

STUDIES ON ANIMALS IN "SABAH AL-AHMAD" NATURAL RESERVED AREA IN THE STATE OF KUWAIT

Bahija E. Al-Behbehani¹ and Hussain M. Ibrahim²

¹ Science Department, College of Basic Education, PAAET, Kuwait

² Environmental Researcher, Kuwait

ABSTRACT

A comprehensive study has been done, through day and night for a period of 12 months (from May 2008 to May 2009), on the animals: Mammals, birds, insects, arachnida and soil of "Sabah AL-Ahmad" natural reserved area in the State of Kuwait. This is to evaluate the different factors controlling the biodiversity in that area. The results indicate that the overall biodiversity, both animals and plants, of the reserved area has been greatly influenced by the scarcity of the rainfall during the last years. The decrease in the plant density gave rise to migration of the animals that were protecting themselves through and under these plants.

The results of studying the biodiversity in relation to the soil taking into consideration the climatic factors, indicate that a number of animals (Scorpion, Uromastyx (Dhub), Fennec fox, Insects (Butter fly, Black and Domino beetles, Beetle) and birds: Hoopoe, the desert lark, and slender-billed Gulls, are found and monitored in "Sabah AL-Ahmad" natural replaced area. The large numbers of insects and birds observed in the studied area may be due to the presence of artificial water lake and its surrounding green land. In contrast, there are some animals, such as snakes and rodents, are not demonstrated which may be due to the lack of feeding source; plant cover, resulting from the scarcity of rainfall. However, the common occurrence of the Uromastyx (Dhub) may be attributed to its hibernation habit and the presence of insects as a feeding source.

The soil studies revealed the presence of five types ranging from mud, sand, sandy clay, gravelly and rocky soil. The texture, moisture content and pH of these soil types are proved as important factors controlling the animal behavior and the biodiversity of the reserved area. Important results concerning the factors controlling the biodiversity are arrived and recommendations for preserving the animals are given.

Key words: Sabah Al-Ahmad Natural Reserved Area, Biodiversity, Fennec Fox, Birds, Scorpion, Beetles, Uromastyx, Insects, Kuwait

INTRODUCTION

The State of Kuwait is an arid country where rainfall is scarce. The maximum rainfall mostly occurs in Kuwait during winter, in the form of showers and thunderstorms of short duration, with an average rate of

about 105 mm/yr. Evaporation ranges between a low average of about 3.3 mm/d and a high average of about 16 mm/d. Under these semi-arid conditions, a considerable part of rainfall evaporates during precipitation, whereas the remaining part occupying the

subsoil pores mostly evaporates through the capillary system.

The State of Kuwait is characterized by two main seasons; Summer and Winter. The mean Summer temperature is 37°C, while becomes very high, particularly during July and August. The weather during November to February is mild to cool, with average minimum temperatures in January decreasing to 7°C. The desert of Kuwait is characterized by a low latitude climate and high-pressure zones in which cold air descends. Then the descending air becomes warm but, instead of releasing rain, the heat from the ground evaporates the water before it can come down as rain.

The ground is super hot because the sun's rays beat down on it directly overhead.

"Sabah AL-Ahmad" natural reserved area lies NE of the State of Kuwait (Fig. 1) with an area of about 320 km². It comprises five areas; Jal Az Zor highs, Um Al Remam depression, Al Ougah, Shagaret Talha and the coastal area. The reserved area is characterized by high biodiversity that comprises 22 mammal's types, 151 bird's types and 21 recites types. These recorded animals and birds are well known and abundant in the Kuwaiti land, but became scanty due to the climatic changes particularly the rapid rise in temperature and scarcity of rains.

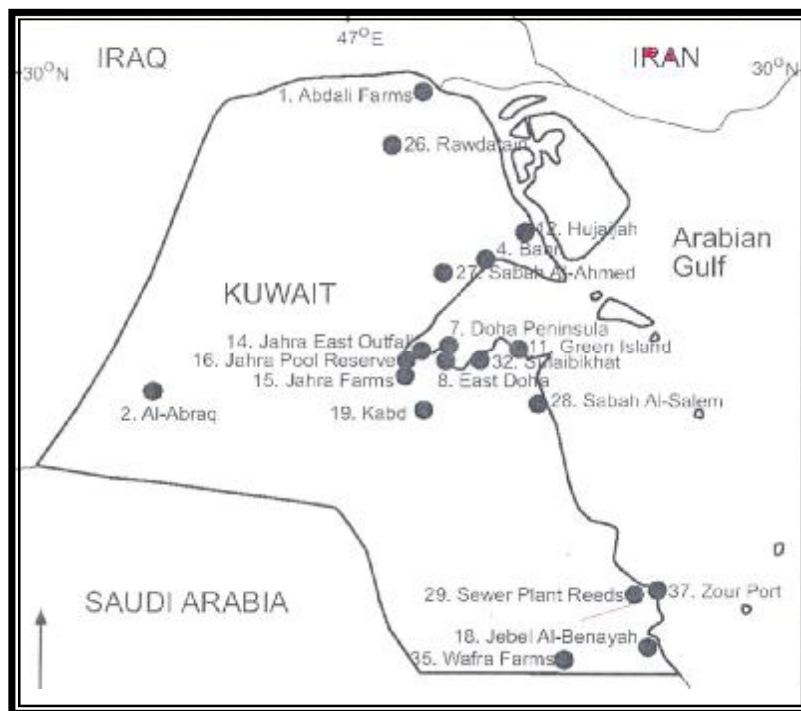


Fig.1: Location of Sabah Al-Ahmad Natural Reserved Area, State of Kuwait.

The present observation on animals behavior can tell much about the animal being observed. By recognizing what are the normal behaviors of a healthy wild and captive animal and being observant of any changes in behavior, we can often head off social, environmental, and health problems before they become advanced enough to require serious and often expensive intervention.

Animal habitat consists of five essential elements: food, water, shelter, space and the arrangement of these elements. Although requirements differ in composition and quantity from species to species, all animals require these elements to survive. Limiting or eliminating one or more of these specifically required elements for a specific species would limit or eliminate that species (Al-Behbenhani and Ibrahim, 2007).

Survival of desert animals depends on their ability to avoid extremely high temperatures. Three basic faunal groups are common in deserts: small mammals, reptiles and arthropods. Individuals in these three groups frequently survive by staying in burrows hot times of the day and being active during cooler periods (Wallwork, 1982).

Human activities, in general, have affected natural habitats in different ways. The most dramatic changes involve widespread degradation of entire areas, such as shift from forest to agricultural use. However, a more pervasive influence is the construction of linear open areas-truck, paths and roads-through previously continuous habitat (Forman, 2000). These open areas may provide ecological situations that differ profoundly from those of the surrounding habitat; for example,

sun penetration may modify floral composition and nest-side availability (Ries et al., 2001 and Riitters, and Wickham, 2003). Predictably animals exhibit a wide range of behavioral responses to the novel environment provided by roads. Some taxa avoid open areas, whereas others use these paths as invasion routes (May and Norton, 1996 and Stiles and Jones, 1998).

Roads that constitute behavioral barriers to animal movement may effectively fragment populations in an otherwise continuous habitat (Mader, 1984 and Fehlberg, 1994). All these impacts may influence the continued viability of populations and, thus, have attracted more studies from conservation biologists. (Mader, 1984, Reh, 1989, Fehlberg, 1994, Alexander and Waters, 2000, Jones, 2000 and Shine et al., 2004). However, the proximate mechanisms that cause roads to influence reptile populations remain virtually unstudied (Shine et al., 2004). Many animals directly affect the characteristics of soil. Soil properties in turn can influence the distribution and abundance of animals living on the soil (Wallwork, 1982).

The present work represents a pioneer study in the State of Kuwait and it is the first that deals with natural populations and animal behavior in the Sabah Al Ahmad reserved areas.

MATERIALS OF STUDY

The present study is based on the following materials:

- 1- Field observations gathered from monitoring some animals for a period of 12 months (from May 2008 to May 2009) during fifteen trips.

- 2- Field photos for the studied animals (reptiles, birds, insects, Arachnida) as well as the soil types that predominate the studied area.
- 3- Soil samples collected from different sites in the studied area.
- 4- Meteorological data of the year 2008 gathered from the Department of Meteorology and Climate Division, Directorate General Civil Aviation.

RESULTS AND DISCUSSIONS

The studied animals:

First of all, the demonstrated numbers of animals and biodiversity are scarce, in spite of the relatively wide area of Sabah Al-Ahmad reserved area.

A number of animals : scorpion (*Androctonus crassicauda*), *Uromastyx aegyptius* (Dhub), Fennec fox (Local name: Al-Hossnie, scientific name: *Vulpes vulpes*), Black and Domino beetles, beetle -Butter fly, and birds: Hoope, desert lake and slender-billed Gulls) are found and monitored in "Sabah Al-Ahmad" reserved area.

A wide variety of insect's fauna can be found in Kuwait. Gardens, parks and marshy areas formed during the rainy seasons host many species that would not commonly be found in this dry desert. True bugs, locusts, beetles and ants comprise most of the local species. Beetles are especially abundant and darkling beetles can account for 23% of all beetle species in a desert region. Ants are also numerous and an important component of a desert environment, especially the most dry areas.

A colorful contribution to the insect fauna

is the butterfly species that inhabit the Arabian Peninsula. There are more than 150 species, many of which are migrants through this area. At least 28 species have been recorded from eastern Arabia, including Kuwait (Jaman and Meakins, 1998).

Reptiles in Sabah Al-Ahmad reserved area

The reptiles in the animal kingdom are related to Phylum Chordata, Subphylum Vertebrata, Superclass Gnathostomata, and Class Reptilia. Jaman and Meakins (1998) reported that at least 94 species of Lizards are known from the Arabian Peninsula including Agamids, Chameleons, Gecko, Lacertid Lizards, Skinks, monitor Lizards and worm lizards.

Reptiles have heavily keratinized epidermal scales covering the body. Respiration is through lungs, fertilization is internal and reproduction is oviparous. The eggs produced are shelled and amniotic. The skeleton has thoracic ribs, a single occipital condyle, which allows for a high degree of head movement, and two sacral vertebrae, which provide support for the pelvis. Only reptiles have all of these characteristics together.

Reptiles are poikilothermic animals. Thermoregulation is often achieved behaviorally but to a certain extent reptiles have the ability to maintain a body temperature that is higher than the environment. Basking in the sun is a heat-gain behavior and the highly impermeable scaly skin allows for exposure to direct sunlight. Burrowing to reduce heat is another heat regulation behavior. Many lizards have the ability to darken or lighten their skin. A darkened skin early in the day increases heat absorption while lightening the skin during

the midday helps reflect the sunlight. Prolonged exposure to extreme heat or cold can be lethal.

Reptiles at all life stages are almost exclusively carnivorous. Prey is located through the use of the senses. Many of the reptiles are visual predators.

The Dhub "*Uromastyx aegyptius*" (Fig: 2)



Fig. 2 : The Dhub "*Uromastyx aegyptius*".

The *Uromastyx aegyptius* is a genus of lizard whose members are better known as spiny-tailed lizards, uros, mastigures, or dhub lizards. *Uromastyxes* are primarily herbivorous, but occasionally eat insects, especially when they are young. They spend most of their waking hours basking in the sun, hiding in underground chambers at daytime or when danger appears. They tend to establish themselves in hilly, rocky areas with good shelter and accessible vegetation. Their size ranges from 14 inches to 36 inches or more. Like many reptiles, these lizards' colors are noticed to change according to the temperature; during cool weather, they appear dull

and dark but the colors become lighter in warm weather, especially when basking; the darker pigmentation allows their skin to soak up more sunlight. Their spiked tail is muscular and heavy, and can be swung at an attacker with great velocity, usually accompanied by hissing and an open-mouthed display of (small) teeth (Forman, 2000). *Uromastyx* generally sleep in their burrows with their tails closest to the opening, in order to thwart intruders.

has distinct occurrence in Sabah Al-Ahmad reserved area, particularly in the open areas where its burrows occurs. It is noticed that it does not go far away from its burrows. It can be thought that the "*Uromastyx aegyptius*" in Figure (2) had lost its way to his burrow; it was detected while the teamwork of this research was walking. It is also noticed that it did not live within a social life, but lives in a solitary habit.

and dark but the colors become lighter in warm weather, especially when basking; the darker pigmentation allows their skin to soak up more sunlight. Their spiked tail is muscular and heavy, and can be swung at an attacker with great velocity, usually accompanied by hissing and an open-mouthed display of (small) teeth (Forman, 2000). *Uromastyx* generally sleep in their burrows with their tails closest to the opening, in order to thwart intruders.

These lizards acquire most of the water they need from the vegetation they ingest. They have rarely been observed - in the

present study- drinking standing water. They are noticed urinate when they are frightened and this can rapidly deplete their crucial water stores. The Dhub is noticed eating some insects, although it is basically an herbivores eating a great variety of plants. This result accommodate with the observations of Clayton and Wells (1994).

Clayton and Wells (1994) and Al Behbehani and Ibrahim (2007) reported one species of snakes and one of vipers: the Arabian Rear-fanged snake *Malpolon moilensis* and the Arabian sand viper *Cerastus gasperettii*. Clayton and Wells (1994) also recorded the hissing sand snake (the racer) and the black desert cobra in the Kuwaiti desert. No snakes are noticed during the present study. This may be due to the absence of asphalt roads in the studied area, as they were detected easily passing the asphalt roads. Shine et al. (2004) stated that the favorable evening temperatures (20.9-29.2°C) may attract snakes and vipers to asphalt roads, especially in areas with high variation in ambient temperatures. This result may explain why snakes were not observed in the present study.

The scorpion, *Androctonus crassicauda* (Fig. 3a), known as "akrab" in Arabic, is fairly common in Kuwait and has become almost a symbol of the dangers of the desert (Clayton and Wells, 1994). Scorpions, in the present study, are found to be solitary and mainly nocturnal. 15-20 scorpions were recorded in each trip. As with most arthropods, the scorpion's activities are linked to temperature. They prefer to hunt at night, while in the daytime they were found hiding under rocks or wood pieces, where they were abundant and

easy to be observed . During wet weather in October, they were active during daytime. Most of the scorpions were found under stones and bits of corrugated iron.

The scorpions of the present study were found, mainly, to be active at night, while during daytime they seek some forms of covers (bushes, rocks or woods) to escape from the high temperature. The present observations agree with those of Hadley (1974) who reported similar behavior and concluded that this is the most important adaptive mechanism for scorpions inhabiting desert areas.

The presence of rocky ground (Fig.3b), with caves and occasionally hard bricks favored the environment for scorpions to live in "Sabah Al-Ahmad" reserved area.

Scorpions were found to hunt their prey using their long stinging tails to kill or immobilize them. Their food includes various invertebrates particularly insects.

The spatial distribution of the studied scorpions was partially dependent on several a biotic factors including temperature, precipitation, soil and substrate characteristics.

The present study showed that scorpions are fairly common in Kuwait, which is similar to the results reported by Clayton and Wells (1994). Al Behbehani and Ibrahim (2007) recorded two species of scorpions during their study of animals in KISR reserved area in Kuwait: the common black scorpion (*Androctonus crassicauda*) and the yellow scorpion (*Compsobuthus arabicus*).



Figure 3 a): The black scorpion *Androcotonus* sp. is trying to hide under woody relics when the worker came close to, b) presence of rocky terrain of the study area.

In the present study only one species of scorpions was detected. On the other hand, the other scorpions, *Apisbhbuthus* sp., *Scorpio* sp. and *Compsobuthus arabicus* which were reported to be present in Kuwaiti area and not detected in the present work. In the present study, whenever the scorpions were always seen to stridulate with their coxae of the pedipalp and the front walking legs.

The black beetles (Fig. 4a) are fairly common in "Sabah Al-Ahmad" reserved area. They belong to order Coleoptera and family Carabidae (ground beetles). They are omnivores and are members of the commonest family of

desert beetles. They cannot fly, like many of beetles that have adopted to desert life. Their wing cases have fused together and form part of a mechanism to conserve water. They get most of their moisture from the vegetation seen by eat, but they are noticed to drink water, if it is available.

Another day-active beetle is the Domino beetle, so-called from the white spots scattered on his black body. Its coloring present a warning signal, also it has defensive sprays, both anal and lateral. The Domino Beetle is an active carnivore who chases its prey. If the Domino beetle is found in an open ground, it



Figure 4 : a) The black beetle

will scurry as fast as his legs will carry him to the nearest patch of vegetation. This species deters attacking ants by spraying vinegar-like chemicals from gland in its sides.

Most Carabidae are dark shiny beetles with striate or linear indented elytra. Ground beetles rarely fly and usually will run when disturbed. The domino beetles is a fairly large beetle measuring 28-30 mm in length and their colors is shiny black with white spots scattered on the dorsal side of the abdomen.

b) The Domino beetle

These white patches are actually clumps of bristles. Their antennae have eleven segments and are filiform. The front pair of legs have five tarsal segments and all legs have claws (Jaman and Meakins, 1998). The domino beetles are found, in the studied area, in firm sand or rocky places hiding under debris during the day and hunts at night.

The Butterfly (Fig. 5) is one of the more spectacular insects demonstrated in "Sabah Al-Ahmad" reserved area, particularly at the



Figure 5: A Butterfly, in the study area.

plants occupied parts. It belongs to the order Lepidoptera, family Danaidae (milkweed butterflies), and subfamily Danainae (Jaman and Meakins, 1998).

The danaidae are large and boldly colored. *Danaus chrysippus* is the common butterfly throughout the Arabian Peninsula (and world-wide) with at least four different coloration patterns. The more common pattern is orange, brown and brown-black with white markings on the forewings, as shown in figure (5). The forewings radius has five branches and the wingspan is 75-80 mm. The front legs are reduced, lack claws and are not used for walking. This description in the present study accommate with Clayton and Wells (1994).

Mammals in "Sabah Al-Ahmad" Reserved Area

At least 150 living species of wild terrestrial mammals have been recorded in the State of Kuwait. Forty-eight of the species are

rodents such as jirds, gerbils and jerboas. The exact number of mammals still exists today. The Dorcas gazelle, Rheem, Cheetah, Arabian wolf, and the Caracal lynx all at one time roamed the Kuwaiti desert (Clayton and Wells, 1994 and Jaman and Meakins, 1998) are not found in the present study in "Sabah Al-Ahmad" reserved area.

With lucky, the Fennec fox (*Vulpes vulpes*) was observed in the present study in "Sabah Al-Ahmad" reserved area, particularly in areas where there are gullies or rocks into which they can tunnel. Since most of the soil of the study area are soft sediments, they can tunnel more or less anywhere; Jal Az Zor and Wadi Batin (Fig. 6) being particularly suitable. Fox avoid the open sandy desert. They occasionally come out during the day, and they observed in the study area to take no notice of us if we are keeping quite. One fox was observed in the Jal Az Zor area and it wandered away very fast, when it was followed by the car.



Figure 6 : Parts of the Jal Az Zor cliffs open on Wadi Al Batin in the study area.

The observed fox (*Vulpes vulpes*), in the present study, is a medium-sized canid. Pelage is reddish-brown. Its ears are large pointed and erect. The legs are long and slender and the tail is thick, long, and bushy.

Hedgehogs recorded in Kuwaiti desert (Clayton and Wells, 1994) were not found in the present study, this may be due to the absence of asphalt roads in the studied area, as they were detected easily passing the asphalt roads in the KISR reserved area (Al Behbehani and Ibrahim, 2007).

Birds in Sabah Al-Ahmad reserved area

The birds in the animal kingdom are related to Phylum Chordata, Superclass Gnathostomata, Subphylum Vertebrata, Class Aves, Subclass Neomithes, Superorder Neognathae (Jaman and Meakins, 1998).

The Bar-tailed Desert Lark (Fig. 7a): is a breeding bird resident and some times, especially in hot days is observed in the present study sheltering from the heat in the opening of the Dhub's (*Uromastyx*) burrows. While in Mars, April and May, they are found resting

on the area plants. The above result agrees with the observations of Clayton and Wells (1994).

The Hoopoe, a migrant bird (Clayton and Wells, 1994) is one of the more spectacular birds that are seen in the desert within the reserved area. In spite, the research team cannot take photo of it, as it escapes quickly when they are near. It is barred wings and amazing crest is quite unmistakable. The Hoopoe feeds mainly on large insects, as well as earthworms and lizards. The Jal Az Zor cliffs (Fig. 7b) are a marvelous place to see migrating birds of prey, especially in the early morning as they sit on the ground waiting for the sun to heat up the air and create the thermal currents on which they ride (Clayton and Wells, 1994).

The hoopoe prefers warm, level, exposed dry ground. This solitary bird can be found in desert areas, gardens and parks but will avoid trees or dense vegetation. It locates its prey by sight or sound and forages by walking and probing the long slender bill into the ground (Jaman and Meakins, 1998).



Figure 7 : a) The Desert Lark,

b) Part of Jal Az Zor cliffs in the study area.

The Slender-billed Gulls (*Danaus chrysippus* L., 1758) (Fig. 8a) is fairly common bird in "Sabah Al-Ahmad" reserved area, as there is an artificial lake is constructed in which fishes are found. This bird feed on fishes and almost anything they can find, including sand hoppers, young crabs and even leftover sandwiches (Clayton and Wells, 1994).

The soil and biodiversity

The soil samples collected from the study area have been mechanically analyzed to determine the soil texture and its impact on the biodiversity and behavior of the studied animals. The moisture content and pH values are measured in situ. The results indicate the presence of five types of soil differing in their texture and moisture content. These types comprise, mud, sand, sandy clay, gravelly and rocky soils (Fig.9).

Inspection of the biodiversity of the studied area and the common soil types shows strong relationship, where soil is the medium for a large variety of organisms and interacts closely with the wider biosphere. Soil provides a vital habitat, primarily for microbes including bacteria and fungi; also for microfauna such as protozoa and nematodes; mesofauna such as microarthropods and enchytraeids; and macrofauna such as earthworms, termites and millipedes (Bardgett, 2005).

Soil is in close cooperation with the wider biosphere - the maintenance of fertile soil is "one of the most vital ecological services the living world performs"; the "mineral and organic contents of soil must be replenished constantly as plants consume soil elements and pass them up the food chain" (Baskin, 1997).



Figure 8 : The Slender-billed Gulls in the study area.

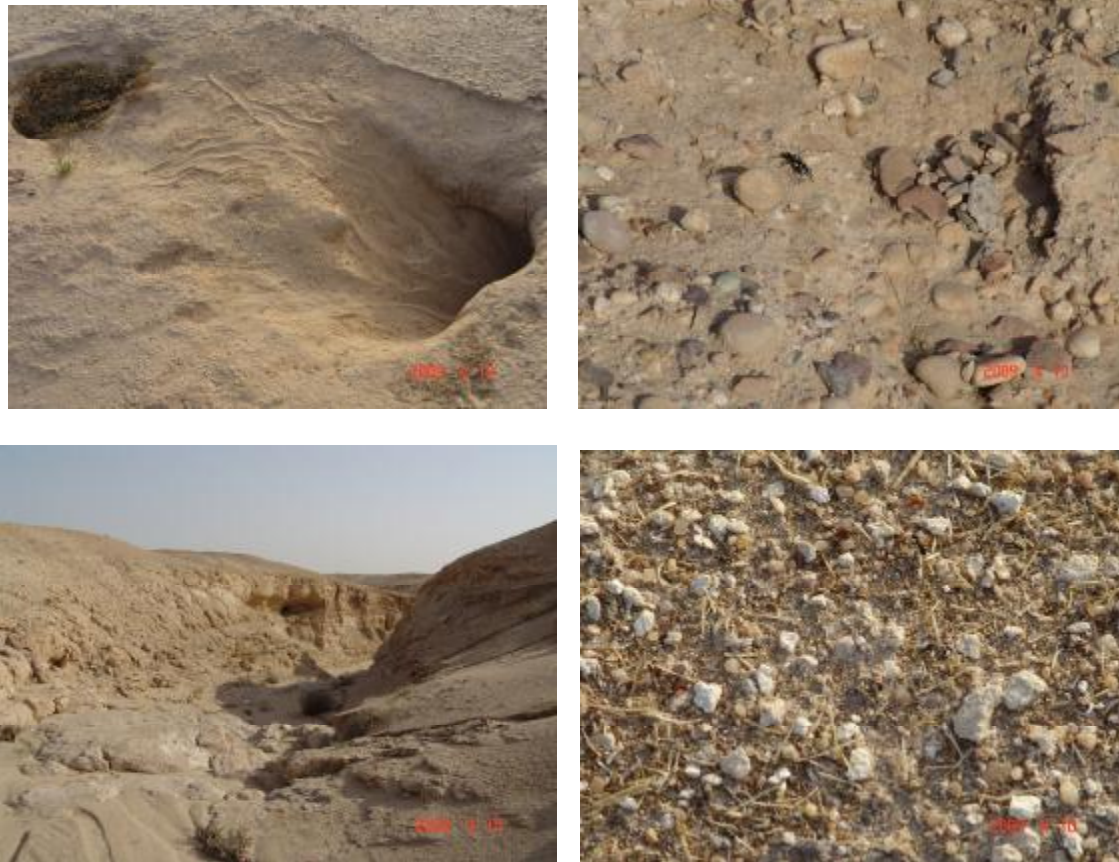


Figure 9 : Types of soil in Sabah Al-Ahmad Natural reserved area.

Soil acidity (or alkalinity), that refers to the concentration of hydrogen ions (H^+), is an invisible condition has its impact on soil biodiversity. It reduces the numbers of most macrofauna including, for example, earthworm's numbers (important in maintaining structural quality of the top soil for plant growth). Also affected is rhizobium survival and persistence. Decomposition and nitrogen fixation may be reduced which affects the survival of native vegetation; biodiversity may further decline as certain weeds proliferate under declining native vegetation (Slattery and Hollier 2002 and Hollier and Reid 2005). Maintaining soil pH at the appropriate level is critical as it can be a limiting fac-

tor in producing quality wildlife openings.

A "subtle synchrony" is how Baskin (1997) describes the relationship that exists between the soil and the diversity of life, above and below the ground. It is not surprising that soil management has a direct impact on biodiversity, including practices that influence soil volume, structure, biological and chemical characteristics, and whether soil exhibits adverse effects such as reduced fertility, soil acidification or salinisation. This section touches on selected soil factors that may be affected by soil management, and the according impact they can have on biodiversity.

CONCLUSIONS

There are many gaps in the scientific knowledge dealing with the wildlife of the State of Kuwait that can make an important contribution to the desert life. In the present study, the animals and soil of "Sabah AL-Ahmad" natural reserved area have been studied. This is to evaluate the different climatological and pedological factors affecting the biodiversity in that area.

A number of animals are found and monitored in "Sabah Al-Ahmad" reserved area. These area: scorpion (*Androctonus crassicauda*), lizard *Uromastix microlepis* (Dhub), Fennec fox (*Vulpes vulpes*). Some of insects (Black and Domino beetles, Beetle, Butterfly) and birds (Hoopoe, the Bear-tailed desert lark and slender-billed Gulls) that are recorded by Clayton and Wells (1994) are also found in the natural reserved area. This may be due to the presence of artificial water lake and its surrounding green land. In contrast, there are some rodents, such as *Jerbillus* sp. are not observed in the present study, which may be due to the lack of feeding source; plant cover, resulting from the scarcity of rainfall. However, the common occurrence of the *Uromastix* (Dhub) may be attributed to its hibernation habit and the presence of insects as a feeding source.

The camels are prevented to live in the area due to the lack of enough vegetation as well as their harmful effects on the insects and small animals of the natural reserved area. However, a number of *Oryx* are located in a special closed area within the area to protect them from disappearances due to the fox attack.

The soil studies revealed the presence of five types ranging from mud, sand, sandy clay, gravelly and rocky soil. The texture, moisture content and pH of these soil types are proved to be important factors controlling the animal behavior and the biodiversity in the area. This study proved that the relationship of soils to biodiversity is intimate and complex; it spans vast spatial and temporal scales and is essential to life. Soil is an asset to the biodiversity, and the two should not be considered separately when it comes to protecting one or the other. It can be concluded that protecting the soil is a vital part for protecting the biodiversity.

The relationship of the biodiversity, the soil and the climatic factors has been studied. It is indicated that the overall biodiversity, both animals and plants, of "Sabah AL-Ahmad" natural reserved area has been greatly influenced by the scarcity of the rainfall during the last few years. The decrease in the plant density gave rise to migration of the animals that were protecting themselves through and under these plants.

RECOMMENDATIONS

- 1- Implementing an action plan to protect and preplaced the environmentally important areas, as well as deteriorated areas with high sand movement to rehabilitate these areas internally.
- 2- Implementing the principles of integrated management of sustainable natural resources in protected areas and its biodiversity.
- 3- Due to the multiple soil types within the reserved area, the area should be classified according to the soil habitat to save

the biodiversity that are nearly going to disappear from the reserved area. This is with ensuring water resources.

- 4- A scientific laboratory should be constructed for continuous monitoring and studying the animal habits and climatologically conditions to save the wild life and biodiversity within the reserved area.
- 5- Further wild life and biodiversity studies are recommended on the reserved area, as the available studies are still scarce and unpublished.

REFERENCES

- Al-Behbehani B. and Ibrahim H. (2007)** : Animal's Behavior in the "KISR" Protected Area in the State of Kuwait. *World J. Zool.*, 2 (2): 29-35, ISSN: 1817-3098.
- Alexander, S. M. and N. M. Waters (200)** : The effects of highway transportation corridors on wildlife: A case study of Banff National Park. *Transport. Res. Part C-Emerg. Technol.*, 8: 307-320.
- Bardgett, R. D. (2005)** : The Biology of Soil: A Community and Ecosystem Approach. Oxford University Press. (Awarded Marsh Ecology Book of the Year Award 2006) .
- Baskin, Y. (1997)** : The work of nature, The Scientific Community on Problems of the Environment (SCOPE), Island Press, Washington, DC.
- Clayton, D. and K. Wells, (1994)** : Discovering Kuwait's Wildlife. Fahad A. L-Marzouk Printing and Publishing, Kuwait. 251pp.
- Feldberg, U., (1994)** : Ecological barrier effects of motorways on mammalian wildlife-an animal protection problem. *Deutsche Tierärztliche Wochenschrift*, 101: 125-129.
- Forman, R. T. T., (2000)** : Estimate of the area affected ecologically by the road system in the United States. *Conserv. Biol.*, 14: 31-35
- Hadley, N. F. (1974)** : Adaptation biology of desert scorpions. *J. Arachol.*, 2: 11-23.
- Hollier, C. and Reid, M. (2005)** : Acid Soils. DPI AgNote, April 2005.
- Jaman, S. K. and Meakins, R., (1998)** : Biodiversity of animals in Kuwait. Center for Research and studies on Kuwait, 215pp.
- Jones, M. E., (2000)** : Road upgrade, road mortality and remedial measures: Impacts on a population of eastern quolls and Tasmanian devils. *Wildlife Res.* :289-296.
- Mader, H. J., (1984)** : Animal habitat isolation by roads and agricultural fields. *Biol. Conserv.*: 81-96.
- May, S. A. and T. W. Norton, (1996)** : Influence of fragmentation and disturbance on the potential impact of feral predators on native fauna in Australian forest ecosystems. *Wildlife Res.* :387-400.
- Reh, W., (1989)** : Investigations into the influence of roads on the genetic structure of populations of the common frog *Rana temporaria*. In: Langton, T.E.S. (Ed.). *Amphibians and Roads: Proceedings of the Toad Tunnel Conference*. Rends burg, Federal Republic of Germany, 7-8 January 1989. ACO Polymer Products Ltd., Bedfordshire, UK: 101-103.

Ries, L., D. M. Debinski and M. L. Wieland, (2001) : Conservation value of roadside prairie restoration to butterfly communities. *Conserv. Biol.* :401-411.

Riitters, K. H. and J. D. Wickham, (2003) : How far to the nearest road? Frontiers in *Ecol. Environ.* (3):125-129.

Shine, R., E. G. Barrott and M. J. Elphick, (2002) : Some like it hot: Effects of forest clearing on nest temperatures of montane reptiles. *Ecology* :2808-2820

Shine, R., M. Lemaster, M. Wall, T. Langkilde and R. T. Mason, (2004) : Why did the snake cross the road? Effects of roads on movement and mate location by garter snakes (*Thamnophis sirtalis parietalis*). *Ecol. Soc.*: 9: 9-10.

Slattey, B. and Hollier, C. (2002) : Impacts of Acid Soils in Victoria, A report for Department of Natural Resources and Envi-

ronment, Goulburn Broken Catchment Management Authority and North East Catchment Management Authority.

Stiles, J. H. and R. H. Jones, (1998) : Distribution of the red imported fire ant, *Solenopsis invicta*, in road and power line habitats. *Landscape Ecol.*: 335-346

Wallwork, J., (1982) : Desert Soil Fauna. Praeger Publication, New York, pp: 113.

Acknowledgements

The authors are greatly indebted to the authorities of the Public Authority of Applied Education and Training (PAAET), for the financial support and facilitate the requirements of conducting the research work under the project no. BE-08-24. My grateful thanks are also due to Prof. Ahmed Al-Sadek and Prof. Fouad Shaaban, Science Department, College of Basic Education, for their continuous help and production during the progress of this work.

Received on 2 / 8 / 2009

الملخص العربي

دراسات على الحيوانات فى محمية صباح الأحمد الطبيعية بدولة الكويت

بهيجه إسماعيل البهبهاني^١ حسين مصطفى عبدالصمد^٢

قسم العلوم - كلية التربية الأساسية - الهيئة العامة للتعليم التطبيقي والتدريب^١

باحث بيئي^٢

يتناول هذا البحث متابعة دورية فى الفترة الصباحية والمسائية ولمدة عام كامل (مايو ٢٠٠٨ - مايو ٢٠٠٩) على الثدييات، الحشرات، العقريبات، الطيور، بالإضافة إلى التربة فى محمية صباح الأحمد الطبيعية بدولة الكويت.

وتهدف هذه الدراسة إلى تقييم العوامل المختلفة التى تنظم التنوع الحيوى بهذه المحمية الطبيعية، ولقد أظهرت نتائج الدراسة أن الحيوانات والنباتات فى المحمية قد تأثرت بصورة كبيرة بقلّة الأمطار فى المنطقة فى السنوات الأخيرة، كما أن النقص فى كمية الأمطار أدى إلى تناقص الكثافة النباتية فى المحمية، ولما كانت النباتات تعتبر ملجأ وظلاً للحيوانات فى المحمية، خاصة فى أشهر الصيف شديدة الحرارة، فإن نقصها يؤدى إلى هجرة الحيوانات.

وقد تم تسجيل الحيوانات التالية فى محمية صباح الأحمد الطبيعية: العقارب - الضب - الثعلب الأحمر (الحصنى) - الحشرات (الفراشة، الخنفساء السوداء، خنفساء الدومينو) والطيور: الهدهد - قنبرة الصحراء - النورس، وقد تناول البحث متابعة سلوك هذه الحيوانات إضافة إلى دراسة أنواع التربة وعلاقتها بالتنوع البيولوجى فى المحمية، مع الأخذ فى الاعتبار العوامل المناخية، وقد لوحظ تواجد أعداد كبيرة من الحشرات والطيور بالمحمية الذى يرجع إلى وجود بحيرة صناعية بالمحمية وماحولها من غطاء نباتى كثيف، وعلى النقيض فقد لوحظ تناقصاً فى أعداد القوارض والثعابين فى المحمية وماحولها من غطاء نباتى كثيف، الذى قد يكون بسبب عدم توافر مصادر الطعام وقلة النباتات ونقص كمية الأمطار، كما أن تواجد الضب بصورة واضحة بالمحمية قد يعزى إلى قيامه بفترة البيات الشتوى، إلى جانب اغتذاءه على الحشرات وهى موجودة بكثرة فى المحمية.

وقد دلت دراسة التربة بالمحمية على وجود خمسة أنواع وهى: التربة الطينية الرملية والرملية الطينية والحصبائية والصخرية، ولقد أكدت الدراسة علاقة وثيقة بين تركيب التربة مع التنوع الحيوى وسلوكيات الحيوان بالمحمية، ولقد تم التوصل إلى نتائج هامة بالنسبة للعوامل المنظمة للمحمية، وتم تقديم توصيات للمحافظة على الحيوانات بالمحمية.

**STUDIES ON ANIMALS IN "SABAH AL-AHMAD"
NATURAL RESERVED AREA IN THE STATE OF KUWAIT**

Bahija E. Al-Behbehani¹ and Hussain M. Ibrahim²

¹ *Science Department, College of Basic Education, PAAET, Kuwait*

² *Environmental Researcher, Kuwait*

Reprint

from

Journal of Environmental Sciences, 2010; Vol. 39, No. 2

