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## Status of the Nubian nightjar (*Caprimulgus nubicus*) In Fifa Nature Reserve (Ramsar site)

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### ABSTRACT

Fifa Nature Reserve was recently established by the Royal Society for the Conservation of Nature (RSCN) that proves to be an important site for several bird species in the Middle East. The reserve is home to a resident population of the Nubian nightjar (*Caprimulgus nubicus*), which is critically endangered in Jordan. The first and only survey of this species to date was conducted in 2014, three years after the establishment of the reserve. This study provides an updated estimate of the Nubian nightjar population, while assessing some potential factors that may influence activity and breeding habits of the species within the reserve. Using spot counts, we recorded 63 calls of male Nubian nightjars; a 24 % increase from the 2014 study. We also provide the first confirmation of breeding of this species within the reserve by nest observations. Twenty-one nests were located, three of which were proven to be active. Distances to agriculture and vegetation community were not found to influence the number of Nubian nightjar calls recorded. However, all of the nests that we recorded were located in habitat dominated by *Tamarix tetragyna* and within 100 m of agriculture. Nesting data were too sparse for statistical analyses, however, we suggest that further attention be paid to breeding habits by conducting a more extensive nesting survey during the breeding period.

### INTRODUCTION

Fifa Nature Reserve (FNR) is a biodiversity-rich ecosystem that is one of the most important sites for migratory bird species in the Middle East (Ellis, 2017). The reserve was established by the Royal Society for the Conservation of Nature (RSCN) in 2011, mainly to protect two major vegetation types: saline vegetation and tropical vegetation. The reserve was designated as the world's lowest elevation Ramsar Site, lying at 426 meters below sea level. It is considered an important habitat for several rare and endangered bird species at both the local and regional level, including the Nubian nightjar (*Caprimulgus nubicus*) and the Dead Sea sparrow *Passer moabiticus* (Al Oshoush and Al-Zoubi, 2017).

Very large numbers of migrant birds pass through the area in spring and autumn. The Nubian nightjar is the smallest nightjar in the Western

Palaearctic (Snow & Perrins, 1998). The species is relatively widespread in the arid part of eastern Africa, however, it has been recorded as uncommon and scarce (Perlman, 2008). In the Middle East, it was reported along the Rift Valley in southern Palestine and the Red Sea coast of the southern Arabian Peninsula (Birdlife International, 2012).

FNR is an important site for the Nubian nightjar, containing the largest population within the Middle East. However, information about the behavior and activity of this bird within the reserve is limited to a single previous study (Qaneer 2014), which recorded 45 male calls. Qaneer (2014) reported a positive relationship between tree cover and the number of calls, mostly from *Tamarix tetragyna* vegetation communities.

The Nubian nightjar is generally regarded as a resident species. However, the northern populations within the Middle East are thought to be predominantly summer visitors, migrating south to eastern Africa for the non-breeding season (Shirihai 1996, Holyoak 2001, Kirwan 2004). The breeding season usually occurs from April to July, and is often influenced by the lunar phase. Nightjars are one group of birds that do not build physical nests, but rather lay their eggs directly on the ground.

The previous survey was conducted only three years after the reserve was established. To determine whether the establishment of the reserve has had an influence on the status of this species, we felt there was a need for an updated study to assess any changes in the Nubian nightjar population over the last five years. Additionally, little is known about the reproductive habits of the Nubian nightjar within the reserve, as no surveys regarding breeding had been conducted.

The current study includes an updated population estimate, as well as documented observations regarding reproductive habits of the Nubian nightjar within FNR.

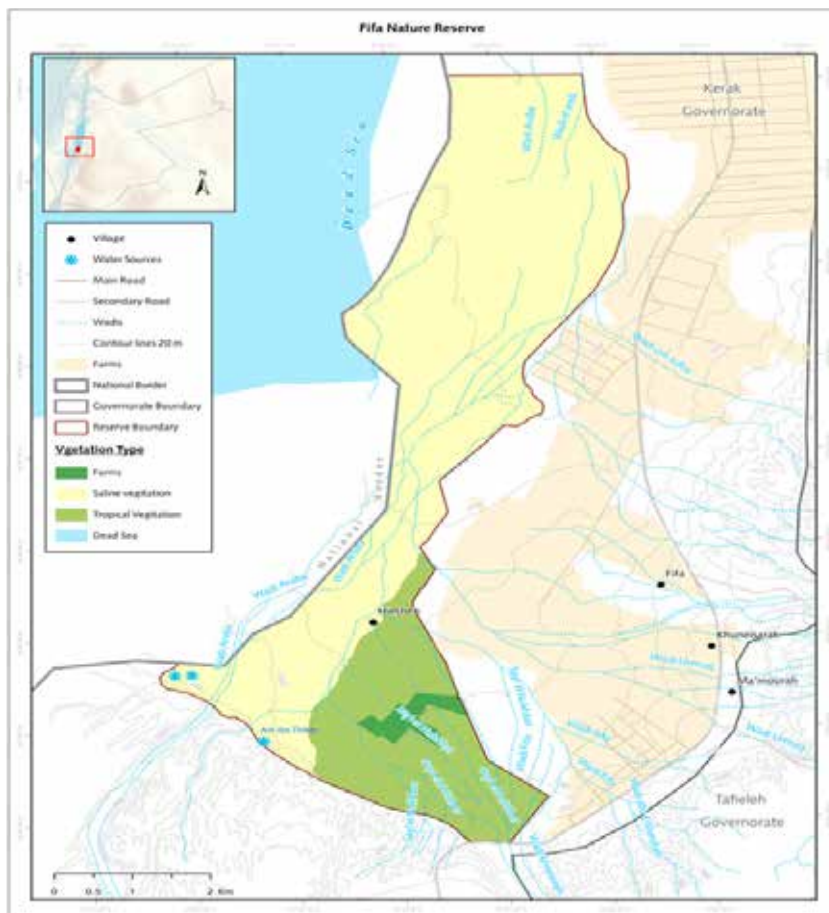
## Study Area

FNR is located at the southwestern part of Jordan, about 33.5 km S-SE of the Dead Sea 157 km north of Aqaba city [UTM East 731366.653, North ,3427479 77] (Figure 1). FNR is located within the Sudanian (Tropical) bio-geographical zone, which is characterized by high temperatures with warm winters and hot summers, combined with low annual rainfall of approximately 100-50 mm/year.

### Principal Vegetation types in FNR Nature Reserve

Two major vegetation types have been recorded in FNR: saline vegetation (19.9 km<sup>2</sup>) and tropical vegetation (656 km<sup>2</sup>), in addition to 0.56 km<sup>2</sup> agricultural land. The area is intersected by wadis and dominated by sparse vegetation of perennial grasses and woody plants such as: *Acacia tortilis*,

*Phoenix dactylifera*, *Nitraria retusa*, *Tamarix* spp. (*T. tetragina* and *T. aphylla*) and *Salvadora persica* (RSCN 2011) (Figure 1).



**Figure 1.** Map of the study area, including vegetation types within Fifa Nature Reserve, as well as the surrounding villages and agricultural land.

## MATERIALS AND METHODS

### Data Collection

To estimate relative population size and density, we used the spot count technique, as used in the previous study (Qaneer 2014). We randomly selected forty spot count locations within FNR and the adjacent agricultural land. The minimum distance between points was approximately 550 m

( $\bar{x}$  126 m), and locations were spread across nine vegetation communities within FNR, at a range of distances to agriculture (mean = 400 m  $\pm$  58 m). We obtained a GIS shape file for vegetation communities within FNR from the RSCN GIS unit.

Between March and August 2019, we conducted a single spot count at each location. Counts were performed for 15 minute each, within a period beginning one hour after dusk until one hour before dawn. We identified Nubian nightjars by the distinctive males' calls during the breeding season. The detection radius of calls was estimated at 150 m by playing audio calls from a specific location and walking in a straight-line to a distance that the call could no longer be clearly heard (Qaneer 2014).

We performed a nest count to determine whether Nubian nightjars use FNR as a breeding site. At each spot count location where a bird was heard or observed during the survey, we established a 2 ha plot in the area that the call came from. We then searched each 2 ha plot and recorded whether a nest was present. For any located nests, we took a GPS coordinate and any information that we deemed relevant or important (e.g. number of nests, signs of recent activity). In addition, after a single observation of a female bird with two young resting on the ground (Figure 2), we installed a motion-sensing camera-trap (Bushnell Trophy Cam: Aggressor) for one week to confirm that this was indeed a nesting site.

## STATISTICAL ANALYSES

To determine whether vegetation community or distance to agriculture influenced the number of Nubian nightjar calls or nests recorded within the reserve, we conducted a multiple linear regression model for each spatial variable. We also grouped vegetation communities into two distinct categories based on whether or not *T. tetragyna* was the dominant species. All analyses were performed using the statistical software R, ver. 2.15.1 (R Core Team, 2012).

## RESULT

A total of 63 Nubian nightjar calls were recorded from 31 spot count locations, which was an increase from 2014, where 45 calls were recorded (Qaneer 2014). The highest number of calls recorded at a single point was five, with a mean of 1.6 ( $\pm$  0.22). Three nests were confirmed to be currently active at the time of the survey by observing birds or the presence of pellets (Figure 2). However, a total of 21 nests were found near two spot count locations. Nests were found to be clustered in small groups (1 – 3) and locations were recorded for each cluster (Figure 3).



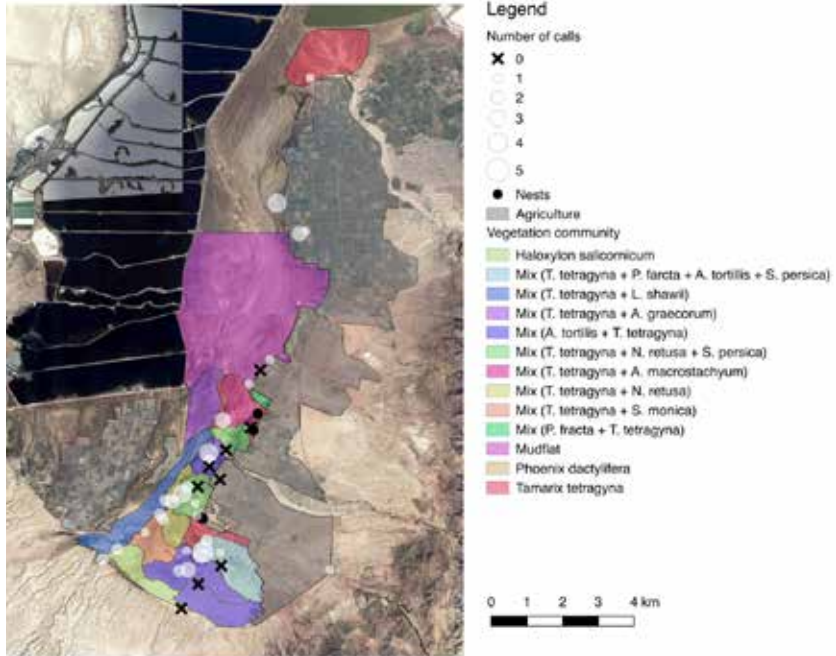
**Figure 2.** Photograph of two Nubian nightjar nestlings occupying a nest within Fifa Nature Reserve

### **Effect of vegetation community and distance to farms on Nubian nightjar activity and nesting habits within Fifa Nature Reserve**

Nubian nightjar calls were recorded from eight of the nine vegetation communities sampled, while nests were found only in two communities; both of which were dominated by *T. tetragyna* (Figure 3). Vegetation community had no effect on the number of calls recorded, both when tested by community type (Table 1) and dominant species (Table 1).

It was noted that all nests were found within approximately 100 m (± 8 m) from agriculture (Figure 3). However, data were too sparse to identify any

significant factors. The numbers of calls were not influenced by distance to agriculture (Table 1, Figure 4).



**Figure 3.** Number of calls and locations of nests in relation to vegetation community and distance to agriculture.

**Table 1:** Summary of results for the multiple linear regression model

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	1.5953359	0.7107364	2.245	0.0314**
Vegetation community	0.0004310	0.0006794	0.634	0.5301
Tamarix spp. dominant	-0.0519405	0.0834544	-0.622	0.5378
Distance to agriculture	0.2456098	0.4627642	0.531	0.5990

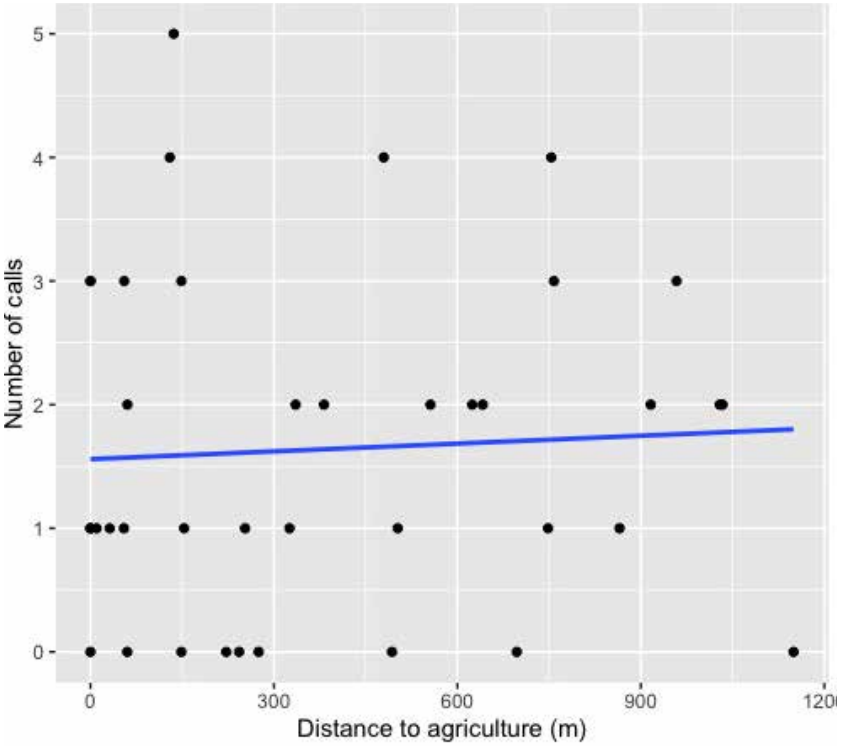


Figure 4. Relationship between the number of Nubian nightjar calls and distance to agriculture.

### DISCUSSION

During the five years between the two surveys, we recorded a twenty-five percent increase in the Nubian nightjar population within FNR confirming the status of the reserve as an important location for the Nubian nightjar. This increase is likely related to the fact that the previous study was conducted when the reserve was relatively young, having only been established three years prior to the survey.

Since FNR was established, threats to the Nubian nightjar population have reduced significantly, particularly those involving humans. For example, people are no longer permitted to collect any plant or animal specimens from the reserve; hunting is prohibited; pressure from grazing has reduced; and it is more difficult for the general public to gain access to the area due to military operations.

During the present survey, we recorded the first nesting observation of

the Nubian nightjar inside FNR. Camera-trap data confirmed that Nubian nightjars within the reserve tend to lay their eggs on either *T. tetragyna* leaf litter or on bare ground in an open area associated with *T. tetragyna*. Although the data were inconclusive, the only spot count locations where nests were observed were within 100 m of agriculture. This may suggest that Nubian nightjars within FNR prefer to nest in proximity to agriculture, likely due to increased productivity in agricultural areas, and consequently higher food resources.

Similar to the previous study (Qaneer 2014), we did not find any significant relationship between the number of Nubian nightjar calls and distance to agriculture. Qaneer (2014) found a positive relationship between the number of calls and tree cover, and noted that most birds were recorded from *T. tetragyna* tree cover. However, no analyses were conducted comparing the number of calls across the different vegetation communities within the reserve. We found that the number of calls was not influenced by vegetation community, or whether or not *T. tetragyna* was the dominant species.

During the present study, we confirmed that Nubian nightjars are indeed breeding within FNR. Due to the relative sparsity of active nest observations, we suggest further investigation of the nesting habits during the breeding season to determine the long-lasting.

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