

Development of A Questionnaire for Nests Identification and Sooty Falcons (*Falco concolor*) Monitoring in South eastern Libya

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ABSTRACT

Sooty falcon (*Falco concolor*) breeds colonially in hot, arid deserts and coastal habitats without vegetation, and on coral islands, where its breeding coincides with the autumn migration of the small birds on which it feeds. It nests in a hole or on a cliff ledge, but sometimes at other sites such as old herons' nests and camel markets. A questionnaire was distributed to bird of prey breeders in eastern Libya with the assistance of the Life Organization for the Protection of Wildlife and Marine Organisms, IUCN member. The questionnaire aimed to collect information for a study on surveying and locating nests and monitoring sooty falcons. Seventy-two breeders and individuals interested in the topic completed the questionnaire, providing their observations of the Sooty Falcon, including identified pairs of birds throughout the year, individuals, nesting locations, number of eggs, and food sources. The study found that Jaghub had a significant increase in both the number of Sooty Falcon nests and single birds compared to Tazirbu. The years 2021 and 2022 showed a notable increase in the number of single birds and nests. These findings provide valuable insights into the population dynamics and breeding patterns of Sooty Falcons in the Jaghub and Tazirbu regions. In conclusion, the study provided valuable information about the Sooty Falcon's presence and behavior in eastern Libya, which can be used to inform conservation efforts for the species. The results of the study also highlight the importance of involving local communities in wildlife research and conservation

تطوير استبيان لتحديد أعشاش ومراقبة الصقر الاسخم (*Falco concolor*) في جنوب شرق ليبيا

اسامة مفتاح البرعصي عصراة رمضان الخجخاج نهي عبدالونيس الكيلاني صالح عبدالله بورزقة عازة عبدربه العوكلي اصالة
جمعة امدورد حنين نبيل عزوز حنين مروان البزوطي هبة صلاح معزب شهد جمال امدورد

الصقر الأسخم (يعرف محليا سلو الصحراء او بصقر الغروب) يتكاثر بشكل جماعي في الصحاري الحارة والجافة والمواطن الساحلية
تفتقر للغطاء النباتي، وعلى الجزر المرجانية، حيث يتزامن تكاثره مع هجرة الطيور الصغيرة التي يتغذى عليها. يعيش في حفرة أو على
حافة صخرية، ولكن في بعض الأحيان في مواقع أخرى مثل أعشاش البجع القديمة وأسواق الجمال. تم توزيع استبيان على مربّي الطيور
الجارحة في شرق ليبيا بمساعدة منظمة الحياة لحماية الكائنات البرية والبحرية، وهي عضو في الاتحاد الدولي لحماية الطبيعة. هدف

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الاستبيان هو جمع المعلومات لدراسة مسح وتحديد أماكن أعشاش ومراقبة الصقر الأسخم. أكمل 72 مرئيًا وأفرادًا مهتمين بالموضوع الاستبيان، وقدموا ملاحظاتهم حول الصقر الأسخم، بما في ذلك تحديد أزواج الطيور، والأفراد، وأماكن التعشيش، ومصادر الغذاء. أظهرت الدراسة أن الجغوب شهدت زيادة كبيرة في أعشاش الصقر الأسخم والطيور الفردية مقارنة بتازربو. أعوام 2021 و 2022 شهدت زيادة ملحوظة في عدد الطيور الفردية والأعشاش. توفر هذه النتائج رؤى قيمة حول ديناميات السكان وأنماط التكاثر للصقر الأسخم في مناطق الجغوب وتازربو. في الختام، قدمت الدراسة معلومات قيمة حول وجود الصقر الأسخم وسلوكه في شرق ليبيا، والتي يمكن استخدامها لدعم جهود الحفاظ على هذا النوع. تسلط نتائج الدراسة أيضًا الضوء على أهمية إشراك المجتمعات المحلية في البحوث والحفاظ على الحياة البرية.

INTRODUCTION:

Sooty Falcon (*Falco concolor*) is a globally Near Threatened species that breeds in the Middle East and northeastern Africa. Its breeding areas in the Arabian Gulf are distant from the main breeding range, extending from Eurasia to Arabia and Africa. This unique breeding strategy is shared only with Eleonora's Falcon (*Falco eleonora*). The distinctive breeding behavior of the Sooty Falcon suggests that demographic drivers of population change may differ from better-studied falcon species, and obtaining information on these factors is critical for effective conservation. (BirdLife International, 2017).

According to (Garrido et al. 2021), the Sooty Falcon species is assessed as Near Threatened under criterion D1. This criterion evaluates the population size and decline of a species. Although the number of individuals in North Africa is relatively small, with an estimated 1,100-1,800 mature individuals, the current population data from Egypt suggests that previous surveys may have underestimated the actual populations. Additionally, the data indicates that the species is not experiencing a continuous decline. This assessment highlights the importance of accurate population data and ongoing monitoring efforts for effective conservation of the Sooty Falcon.

The Sooty Falcon breeds colonially in hot, arid deserts and coastal habitats without vegetation, and on coral islands, where its breeding coincides with the autumn migration of the small birds on which it feeds (Clark and Davies, 2018). It nests in a hole or on a cliff ledge, but sometimes at other sites such as old herons' nests and camel markets (Clark and Davies, 2018)

The Sooty Falcon is a small to medium sized migratory species, which breeds in mountainous desert areas with canyons and cliffs, across eastern North Africa, from eastern Libya through Egypt and Jordan, to the coasts of the Red Sea and Arabian Gulf, through the Middle East to southwest Pakistan in summer (Mcgrady et al., 2019).

Sooty Falcons can reach their adult size and become capable of breeding at 2 years of age, although in some cases, individuals have been known to successfully breed as early as one year old (Orta, 1994). However, breeding may be significantly delayed, lasting up to approximately 3.8 years, depending on environmental conditions and availability of fluctuating resources (McGrady et al., 2016)

It appears that the breeding records of the species are discontinuous and highly localized, spanning from the Libyan Desert eastwards through Egypt, including the Sahara Desert, the east coast, and the Red Sea islands (Habib, 2019). This suggests that the species has specific breeding preferences and is found in specific areas within this region.

The Sooty Falcon (*Falco concolor*) is closely related to the Eleonora's Falcon (*Falco eleonora*) and shares ecological similarities with it. However, the Eleonora's Falcon has been more extensively studied compared to the Sooty Falcon. This suggests that the knowledge and research on the Eleonora's Falcon can provide valuable insights and comparisons for understanding the ecology and behavior of the Sooty Falcon (Lo'pez-Lo'pez et al., 2010).

According to Ferguson-Lees and Christie (2001), previous estimates of the Sooty Falcon population size suggested that there were approximately 40,000 breeding pairs or 100,000 individuals. However, it is important to note that these estimates were based on rough approximations or "guestimates" and may not accurately reflect the true population size. It is crucial to gather more accurate and up-to-date data to better understand the population dynamics and conservation needs of the Sooty Falcon.

Birdlife International (2015) puts the global population at 10,000–19,999 individuals), but this guestimate is not based on empirical data.

Based on the available empirical data, the population ecology of Sooty Falcons (*Falco concolor*) is not well

understood, and there have been no surveys conducted to establish their distribution in Libya. This lack of information highlights the need for further research and surveys to better understand the population dynamics, distribution, and conservation status of Sooty Falcons in Libya.

STUDY AREA

The Life Organization for the Protection of Wildlife and Marine Organisms, which is a member of the International Union for the Conservation of Nature (IUCN), has targeted South Jaghub and Tazirbu as key study areas for our research. These locations are situated in southeastern Libya., Jaghub located approximately 286 km south to the city of Tobruk and Tazirbu about 400 km east to Kufra.

The study area primarily consists of arid land that is originally desert with shifting sand dunes. Figure 1 below displays the location of Jaghub and Tazirbu in Libya, along with a recent aerial image of the area where the Sooty Falcon was observed in Libya.

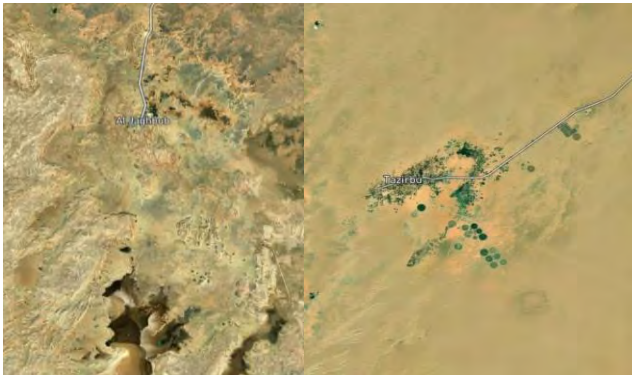


Fig. 1. Shows The location of Jaghub and Tazirbu in Libya which includes a recent aerial image of the region where the Sooty Falcon was observed in Libya.

METHODS

In order to collect the necessary information for this study on surveying and locating nests and monitoring sooty falcons, questionnaires were distributed to bird of prey breeders in eastern Libya with the help from the team of Life Organization for the Protection of Wildlife and Marine Organisms.

Between January and March 2023, 72 out of 100 dedicated bird breeders, specializing in birds of prey, conscientiously filled out questionnaires, providing their observations on the Sooty Falcon. This included

identified pairs of birds throughout the years, individuals, nesting number, and food sources. The information collected was used to facilitate analysis. All responses to the questionnaire were assessed, and only those meeting the inclusion criteria were used in this study. The results were presented as means.

Results were expressed as means \pm SE. Statistical significance was calculated using one- way analysis of variance t-test followed by post hoc tests for multiples comparisons. All the statistical analysis was carried out with the use of SPSS 17 software. Differences were considered significant at $P \leq 0.05$.

RESULTS

Sooty Falcons were observed in the Jaghub and Tazirbu regions, and the number of Sooty Falcon nests recorded ranged from 3 to 32 nests (mean, 15.25 ± 4.18 nests) per annum during the years from 2014 to 2022 (Table 1). Jaghub showed a significant increase in the number of nests (12.125 ± 3.35) compared to Tazirbu (3.125 ± 1.76) (Table 1) and (Fig.2).

Table.1. Direct observations of Sooty Falcons (nestlings) in the Jaghub and Tazirbu from 2014 to 2022.

Year	Nests	Jaghub	Tazirbu	t test
2022	32	20	12	
2021	25	15	10	
2020	3	0	3	
2019	10	10	0	
2018	11	11	0	
2016	6	6	0	
2015	30	30	0	
2014	5	5	0	
(mean \pm SE)	15.25 ± 4.18	12.125 ± 3.35	$3.125 \pm 1.76^*$	3.72

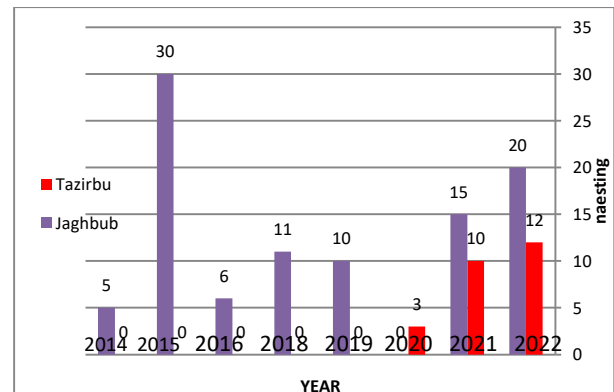


Fig.2. Number of nesting Sooty Falcon on the Jaghub and Tazirbu from 2014 to 2022.

The number of single Sooty Falcon birds (adults) ranged from 11 to 159 (mean, 36.92 single birds) per annum during the years from 2005 to 2022. Jaghub showed a significant increase in the number of single birds (30.28 ± 5.29) compared to Tazirbu (6.64 ± 4.75) (Table 2) and (Fig.3). In 2021 and 2022, there was an increase in the number of single birds and nests compared to other years.

Table.2. Number of single Sooty Falcon on the Jaghub and Tazirbu from 2005 to 2022.

Year	Total single birds	Jaghub	Tazirbu	t test
2022	136	69	67	
2021	15	5	10	
2020	56	50	6	
2019	60	50	10	
2018	30	30	0	
2016	30	30	0	
2015	25	25	0	
2014	59	59	0	
2013	25	25	0	
2012	10	10	0	
2011	20	20	0	
2010	10	10	0	
2008	30	30	0	
2005	11	11	0	
(mean \pm SE)	36.92 \pm 8.93	30.28 \pm 5.29	6.64 \pm 4.75*	5.82

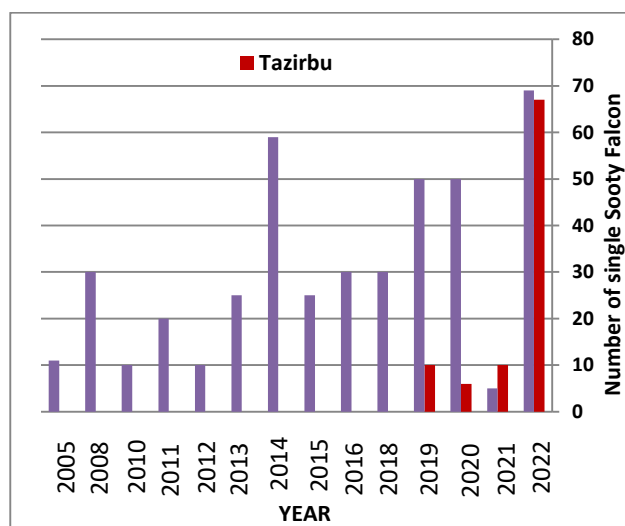


Fig. 3. Number of single Sooty Falcon on the Jaghub and Tazirbu from 2005 to 2022

Based on the survey, 57% of the respondents reported that Sooty Falcons feed on small birds, 21% reported that they feed on insects, 19% reported that they feed on lizards, and 3% reported that they feed on rodents. (Fig.4)

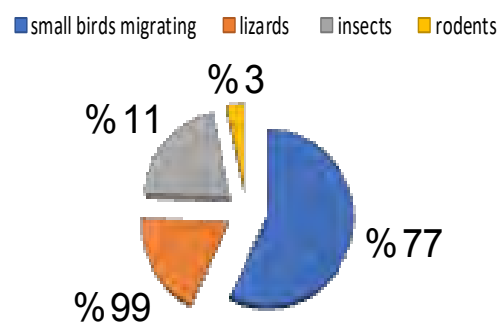


Fig. 4. food Sooty Falcon on in study area

DISCUSSION

Time New Roman Font size 10 Sooty Falcons are known to nest in In plain desert zones, they prefer to nest in caves, karst towers, and inselbergs (Salama et al., 2020).

This study recorded the number of Sooty Falcon nests ranging from 3 to 32 on the Jaghub and Tazirbu regions during the years from 2014 to 2022.

Similar findings were reported by Habib (2019), who found that the breeding records of the Sooty Falcon are discontinuously and highly locally distributed from the Libyan Desert eastwards through Egypt, including the Sahara Desert, the east coast, and the Red Sea islands.

Indeed, the Middle East, which includes the countries of southwest Asia and North Africa extending from the Libya-Egypt border in the west to Afghanistan in the east, Turkey in the north, and Yemen in the south, is home to a great variety of bird species. Contrary to popular perception, the biodiversity of the region is actually higher than some northern temperate areas (Evans, 1994).

The observed findings revealed that the number of single Sooty Falcon birds (adults) ranged from 11 to 159 (mean, 36.92 ± 8.93 single birds) per annum during the years from 2005 to 2022. The number of single birds (adults) in 2022 in Libya is generally reasonable compared to the previous years (2005-2021). Sooty Falcons were observed in the South Jaghub, except for a few that were seen in Tazirbu. Although accurate estimates of population size do not currently exist for the Sooty Falcon, the results suggest an increase in their numbers. This study sought to fill this knowledge gap.

CONCLUSION

the study provided valuable information about the Sooty Falcon's presence and behavior in eastern Libya, which can be used to inform conservation efforts for the species. The results of the study also highlight the importance of involving local communities in wildlife research and conservation.

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