

# Twenty years of monitoring of the Vulnerable Farasan gazelle *Gazella gazella farasani* on the Farasan Islands, Saudi Arabia: an overview

PETER LOW CUNNINGHAM and TORSTEN WRONSKI

**Abstract** The mountain gazelle *Gazella gazella* in Saudi Arabia is categorized as Vulnerable on the IUCN Red List. On the mainland the species' survival depends on a few remnant populations in the western Mountains and coastal plains and on two reintroduced populations. The largest natural population of *G. gazella* in Saudi Arabia is the Farasan gazelle subspecies *G. g. farasani*, which inhabits the Farasan Islands in the Red Sea. We review and collate the available literature on this subspecies, mainly unpublished reports presenting wildlife census data, and supplement this with the most recent, 2009, count. The number of free-ranging gazelles has remained approximately constant since the first counts in 1988, with an overall density of 0.64 km<sup>-2</sup> and an estimated population of 1,039 on Farasan Kebir in 2009. The populations on two other islands, As Saqid and Zifaf, have not fared as well, possibly because of uncontrolled hunting pressure, competition with domestic stock or poor habitat conditions overall. The population on Qummah Island is extinct. Threats to this subspecies include uncontrolled hunting and uncoordinated development. Continued protection of this apparently stable population of mountain gazelle in Saudi Arabia is imperative to ensure the survival of the species.

**Keywords** Farasan gazelle, *Gazella gazella farasani*, monitoring, Saudi Arabia, status

## Introduction

Gazelles from the Farasan Islands have been known to scientists since at least 1825, when the first specimens were collected there by the explorers Hemprich and Ehrenberg (Groves, 1983), and are now recognized as the Farasan gazelle *Gazella gazella farasani* (Thouless & Al Bassri, 1991). Until 1988, when the first official survey was conducted on the Islands (Thouless et al., 1988a), nothing was known regarding the status of this subspecies. The 1988 survey not only estimated a population of > 500 but also noted that this was the largest free-ranging population of

*Gazella gazella* (mountain gazelle, or *idmi* in Arabic) in Saudi Arabia (Flamand et al., 1988). The high numbers of Farasan gazelle were surprising because all species of Arabian gazelle have been drastically affected by hunting, habitat degradation and competition for food with domestic livestock in unfenced protected areas (Dunham et al., 2001; Thouless et al., 1991, 1997).

Historical data on the gazelle populations of Saudi Arabia are few, with the Arabian Peninsula always having been a little visited and understudied part of the world. Historically, *G. gazella* occurred across most of the Arabian Peninsula to northern Syria and Turkey and westwards into Sinai (Gentry, 1968; Davis, 1980; Kasperek, 1986; Tchernov et al., 1986). The species is probably extinct in Egypt, Turkey, Syria, Lebanon and Jordan, although occasional sightings are still reported (Kingswood & Khairallah, 2001; Saleh, 2001; Masetti, 2004). The species' current range includes Israel, Oman, the United Arab Emirates, Yemen and Saudi Arabia. In the latter the species occurs in four protected areas, At Tubaiq, Al Khunfah, Uruq Bani Mu'Arif and the Ibx Reserve, and as scattered populations in the western Asir Mountains and on Farasan Island (Child & Grainger, 1990; Magin, 1997; IUCN, 2009).

The numbers of *G. gazella* in Saudi Arabia, although once widespread and abundant, have diminished throughout their range since the middle of the twentieth century (Nader, 1989), and Ghandour (1989) regarded the species as threatened with extinction. Since the mid 1940s motorized hunting has decimated the species, and artificial water and fodder supply for domestic stock have allowed them to increase their range and numbers and consequently their competition with gazelle for food (Williamson & Tatwany, 1996). The precarious future of *G. gazella* was highlighted by Wilfred Thesiger during his trek through the Empty Quarter of Saudi Arabia in 1947–1948:

In Saudi Arabia during the last few years even gazelle have become rare. Hunting parties scour the plains in cars, returning with lorry-loads of gazelle which they have run down and butchered. (Thesiger, 1994)

*G. gazella* is categorized as Vulnerable on the IUCN Red List (IUCN SSC ANTELOPE Specialist Group, 2009). The total population, which exhibits a downward trend, is estimated to be < 15,000, with 1,500–1,700 in Saudi Arabia (c. 1,000 of which occur on the Farasan Islands; IUCN, 2009). Other protected areas have estimated populations ranging from only c. 10 (Al Khunfah; Wacher, 1993) to c. 30

PETER LOW CUNNINGHAM (Corresponding author) and TORSTEN WRONSKI King Khalid Wildlife Research Center, Thumamah, P.O. Box 61681, Riyadh, Kingdom of Saudi Arabia, and Zoological Society of London, Conservation Programmes, Regent's Park, London, NW1 4RY, UK. E-mail pckkwrwc@yahoo.co.uk

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(Ibex Reserve; Wronski, 2010) and c. 121 (Uruq Bani M'arid; Cunningham, 2008). Here we examine the distribution, abundance and status of *G. g. farasani* on the Farasan Islands based on a review of unpublished data from the last 20 years and the most recent surveys.

### Study area

The Farasan Islands are an assemblage of islands formed of raised fossil coral reefs at altitudes of 0–30 m in the Red Sea c. 80 km off the coast of Saudi Arabia (Flamand et al., 1988; Child & Grainger, 1990). Although there are more than 300 islets and shoals (Anon., 2000), only three, Farasan Kebir (400 km<sup>2</sup>), As Saqid (160 km<sup>2</sup>) and Qummah (25 km<sup>2</sup>), are permanently inhabited (Flamand et al., 1988; Fig. 1). Large parts of the islands are weathered flat gravel plains incised by often well-vegetated wadis and other broken terrain formed when the fossil reef was raised by underlying salt domes (Flamand et al., 1988; Habibi & Thouless, 1997). The climate is arid with a highly variable annual rainfall of 50–100 mm (Child & Grainger, 1990) and there is no permanent surface water (Flamand et al., 1988). The combined human population of Farasan Kebir, As Saqid and Qummah Islands is > 20,000 (J. Grainger, pers. comm.). Other islands, such as Zifaf Island, have coastguard stations.

Isolated thickets of *Acacia ehrenbergiana* occur on the gravel plains and the vegetation in the wadis consists of a variety of grasses, shrubs and trees, including *A. ehren-*

*bergiana*, *Capparis decidua* and *Commiphora gileadensis* (Flamand et al., 1988). The Farasan Islands are protected for the conservation of *G. gazella*, the islands outstanding biological value and as a marine reserve, and are designated a special nature reserve, natural reserve, resource use reserve and controlled hunting reserve (Child & Grainger, 1990).

### Methods

Data from surveys since 1988 were collected by a search of the literature published on the Farasan Islands, including unpublished census reports (Table 1). These include actual sightings (not extrapolated, i.e. minimum numbers seen) and extrapolated results. The various reports provide data collected during foot, vehicle and/or aerial surveys, following predetermined or random transects, and covering the entire area or only sections. The surveyors' involved and monitoring techniques applied varied between years and methods were not standardized, and thus direct comparisons between years cannot be made. Because of the various techniques used we do not describe them in detail here.

The most recent, 2009, estimates are based on extrapolations of actual sightings during a standardized vehicle count using the road strip count technique (see Bothma, 1989, for an in-depth explanation of the technique and the formula used for extrapolating numbers from actual sightings). Farasan Kebir was demarcated into five sections known to have Farasan gazelle populations. These sections

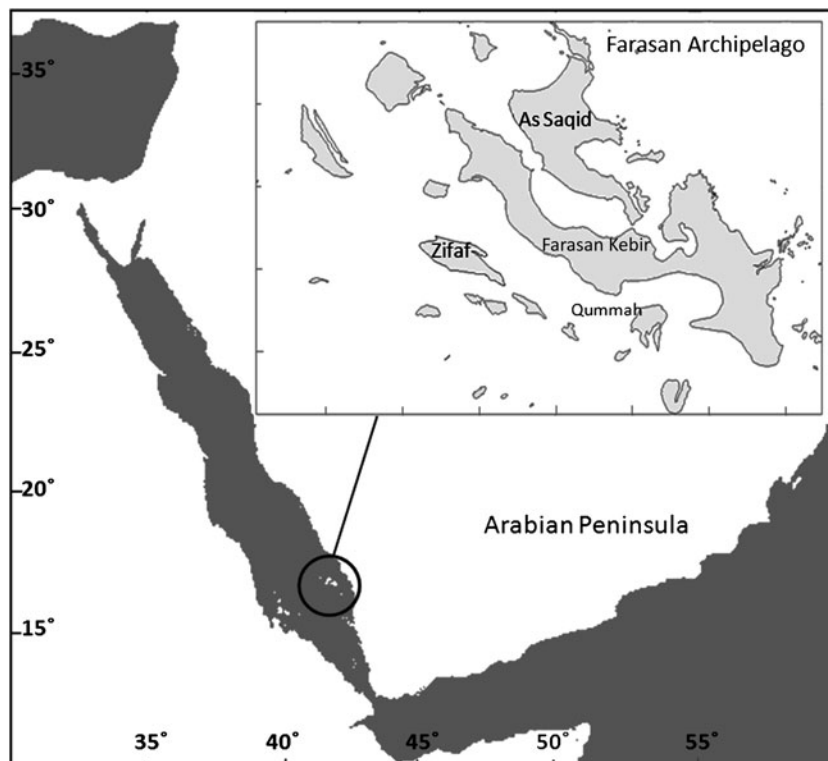


FIG. 1 The Arabian Peninsula, indicating the location of the Farasan Islands in the Red Sea. The inset shows the Farasan Archipelago and the locations of the islands As Saqid, Zifaf, Qummah and Farasan Kebir.

TABLE 1 *Gazella gazella farasani* numbers (actual or extrapolated) from 1988 to 2009 for Farasan Kebir, As Saqid, Zifaf and Qummah Islands in the Farasan Islands Protected Area (Fig. 1).

Survey method	Technique <sup>1</sup>	Year	Farasan Kebir	As Saqid	Zifaf	Qummah	Reference
Foot & aerial (helicopter)	Actual	1988	120	Low numbers	81	4	Thouless et al. (1988a)
Aerial (helicopter)	Actual	1988	86		15		Thouless et al. (1988b)
Foot	Actual	1989	65				
Foot & vehicle	Extrapolated & actual	1989	115 <sup>2</sup>		100–150 <sup>3</sup>		Habibi (1989)
Foot	Actual	1990				7	Habibi (1990)
Foot	Extrapolated	1993	950				Habibi & Al Toum (1993a)
Aerial (fixed wing)	Extrapolated	1993	1,013	41	121	0	Habibi & Al Toum (1993b)
Aerial (fixed wing)	Extrapolated	1994	650	40	90	25 <sup>4</sup>	Wacher & Al Toum (1994)
Aerial (fixed wing)	Extrapolated	1995	840–1,195	25	30	0	Wacher et al. (1995)
Aerial (fixed wing)	Extrapolated & actual	1996	929–1,024 <sup>3</sup>	0 <sup>2</sup>	0 <sup>2</sup>		Wacher et al. (1996)
Aerial (fixed wing)	Extrapolated & actual	1997	937 <sup>3</sup>	4 <sup>2</sup>	5 <sup>2</sup>		Wacher & Al Toum (1997)
Foot	Actual	1998			8		Al Toum & Wacher (1998)
Aerial (fixed wing)	Extrapolated & actual	2000	693 <sup>3</sup>	0 <sup>2</sup>	5 <sup>2</sup>		Wacher et al. (2000)
Aerial (fixed wing)	Extrapolated & actual	2001	1,694 <sup>3</sup>	1 <sup>2</sup>	8 <sup>2</sup>		Wacher & Al Toum (2001)
Vehicle	Extrapolated	2008	811				Sher Shah et al. (2008)
Vehicle	Extrapolated & actual	2009	1,039 <sup>3</sup>	Signs	1 <sup>2</sup>	0 <sup>4</sup>	Cunningham & Wronski (2009)

<sup>1</sup>Actual sightings (i.e. minimum numbers seen); Extrapolated, based on extrapolation of sightings within a fixed area to the total area

<sup>2</sup>Actual

<sup>3</sup>Extrapolated

<sup>4</sup>Estimated numbers (i.e. anecdotal)

correspond to a large extent with those defined by Thouless et al. (1988b; names in parentheses below) and also used by Wacher & Al Toum (2001): Seir/West (the Jabals), Central and North (Broken Country), Harbour/East (Rough Coral Rocks) and Wadi Matr/South (Acacia Grove). We used this demarcation to facilitate a comparison with these earlier surveys. A total of 163 km were driven along existing tracks covering most of the potential Farasan gazelle habitat on Farasan Kebir and As Saqid Islands. The area sampled on Farasan Kebir was 97.8 km<sup>2</sup> (total sampling time: 15 hours and 8 minutes) and the area sampled on As Saqid was 22.1 km<sup>2</sup> (2 hours and 7 minutes). Counts were carried out either during the early morning (from 05.30) or late afternoon (from 17.30), when gazelles are most active, using a vehicle at a speed of 20–40 km h<sup>-1</sup> depending on the terrain. The length of the various road strips varied according to the area and terrain surveyed. A fixed strip width of 300 m each side of the vehicle, based on the average visibility, determined in the field prior to the actual count, was used for extrapolation purposes.

## Results

The highest gazelle densities (3.2 km<sup>-2</sup>) were observed in southern Farasan Kebir (Wadi Matr/South), followed by the eastern section (Harbour/East; 0.69 km<sup>-2</sup>). The overall mean density on Farasan Kebir, calculated using the actual number of gazelles sighted, was 0.64 km<sup>-2</sup>. The extrapolated gazelle numbers were highest in the western (Seir/West)

and central (Central) sections, with an estimated total of 1,039 for the island (Table 2).

Although we surveyed 22.1 km<sup>2</sup> on As Saqid Island, no gazelles were observed. Thickets of *A. ehrenbergiana*, and other likely places, were searched for evidence of gazelles and fresh tracks were located in the southern part of the island, along with four dung middens, one recently used, indicating the persistence of gazelles, albeit in low numbers.

In a brief visit to Zifaf Island on 18 April 2009 two people walked 9 km between 08.00 and 11.00. One female gazelle was observed and four active dung middens were found, along with many fresh tracks. In a short visit to Qummah

TABLE 2 Summary of Farasan gazelle densities and estimated numbers (extrapolated) for the five sections surveyed on Farasan Kebir (Fig. 1) during June 2009.

Section	Surface area (km <sup>2</sup> )	Density <sup>1</sup> (km <sup>-2</sup> )	Extrapolated gazelle numbers
Seir/West	93.75	0.52	287
Central	100.02	0.59	239
North	68.77	0.38	88
Harbour/East	43.79	0.69	74
Wadi Matr/South	31.25	3.20	164
Other areas	62.42		187 <sup>2</sup>
<i>Total (mean)</i>	400		1,039

<sup>1</sup>Actual numbers observed were used for density estimates

<sup>2</sup>These individuals potentially occur in sections not surveyed or in areas surveyed but not sighted because of terrain restrictions; the value was estimated using the actual number of gazelles sighted elsewhere

Island on 11 April 2009 we determined, after discussions with local inhabitants, that no gazelles remain on the island and that the last had been killed for food a long time previously.

## Discussion

On Farasan Kebir the Farasan gazelle is widely distributed in suitable habitat, with the highest densities estimated for Wadi Matr in the south, which is dominated by extensive *A. ehrenbergiana* thicket. The eastern section, adjacent to the harbour, consists of rugged, broken terrain and has the second highest estimated densities. The lowest densities were observed in the north. The occurrence of *A. ehrenbergiana* and broken terrain appear to be the key factors influencing gazelle density. Densities of 4–10 km<sup>-2</sup> were originally estimated (Thouless et al., 1988a) in the northern section adjacent to the harbour. This is much higher than our estimate of 0.69 km<sup>-2</sup> for the same area and higher than our maximum estimate (3.2 km<sup>-2</sup>), for the southern section. It is likely that differences in survey methods (aerial vs vehicle), seasonal differences (spring 1988 vs summer 2009) and size of areas surveyed account for these differences. That seasonal differences occur was confirmed during an autumn aerial survey in the same year in which a density of 4.3 km<sup>-2</sup> was estimated for the harbour area (Thouless et al., 1988b). Areas of broken terrain have much higher densities of gazelles (Thouless et al., 1988a,b; Habibi & Al Toum, 1993a), at least during daylight hours, indicating that this habitat is preferred for food and shelter or that the terrain provides better protection against people.

Gazelle population densities tend to increase with higher rainfall (Martin, 2000), and Baharav (1983) indicated that the increased range of available food plants after rain results in higher gazelle densities. However, decreased food availability after extended periods of drought seems not to influence gazelle densities on the Farasan Islands; the vegetation is varied, with gazelles utilizing a wide range of plant species (T. Wronski, unpubl. data). Gazelle densities in two wadis in the Ibex Reserve in central Saudi Arabia can reach 7.1–15.1 km<sup>-2</sup> under favourable environmental conditions (Dunham, 1997) but fall to 1.4–2.8 km<sup>-2</sup> under less favourable conditions (Wronski, 2010). Gazelle densities elsewhere on the Arabian Peninsula are 0.2 km<sup>-2</sup> in central Oman (Strauss et al., 2009) and, in Israel, 2.5 km<sup>-2</sup> (northern Negev; Walther et al., 1983), < 15 km<sup>-2</sup> (Golan; Mendelssohn et al., 1995), 12–20 km<sup>-2</sup> (Upper Galilee; Baharav, 1983), and 23–37 km<sup>-2</sup> (Baharav, 1974) and 30–40 km<sup>-2</sup> (D. Baharav, pers. comm., in Mendelssohn et al., 1995) in Lower Galilee.

The total number of gazelles on Farasan Kebir seems to have remained relatively stable since 1993, with the current population estimate of 1,039 similar to that of a number of authors (Table 1). This stability can probably be attributed

to the fishing culture of the residents and thus the absence of traditional hunting of gazelles.

In the 1988 survey no gazelles were sighted on As Saqid, although signs of gazelles were observed (Thouless et al., 1988a) and surveys in the early 1990s estimated 25–40 gazelles (Table 1). It appears there has been a major decline of the gazelle on this island, especially after 1995, although the causes are unclear. The terrain, being flat, does not protect gazelles from human persecution and there is probably intense competition with goats and feral donkeys (Wacher & Al Toum, 1994; Wacher et al., 1996; Robinson et al., 2001). Reintroducing gazelles from Farasan Kebir would be feasible as there is suitable habitat available. Adequate protection would have to be ensured, however, before any reintroduction could be contemplated.

The gazelle population on Zifaf Island also appears to have undergone a major decline, with an apparent population crash after 1995 (Table 1). This may be attributed to hunting by the coastguards stationed on the island. A detailed survey is required to determine the current status of gazelles on the island and the possible reasons for the apparent decline.

The last sighting of gazelles on Qumma Island was in 1990, when seven individuals were observed (Habibi, 1990). None were seen in 1993 (Habibi & Al Toum, 1993b). Wacher & Al Toum (1994) indicated that local inhabitants estimated 25 gazelle remained, although none were actually observed. Information obtained during our survey confirmed they were hunted to extinction 'years ago' according to local inhabitants. The island's small size and limited suitable gazelle habitat probably makes this island unsuitable for any reintroduction.

Continued protection of the Farasan gazelles is imperative as these animals are not only potentially unique genetically (Hundertmark et al., 2004) but occur in higher numbers than elsewhere in Saudi Arabia. Protection in the form of regular patrols, especially at night, is effective, and should be continued, as population densities have been shown to increase under protection (Habibi & Al Toum, 1993a; Dunham, 1997). Although illegal hunting (predominantly fuelled by a demand from mainland Saudi Arabia) has always occurred, and continues, any excessive hunting could eradicate the Farasan gazelle, as has occurred with other gazelle species elsewhere in the Middle East and North Africa (Saleh, 1987; Newby, 1990; Cloudsley-Thompson, 1992; Thesiger, 1994). To ensure the survival of the Farasan gazelle any development on the islands (e.g. the construction of an airport) should be coordinated with the Saudi Wildlife Commission to maintain gazelle movement corridors and not isolate the existing pockets of gazelle on Farasan Kebir. These islands are the stronghold of the Saudi Arabia gazelle population and need to be prioritized for protection to ensure the continued survival of this subspecies.



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### Biographical sketches

PETER CUNNINGHAM studied the feeding ecology of the sand gazelle *Gazella subgutturosa marica* in protected areas in Saudi Arabia, where he assisted with the management of the species during 2008–2009. He currently runs an environmental consultancy company in Namibia. TORSTEN WRONSKI is studying the ecology of wild and reintroduced mountain gazelles in several protected areas in Saudi Arabia. Previously he worked in Uganda, where he researched the behavioural ecology and social organization of the bushbuck *Tragelaphus scriptus*, and he recently worked on the biogeography of East and Central African land snails.