THE LIZARDS LIVING IN QATAR

This book is dedicated to the people of Qatar

His Highness
Sheikh Hamad bin Khalifa Al Thani
Father Emir

His Highness
Sheikh Tamin bin Hamad Al Thani
Emir of the State of Qatar

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Cover image: Yellow-spotted agama, *Trapelus flamimaculatus*
The most colourful lizard in Qatar
Photograph by Dileepkumar Pushpangadhan

Supporting Organizations

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MESSAGE FROM THE MINISTER

Qatar aims to be an advanced society, capable of sustaining its development and providing a high standard of living for its entire people in the near future. The Qatar National Vision 2030, envisaged by our beloved Emir HH Sheikh Tamim bin Hamad Al Thani, is the blue print for this. Environmental development is one of its four pillars. It is said that where the quality of environment goes down, the quality of life goes down for mankind. Realising this, our wise leadership has made it clear that sustaining economic and social development is impossible without a holistic vision that places environmental preservation for Qatar's future generations at the forefront.

We need to strike a balance between developmental needs and the protection of nature, including the air, land, water or the biological diversity. We must protect our flora and fauna, and make sure our rapid development leaves minimal carbon footprints on our beautiful nature.

Plans to protect air and water, wilderness and wildlife are in fact plans to protect mankind. The fate of the living planet is the most important issue facing mankind today. In order to effectively protect our environment, we need to give adequate emphasis on establishing an effective legal framework and setting up institutions that can serve as the guardians of our environmental heritage.

We, at the Ministry of Environment, are committed to protect our environment, and co-operate with the regional and international communities to achieve this goal. In coordination with international organizations Qatar will take the necessary steps to identify the main areas of biodiversity on the peninsula, and will embark on a program to protect wildlife through conservation laws and awareness campaigns. We are also committed to start a program of scientific research to examine the biological and ecological requirements of the species, which is a basic step to proceed with conservation actions; to conduct taxonomic studies and systematic studies to identify new species, and explore each organism's responses to human activities including climate change.

We believe it is of paramount importance to engage the people of our region, especially the youth, who hold the future of this world in their hands, in all these programmes. We need you on board. Together we can make our earth a better place to live in. Believe that we have the capacity and the responsibility. We must act before it is too late.

His Excellency Ahmad Amer Mohamed Al Hemaidi
Minister of Environment

ABOUT THIS BOOK

This is the first comprehensive book that has ever been published worldwide on the lizards of Qatar. The authors have collected novel and updated data about the presence and distribution of the lizard species in Qatar, making scientific biodiversity data available and useful for Qatar, the Gulf region and the international community. The book shows the first distribution maps for the Qatar lizards, and they also constitute the first maps that have ever been conducted for the distribution of any animal species in the Qatar country.

The content of the book with ten chapters is described with easy words making it useful for nature lovers and the general public. It is also valuable for stakeholders, and is a reference for graduate students interested in ecology, management and scientific research. The book also aims to create public awareness and encourage the general public to contribute towards protecting the Qatar´s environment for future generations.

The reader will also find in this book valuable and enjoyable information about the Qatar country that is illustrated with 635 excellent photographs of landscapes, habitats and plants that can be found in Qatar. High quality photographs essential for recognising and identifying lizard species in the field can also be found in the book.

This book has been produced with the efforts of a large team of scientists, students, experts and volunteers from different countries and cultures that have been working together in harmony and great passion to get it done. Seventy five percent of the authors of the book belong to Qatari institutions, fifty eight percent of the authors are Qatari nationals, and forty two percent are students. Qatari students have been given the opportunity to participate in different phases, and have learned the process of searching international literature, conducting field work, designing figures and editing photos to produce this scientific publication. They have also learned to work as a team while also interacting with experts and scientist from Qatari and international institutions.

It is part of our social responsibility to highlight the importance of protecting the Qatar environment and its wild species among nationals, residents and visitors. Many readers of this book will be encouraged to go out and discover the treasures of the Qatari desert and national heritage.

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Laboratory work is very important to examine the reproductive cycles of lizards

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All lizard species in Qatar except the skink (Scincus mitranus) lay eggs that are incubated in burrows, under rocks, in soil under vegetation or inside artificial structures. Balance to measure egg mass

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Recently hatched lizards are very small, with approximately 40 cm of total length in the case of geckos (*Cyrtopodion scabrun*) that hatched in the gardens of Qatar Foundation, with enough humidity and shade. Hatchlings can be smaller in the desert where there may be less humidity in the soil where eggs incubate. Bigger hatchlings normally have higher chances of survival than smaller ones

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Hatchings directly after coming out from the egg show an opening in their belly that is closed after few days

Locomotion

Most lizards are quadrupedal and have powerful limb musculature. They are capable of rapid acceleration and can also rapidly change direction. Because lizard survivorship depends on ways to escape from predators, running and speed is very important for many species, particularly in deserts habitats.

In Qatar there are two exceptions of lizards that do not run fast using their legs. The lizards without legs (*Diplometopon zarudnyi*) propel themselves entirely by lateral movements, similar to the way snakes move. The skink (*Scincus mitranus*) live in the soft sand of the dunes and are known as diving lizards because they mainly move by lateral trunk bending in the sand, even though they possess short legs.

Maximum sprint-running speed and endurance capacity of lizards has attracted the attention of many scientists all over the world (e.g., Bauwens et al. 1995, Bonine and Garland 1999, Clemente et al. 2008), and specialized equipment has been constructed to measure speed and endurance.

Diurnal lizard species are generally faster runners than nocturnal species, and many of the fastest lizards live in deserts of North America and Australia (Bonine and Garland 1999, Clemente et al. 2008). None of the Qatar lizards have been tested for locomotor capacities in any country. The length of the legs is very important, and those species with longer legs are able to run faster (Bonine and Garland 1999).

Maximal running speeds of lizards are measured by chasing them along a photocell-lined racetrack connected to a computer, or by running them on a high-speed treadmill that can rapidly reach 45 km/h, faster than the fastest lizard (Bonine and Garland 1999).

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Photocell-lined racetrack connected to a computer used to measure maximal running speeds of lizards. Lizards are chased by hand which simulates a predator

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High-speed treadmill connected to a computer that can rapidly reach 45 km/h. This is used to measure maximal running speeds of lizards that are chased with the hand simulating a predator

Some small-bodied desert lizards (e.g. racerunners or whiptails, zebra-tailed lizards) can attain speeds that exceed 20 km per hour, which in terms of their body length (less than 50 cm), puts them in a class with the fastest terrestrial mammals. Some larger-bodied species of lizards, such as monitors (Varanus), can exceed 30 km/h, and the world's fastest lizard (the spiny-tailed iguana, Ctenousara similis from Costa Rica) can reach almost 35 km/h (Garland 1984). Body proportions, such as leg or tail length, and the ability to produce large undulations of the trunk have a large effect on locomotor abilities in terrestrial lizards (Bonine and Garland 1999). Stride length (the amplitude of limb movement) and stride frequency (the rhythm of limb movement) are two components of speed that are directly related to the body geometry, the amount of body curvature, as well as muscle properties, such as the amount of fast-twitch muscle fibre, of an organism (Bonnie 2005).

Endurance (i.e. physical stamina) in lizards is usually measured on motorized treadmills, often at a standard speed of 1.0 km/h. The length of time the lizard can run at this speed is taken as the measure of endurance. Endurance capacity measured in this way is positively related to the daily movement distances of different species in the wild (Garland 1999).

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Motorized treadmill used to measure endurance in lizards. The standard speed of the treadmill is 1.0 km/h. The length of time the lizard can run at this speed is taken as the measure of endurance. The lizards are chased to keep them moving

One way to calculate the energy lizards expend during locomotion is by measuring metabolic rates while a lizard runs on a motorized treadmill at various speeds (Figure 1). A rubber diaphragm (not shown in the figure) holds the clear plastic mask around the lizard's neck. A pump (not shown either) draws air from the room in from around the neck of the lizard, and out through the plastic tubing. The rate of flow is high enough to ensure that all of the air breathed out by the lizard is captured. The air flows through a drying column that contains chemicals to remove water vapor, and then into sensors to measure the content of carbon dioxide and oxygen in the expired air. By comparing gas concentrations in the expired air with concentrations in the room air, computer programs can calculate the rate of oxygen consumption and carbon dioxide production by the lizards.

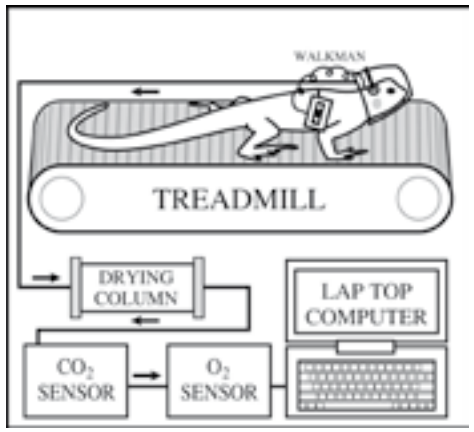

Figure 1. Diagram showing the method used to calculate energy expenditure by measuring oxygen consumption in lizards during locomotion. See text for details (Figure modified from Bennett 1985)

The maximal sprint speeds of lizards and mammals are similar if we take into consideration body mass (Figure 2) (Garland 1983b, Clemente et al. 2009). However, the daily movement distances (actual walking paths) of lizards in the wild are shorter than that of mammals. Lizards move about 1/5 as far as mammals when considering similar body size (Figure 3) (Garland 1983a, 1993, 1999; Goszczynski 1986). Thus larger animals move further than smaller ones.

Running and walking is energetically costly, and to know how much energy the lizards consume during locomotion, scientist measure oxygen consumption while the lizards are walking or running on motorized treadmills at a range of speeds. Comparisons among animals have shown that lizards and mammals have a similar energetic cost of transport. Thus, it is clear that lizards are no less "efficient" than mammals (Figure 4).

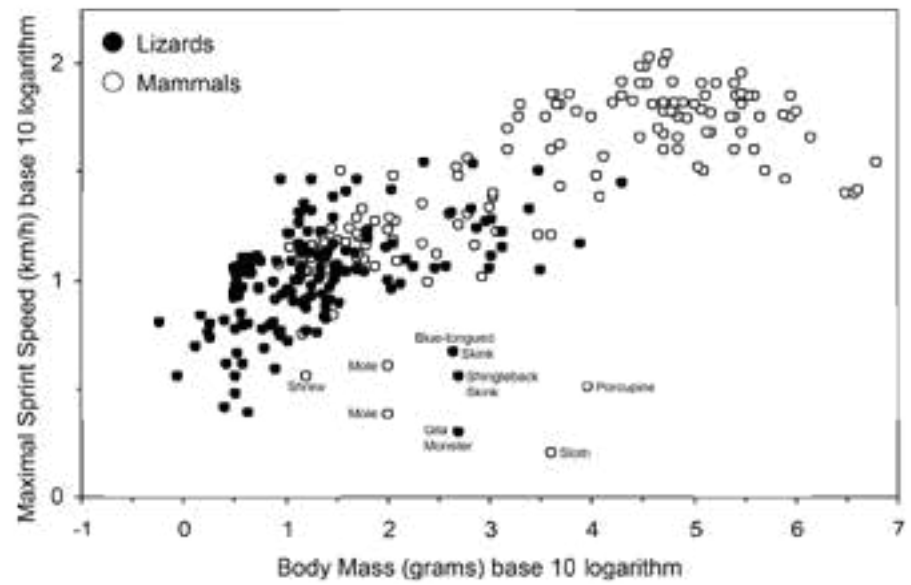

Figure 2. Maximal sprint speeds of lizards and mammals are similar for a given body mass (Figure modified from Clemente et al. 2009)

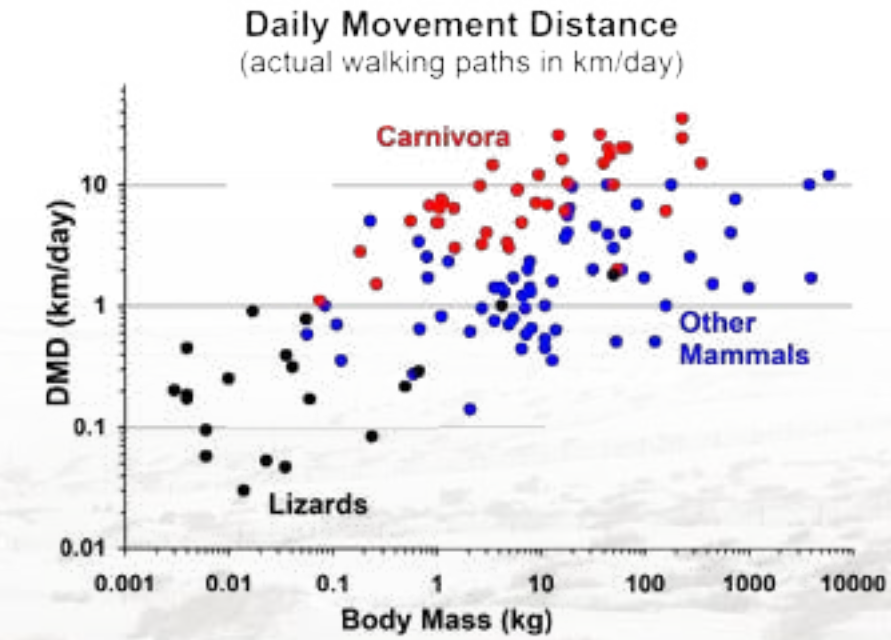

Figure 3. Daily movement distances of lizards and mammals in the field in relation to body mass. Data for the figure taken from different sources (Garland 1983, Goszczynski 1986, Garland 1993, Garland 1999)

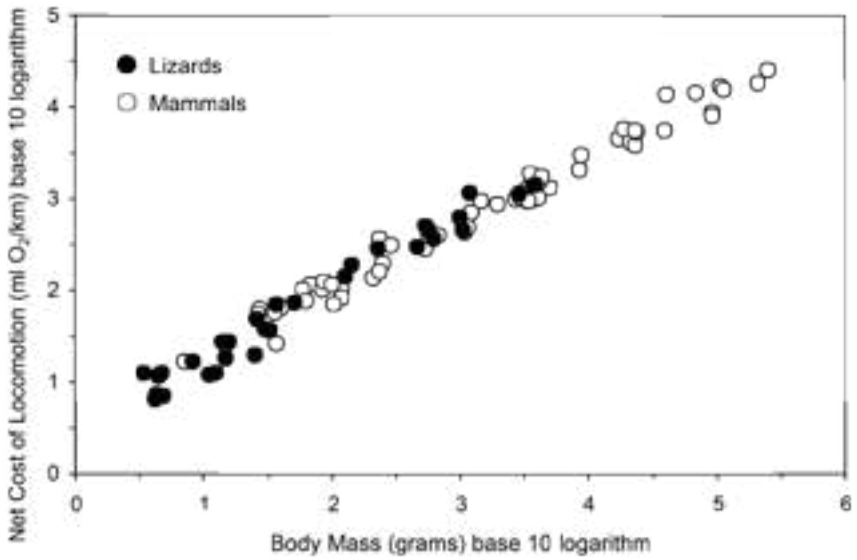

Figure 4. Net cost of locomotion of lizards and mammals for a given body mass. Data for the figure taken from different sources (Taylor et al. 1982, John-Alder et al. 1986, Autumn et al. 1999)

Dhub (*Uromastyx aegyptia*) walking while searching for food in Ras Laffan

Dhub (*Uromastyx aegyptia*) running slowly in Al Shamal

Dhub (*Uromastyx aegyptia*) running fast in Ras Laffan while being chased by a car

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