olive, fig and grapes. The body is covered with shiny scales and ends with a short and stocky tail. The yellowish color seems to be a camouflaging character allowing the animal to conceal itself from predators. If surprised, when facing the surveyor, it buries itself with astonishing speed in sands. Due to habitat destruction, sand overexploitation and residential creeping in the Gaza Strip, the sand skink is really under actual threat.

Sand Boa *Eryx jaculus*: This nonpoisonous snake species is very rare in the Gaza Strip, where only one dead sample was seen in Wadi Gaza area (Figure 3A). According to local people, this species is nocturnal and could be found when removing logs and stones in agricultural fields, or when soil is dug up. Threats facing this snake species are similar to all snake species encountered in the area. Threats include habitat destruction and intentional killing by locals. It is worth mentioning that killing is the waiting fate for any snake species seen in the area. There are negative attitudes among Palestinians towards all poisonous and nonpoisonous snake species. They did not acknowledge the ecological roles played by these creatures in eliminating harmful pests and stabilizing ecological balances in various ecosystems.

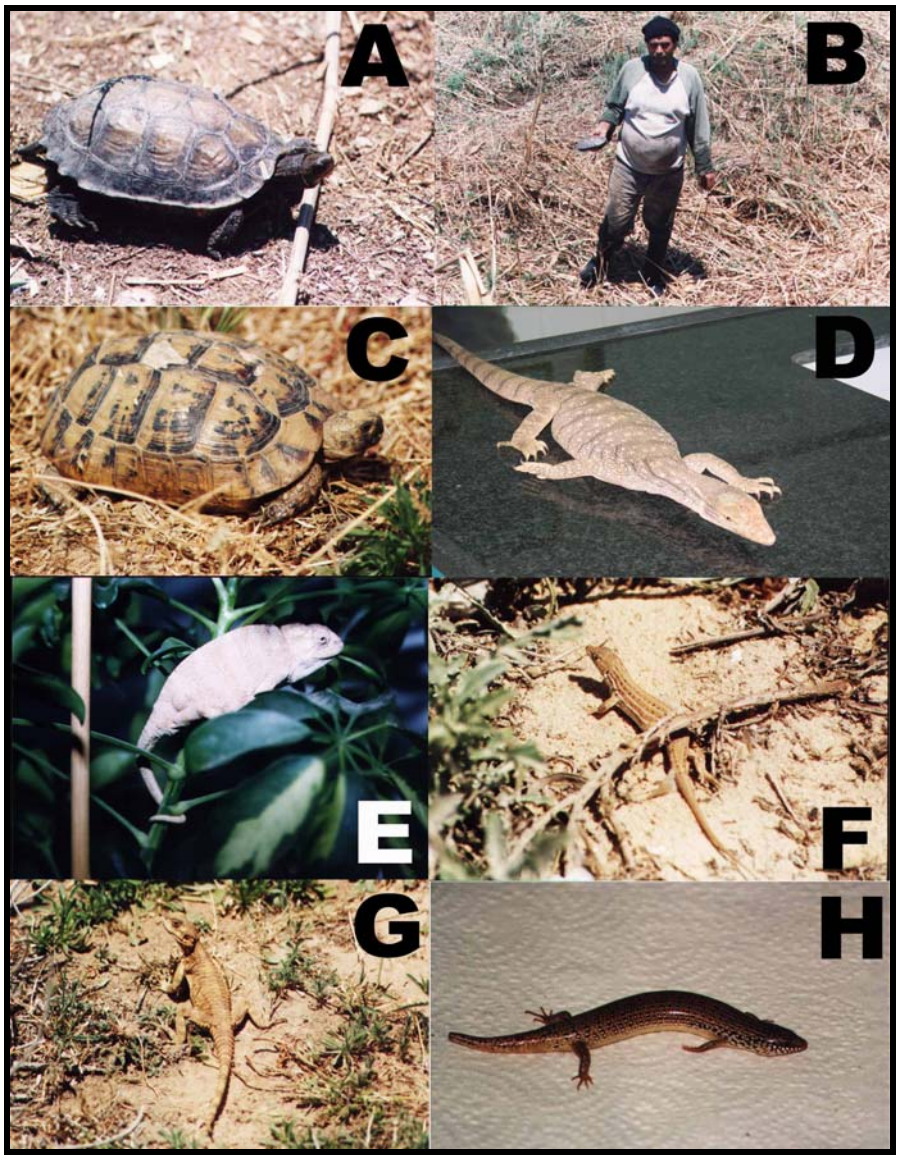

Figure 2: Herpetofauna of Wadi Gaza: (A-B) Caspian Pond Turtle *Mauremys caspica rivulata* caught by reed harvester in Wadi Gaza (C) Spur-thighed Tortoise *Testudo graeca* (D) Desert Monitor *Varanus griseus* (E) Mediterranean Chameleon *Chameleo chameleon* (notice the prehensile tail) (F) Bosc's Lizard *Acanthodactylus boskianus* (G) Agama *Laudakia (=Agama) stellio* (H) Ocellated Skink *Chalcides ocellatus*.

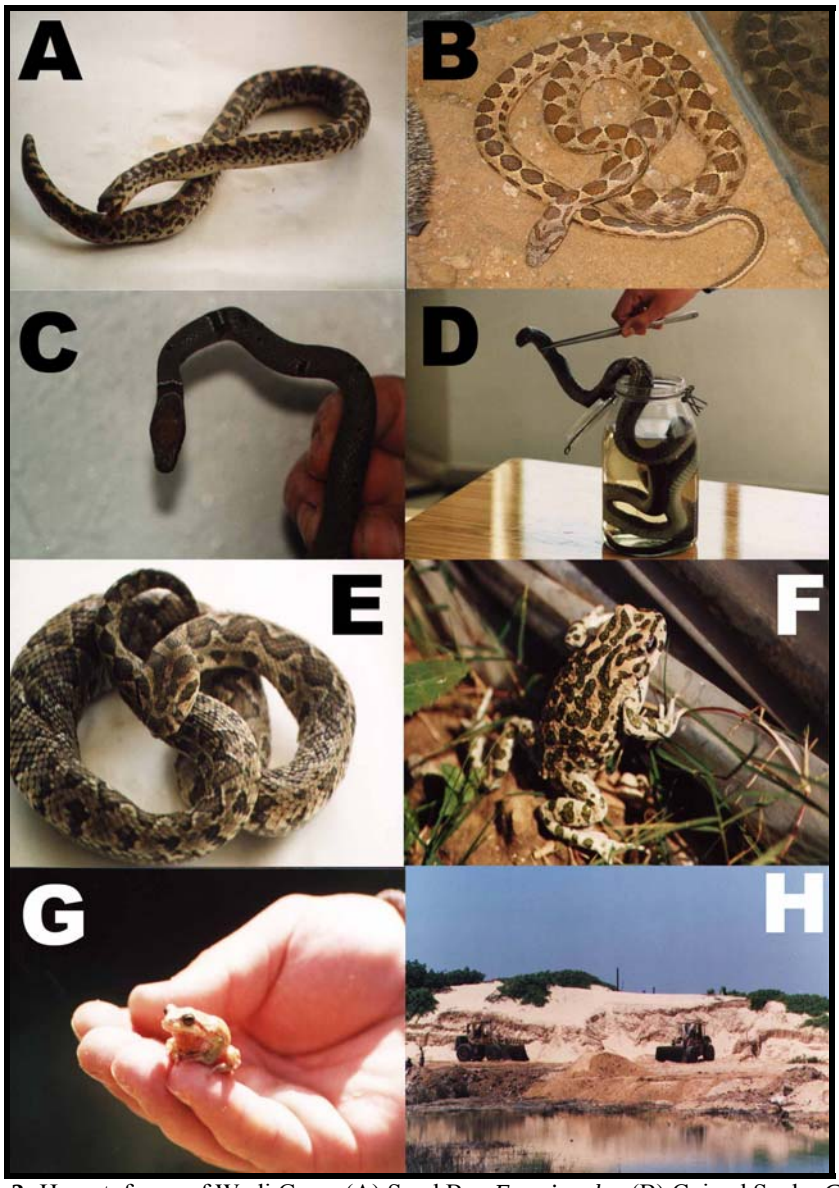

Figure 3: Herpetofauna of Wadi Gaza: (A) Sand Boa *Eryx jaculus* (B) Coined Snake *Coluber nummifer* (C) Red Whip Snake *Coluber rubriceps* (D) Syrian Black Snake *Coluber jugularis asianus* (E) Palestine Viper *Vipera palaestinae* (F) Common Toad *Bufo viridis* (G) Tree Frog *Hyla savignyi* (H) Habitat destruction and modification in Wadi Gaza

Desert Black Snake *Walterinnesia aegyptia*: This poisonous snake inhabits vegetable farms, olive orchards and other vegetated areas rich in bushes and trees in addition to bare deserts. It is a stout snake with a small head slightly distinct from the neck. The color is shiny black dorsally and bluish black ventrally. Two records of the snake were found stuffed at the BD/IUG; one of them was brought from Wadi Gaza in July 2003.

Coined (Coin Marked) Snake *Coluber nummifer*: Four individuals were found dead in the soil roads of Wadi Gaza in addition to another 6 live and dead specimens were brought either by locals or students to the BD/IUG for preservation (Figure 3B). The species inhabits cultivated as well as bushy areas in Wadi Gaza. The species may invade old houses or buildings in order to search food. The species is characterized by blotches arranged along the dorsal side of the body, and the head is distinct from the neck. An oblique dark streak is found below the eyes.

Jan's Desert (Cliff) Racer *Coluber rhodorhachis*: Only two stuffed samples of the species were found. The first was brought dead and highly distorted from Wadi Gaza in April 2004. The second sample was found among four stuffed snake species at the home of a secondary-school teacher who used to teach biology. The other species found were the Red Whip Snake *Coluber rubriceps*, a juvenile of the Syrian Black Snake (Arbeed) *Coluber jugularis* and a juvenile of the Palestine Viper *Vipera palaestinae*. According to the teacher, these specimens were collected from various ecosystems in Wadi Gaza.

Red (Red-headed) Whip Snake *Coluber rubriceps*: Only one living sample of this snake species was caught in Wadi Gaza and brought alive to the BD/IUG, where it was identified, stuffed and photographed (Figure 3C). According to the hunter, the species was hunted at daylight in an agricultural field not far a way from the north bank of Wadi Gaza. Many brown bands or rings with white edging follow the head region of the snake.

Syrian Black Snake (Arbeed) *Coluber jugularis asianus*: This is a familiar snake species to all Palestinians in the Gaza Strip to the extent that two Palestinian families were named with the name of this reptile; "*Al-Arbeed*" and "*Al-Arabeed*" (the Arabic plural of the word *Arbeed*). The total length of adult

individuals exceeded 180 centimeters and sometimes reached about 250 centimeters. In one occasion, the Syrian Black Snake was seen crossing the width of an agricultural field with astonishing speed in a mid-day of August 2003 in Wadi Gaza. In a second occasion, a dead and a semi-decomposed specimen was found in February 2004 beside the wetland of Wadi Gaza. A pointed branch of a plant was found piercing its palate, causing its death under a Tamarisk bush at the edge of the wetland. Apart from the field, as many as six preserved samples of the species with various lengths were found at the BD/IUG (Figure 3D).

This species was found year round in a variety of habitats including agricultural and forested areas, open areas and near chicken farms. As reported by Wadi Gaza inhabitants, this species is very aggressive to humans though it is not dangerous. In more than three occasions, it attacks human as a sort of defense mechanism, hisses and tries to bite. If it is in direct danger, it makes a brave stand. It feeds on many small wildlife and domestic species including lizards, chicken, rodents and passerines. It wraps itself and coils its strong body around its preys. Some Palestinians believe that the Arbeed can twist around a man and may cause suffocation.

Carpet Viper *Echis coloratus*: This rare nocturnal species was recorded once killed near an agricultural orchard in Wadi Gaza. Like the Palestine viper, the head is triangular and distinct from the neck.

Palestine Viper *Vipera palaestinae*: The Palestine Viper (Figure 3E) is the only endemic snake species in the historic Palestine, where it represents one of the most poisonous and dangerous viper species in Palestine. Most snake bites in the Gaza Strip were attributed to this species. In September 2004, the surveyor visited a 20-year old Palestinian youth from Beit Hanoun, North Gaza who was bitten by this dangerous snake. Due to his severe case, the person was firstly admitted to an advanced Israeli hospital for a week. After then, the patient was transferred to Al-Shiffa Hospital in the Gaza Strip to complete his treatment. The patient was treated for 20 days.

The Palestine Viper is known locally as "*Haya Za'ara*" which means the short viper. It inhabits the Mediterranean biotope, which is rich in rodents and avifauna. In Wadi Gaza, the species inhabits agricultural fields, neglected areas, plains, rocky hills, marshy areas and around villages and human settlements.

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During the study period, the researcher watched the capture of five individuals by Wadi Gaza inhabitants. Moreover, people from Wadi Gaza and other areas of the Gaza Strip used to bring many alive as well as killed specimens of the species to the BD/IUG for preservation. The head is triangular and distinct from the neck. An inverted brown "V" band on the head characterizes the Palestine Viper. The body is stout and the tail tapers abruptly behind the cloaca. Finally and in spite of its ecological role as a pest control agent, the species suffers an actual threat due to killing and habitat destruction.

Common or Green Toad *Bufo viridis*: The Common or Green Toad is common and found year round in relatively reasonable numbers in Wadi Gaza with the exception of winter months as the animals hibernate. It inhabits wetlands, wastewater ponds and seasonal water spots scattered after the rainy season (Figure 3F). The species was sometimes found in agricultural areas adjacent to wetlands and not far a way from freshwater bodies, temporary ponds and irrigation schemes. As many as tens of the species were recorded at Wadi Gaza wetlands, while few (N=8) were recorded in other localities. In six visits, the species was found together with the Caspian Turtles *Mauremys caspica rivulata* sharing the same ecological habitat. The two herpetofaunistic species were sometimes extracted from their aquatic environment using aquatic nets or seldom by hand capture especially when the animals were basking on the banks of ponds. The current drainage of Wadi Gaza wetland ecosystem, habitat destruction and modification in addition to the pollution caused by heavy use of pesticides and other chemicals are threatening all frog species and other biota in Wadi Gaza. Furthermore, roadkills of the toad and other frog species were recorded in the area, since the toad lives close to main roads.

Levantine Frog *Rana bedriagae*: During the study period, only 4 live specimens were encountered as singles in the area. In one occasion, a large frog was found standing on the main soil road of Wadi Gaza near the wetland. The other specimens were seen among reeds bordering the edges of the wetland, indicating that the species does not like to stay in drier habitats compared to *Bufo viridis* which may happen in such places.

Tree Frog *Hyla savignyi*: The Tree Frog (Figure 3G) is the smallest of frog species occurring in Palestine. As many as 20 individuals were either seen or collected by the surveyor from the cultivated areas and fruit orchards bordering the two banks of Wadi Gaza. The species usually hides most of the day-time on trees and bushes. It inhabits permanent water bodies in Wadi Gaza area which are rich in vegetation, trees, bushes and reedbeds. The color of the dorsal side is uniformly bright green and may be changeable depending on the environment. The ventral side, in contrast, is creamy. A dark brownish stripe is noticed extending from the nostril through the eyes and tympanum and along the flanks to the groin. Finally, the threats facing the species are similar to that of the other frog species. Habitat destruction and modification are frequent in Wadi Gaza especially during the last three years (Figure 3H).

4. Discussion

The strategic position of Palestine at the terrestrial meeting point between Asia, Europe and Africa along with its climate and topography facilitates the interaction and spread of faunistic and floristic species of the three continental masses (Ali-Shtayeh and Hamad, 1997). The diversity of ecological habitats in the Gaza Strip in general and Wadi Gaza in particular contributed much to species diversity though 21 herpetofaunistic species were recorded (Abd Rabou, 2005). The various ecosystems including wetlands, sand dunes, natural vegetation and agricultural orchards provide reptiles and amphibians with all needs; shelter, food, breeding and camouflaging sites. However, the ever-increasing human impact on the existing natural resources in the Gaza Strip has threatened many wildlife species including herpetofaunistic ones. The populations of frogs and many reptilian species are declining in an alarming fashion. The results reinforce the necessity of long-term inventories in order to understand the dynamics of animal communities in the study area. It is expected that the population over-crowding, the residential and agricultural expansions, the intensive and extensive infrastructural and developmental projects and the poor implementation of environmental laws and legislations are major factors contributing to the gradual decline of biodiversity in the area. In this regard, the Israeli forces and Israeli settlers played a capital role in deteriorating and destroying both natural and cultivated ecosystems in the OPTs. Uprooting of vast vegetated areas had its major impact on wildlife ecology in the area. Habitat modification and fragmentation which was apparent in Wadi Gaza and

other areas of the Gaza Strip may have a capital role in changing animal composition and distribution.

The illegal hunting and poaching in Wadi Gaza and the Gaza Strip are common practices that could hurt the populations of herpetofauna to such low levels that species go extinct. Mendelessohn and Yom-Tov (1988) and Yom-Tov (2003) highlighted the serious deleterious effects of illegal hunting and poaching on wildlife by Thai workers in Israel, and indicated that such illegal hunting or over-hunting are common practices in Third World countries and have resulted in that many wildlife species are threatened. In the light of these findings, it is the responsibility of the Palestinian authorities to protect wildlife through posing environmental laws and legislations.

The arid to semi-arid environment of Palestine hosts reptile populations comprising desert species that are also found in the neighboring countries and particularly the Sinai Peninsula (Kochva, 1998 and Disi, 2002). Wadi Gaza lies in the mid of the Gaza Strip which has a geographical contact with both the Negev Desert and the Sinai Peninsula seems to have good representatives of reptilian species inhabiting such arid to semi-arid environments. Many reptilian species recorded in the present study resemble the species recorded in other studies carried out in different Middle East countries, e.g. Israel (Sivan and Werner, 1992), Turkey (Budak *et al.*, 1998; Kumlutas *et al.*, 1998 and 2004; Ugurtas *et al.*, 2000; Baran *et al.*, 2001; Ozdemir and Baran, 2002) and Jordan (Disi *et al.*, 2001 and Disi, 2002). These similarities could be attributed to the fact that these countries lie in the east Mediterranean basin where climatic conditions are nearly the same as in Palestine.

The Freshwater Caspian Terrapin *Mauremys caspica rivulata* utilizes diverse riparian habitats in Wadi Gaza. The ecological flexibility of the species exhibited by its ability to thrive in heavily polluted water bodies such as sewage lagoons and semi-natural wetlands in Wadi Gaza coincided with the findings of Gasith and Sidis (1983 and 1984) who found it inhabiting polluted aquatic habitats in Israel. Polluted water has been reported to affect adversely certain turtle species while others have successfully adapted to the changing conditions in their environments (Moll, 1980). The current deterioration and drainage of wetland habitats in Wadi Gaza will seriously threaten the existence of the species. Similar to the situation in Wadi Gaza, human intervention by habitat alteration, drainage of riparian wetlands, water pollution and turtle collection was reported to endanger the existence of certain populations of the Caspian

Terrapins and other turtle species in Illinois and Iowa, U.S.A. (Moll, 1980) and in Europe (Honegger, 1981). The second turtle species; the Spur-thighed Tortoise *Testudo graeca* was easily and commonly captured by local Palestinians in a variety of habitats. The ease with which the species is captured and kept in captivity has led to massive commercialization, and resulted in declining the numbers and abundance of the species in Spain (Blasco *et al.*, 1986/1987).

Different lizard species were recorded in different dry and wet habitats in Wadi Gaza and the whole Gaza Strip. The protective and rough skin characterizing lizards make them inhabiting dry and harsh environments (Capula, 1989) such as the study area. The diversity of agro-environments and wetland habitats in Wadi Gaza attracts more insects and other micro-fauna to happen and this, in turn, constitutes a major trophic level in the food chain of lizards (Keiper *et al.*, 2002). This may contribute to the high populations of many lizards in Wadi Gaza; particularly the Agama *Laudakia stellio* and the Bosc's lizard *Acanthodactylus boskianus* which depend mostly on insects as a major food source. This coincides with the study of Dusen and Oz (2001) who found that the majority of the diet of *Laudakia stellio* consisted of the class Insecta (99.18%). All of lizard species recorded in the Gaza Strip were found to occur in Israel (Sivan and Werner, 1992) and Jordan and other neighboring countries (Disi, 2002). The Desert Monitor *Varanus griseus* is the largest and the rarest among lizards occurring in the area. Because it is persecuted by farmers and local people, the species is highly threatened.

Venomous and non-venomous snakes play an ecological role in eliminating pests and harmful animals from the environment (Kochva, 1998; Disi *et al.*, 2001 and Disi, 2002). However, this role was not acknowledged and they were usually killed. This may confirm the fact that most identified snake species throughout the study period were either killed or stuffed in educational institutions. The most targeted species were the Syrian Black Snake *Coluber jugularis asianus* and the Palestine Viper *Vipera palaestinae*. People feared the former due to its black color and length which may exceed two meters, while the fear from the latter comes from the public knowledge of its dangerous bites (Kochva, 1998). Solutions to this problem lie in improved education of the local community and in enforcing laws regarding wildlife protection. Ten species of venomous snakes belonging to three families (Viperidae, Elapidae and Atractaspididae) occur in Palestine. Being the only endemic reptile species

in the historic Palestine (Disi, 2002), the Palestine Viper is also the most common and most dangerous among other venomous viper species (Kochva, 1998). Many people were bitten by the species. In the same context, Kochva (1998) pointed out that several hundred bites are reported every year in Israel and Jordan and fatalities, though rare, still occur.

Amphibians in the study area were only restricted to three frog species compared to the 7-8 amphibian species occurring in Palestine (PIALES, 1996 and Ali-Shtayeh and Hamad, 1997). Among other vertebrates, they are the most affected by human encroachment on their habitats (Capula, 1989). Hence, aquatic habitat destruction, wetland drainage and pollution are actual threats to amphibians. A clear example of such habitat destruction was known from Israel where the drainage of the Hula Lake resulted in the extinction of the frog *Discoglossus nigriventer* (Skinner and Zalewski, 1995 and Gabbay, 1998). Poaching and eating of the three mentioned species were recorded among Thai workers in Israel, and such actions could have significant losses in their populations (Yom-Tov, 2003). These threats along with the shortage of natural water bodies in the Gaza Strip contributed much to the very limited amphibian occurrence where urodeles (order Urodela or Caudata) were not known to occur there. Very few urodele species including the Banded Newt *Triturus vittatus vittatus* were known to breed in the rainpools in Israel (Geffen *et al.*, 1986/1987).

Bufonidae is adapted to arid habitats that are not far a way from water bodies. Thus, the *Bufo viridis* shows very wide distribution throughout the Gaza Strip, Israel (Werner, 1986/1987), Jordan (Disi, 2002) and Turkey (Ozdemir and Baran, 2002). The other two species encountered in the present study; *Rana bedriagae* and *Hyla savignyi* were mostly seen near or in their aquatic habitats and they seemed not to occur in drier habitats compared to *Bufo viridis*. These observations seem to coincide with the available herpetological texts (Capula, 1989 and Disi, 2002), as *Rana bedriagae* was found to inhabit many aquatic systems in Turkey (Budak *et al.*, 2000; Kaya and Erismis, 2001; Kaya *et al.*, 2002 and Dusen *et al.*, 2004).

Finally, the authors recommend carrying out more studies regarding wildlife and biodiversity in Palestine. They also recommend improving cooperation of different parties to enhance the public awareness and to implement environmental laws and legislation to conserve nature and to protect wildlife especially the sensitive and rare species of herpetofauna.

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