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Avifaunal updated survey in St. Catherine protectorate, Egypt

Amir Soliman¹, Basma M. Sheta^{2*}, Mohamed Bahnasway², Gamal M. Orabi³

1 Saint Catherine Protectorate, PO Box 46616, Saint Katherine City, South Sinai, Egypt.

2 Zoology Department, Faculty of Science, Damietta University, PO Box 819, 34517 New. Damietta, Damietta, Egypt.

3 Department of Zoology, Faculty of Science, Suez Canal University, 41522 Ismailia, Egypt.

*Corresponding author. E-mail address: bas masheta@du.edu.eg

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Abstract:

St. Catherine is a unique and remarkable stopover place for migratory birds and a high-quality resource habitat for resident birds. St. Catherine is an important bird area (IBA) and declared a protectorate. In the present study, the bird community was surveyed across a gradient of different habitat types across the St. Catherine protectorate. A total of 3884 individuals belonging to 73 bird species (represented by 12 orders and 28 families) were recorded during the period from June 2017 to August 2018. The total resident bird species richness was 25 bird species with 3100 individuals in abundance belonging to 7 orders and 16 families. The most abundant resident bird species were Chukar partridge (*Alectoris chukar*), Rock Dove (*Columba livia*), Sinai Rose Finch (*Carpodacus synoicus*), and Desert Lark (*Ammomanes deserti*). The crossing over Palearctic migratory species was higher than resident species, with a richness of 48 bird species related to 8 orders and 18 families. The top abundant migrants were White Pelican (*Pelecanus onocrotalus*), lesser whitethroat (*Sylvia curruca*), Chiffchaff (*Phylloscopus collybita*), and European honey buzzard (*Pernis apivorus*). This survey showed the importance of St. Katherine for both resident and migratory birds. A continuous standardized bird survey is required in this very special protectorate for both migratory and resident bird species.

Key Words: Bird, migratory, resident, survey, St. Catherine, South Sinai

Introduction

The position of Sinai between the two continents, Africa and Asia, in addition to the South Sinai's natural and geographical conditions, has awarded the South Sinai region relatively unique biodiversity with characteristic fauna and flora (Zalat et al., 2001; Fakhry, et al., 2019). Accordingly, the Egyptian Environmental Affairs Agency (EEAA) declared Saint

Catherine a protected area in 1996 at 4350 Km² occupying most of the South Sinai Governorate (SKP, 2003).

There is a distinctive scenery with diverse associated habitats as a result of the difference in altitude and slope direction between such habitats. The diversity of habitats results in the diversity of flora and fauna along with traditional land-use patterns and

social organizations (Khedr, 2007; Moustafa, 2001). IUCN stated that the Saint Catherine protectorate is one of the most important regions for flora diversity in the Middle East (Davis et al., 1994; Shaltout et al., 2020), as it has about 44% of Egyptian endemic Flora (Boulos, 1995; Shaltout et al., 2004) and some endemic fauna consisting mainly of insects, including Sinai Baton Blue *Pseudophilotes sinaicus* one of the world's smallest butterflies (Grainger, 2003).

Although Sinai represents only 6% of Egypt's territory, it has many Important Bird Areas (IBAs) (29% of Egypt's IBAs) according to BirdLife International criteria, indicating the diversity of habitats and the unique biogeographic location of the region. Saint Catherine is one of five IBAs identified by Baha El Din (Baha El Din, 1999; BirdLife 2005). The diverse habitats in St.Catherine including gardens, sewage, agricultural lands, mountains, and wadis make it hold different bird communities for both residents

and migratory. Besides, St. Catherine is one of the great points in the eastern Mediterranean flyway. Ongoing research and continuous bird assessment are crucial for a conservation plan and tracking the changes in bird numbers.

Materials and methods

Study area

The St. Catherine Protectorate is situated on the southern peninsula of Sinai. The Protectorate is one of Egypt's largest and most important protected areas, and its 4350 km² area covers almost the entire high mountains of southern Sinai (Grainger, 2008). This study was carried out on 16 sites in an area of 174.75 km² around St. Catherine city, in the core area of the protectorate, which is characterized by volcanic dykes forming the highest mountains in Egypt. On biodiversity scales, the ring dyke is an extremely valuable figure (1).

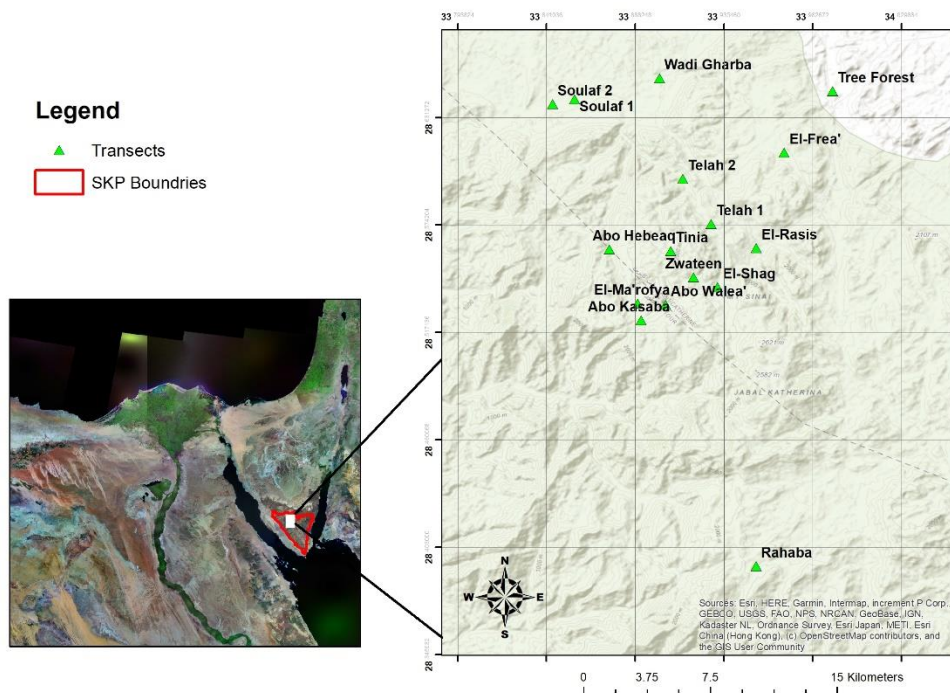


Figure (1): The map shows the study area and survey transects.

Table 1. Sites and the coordinates (lat. = latitude and long. = longitude). Each location had one transect except for Wadi Sulaf and Wadi Itlah, which had two transects. The transects' lengths were 1 km each, except for the tree forest, where the length was 0.5 km.

No.	Name	Code	Start lat.	Start long.	End lat.	End long.
1	Wadi Itlah	T1	28.57473	33.92870	28.58241	33.92382
2	Wadi Itlah	T2	28.59876	33.91373	28.59084	33.91899
3	Wadi Abo Kasba	T3	28.52366	33.89140	28.52919	33.89953
4	Abo Walea	T4	28.53185	33.90445	28.53524	33.91364
5	Wadi Zwateen	T5	28.54635	33.91931	28.53951	33.92593
6	Wadi El Shag	T6	28.54117	33.93218	28.53254	33.93538
7	Wadi Sulaf	T7	28.64101	33.85603	28.64103	33.84576
8	Wadi Sulaf	T8	28.63862	33.84428	28.63502	33.83496
9	Wadi Gharba	T9	28.65229	33.90123	28.65005	33.89269
10	Tree Forest	T10	28.64546	33.99332	28.65011	33.99259
11	El Rasis	T11	28.56190	33.95276	28.55382	33.94885
12	Wadi Tinia	T12	28.56047	33.90728	28.56908	33.90446
13	El Maroufia	T13	28.53260	33.88958	28.53154	33.88567
14	Abo Hepaeq	T14	28.56135	33.87466	28.55264	33.87800
15	El Rahaba	T15	28.39289	33.95264	28.39573	33.96251
16	El Ferea	T16	28.61278	33.96748	28.62131	33.95185

Bird Survey Techniques

Point transects were chosen as the study technique to fit the topographic nature of the study area (Gregory et al., 2004). A one km transect has been established for each site except for Wadi Itlah and Wadi Sulaf; each of them has two one km transects, and the tree forest has a 0.5 km transect. Ten monitoring points; spaced 100 m apart were established along the transect. The first monitoring point was 50 m from the transect start. Each sample point was assigned a number to be entered onto the bird's field datasheet. The coordinate information for each selected site was recorded by using a GPS unit (Garmin e-Trix).

Bird surveys were done for successive 15 months between May 2017 to July 2018 to record all breeding resident birds and migrants.

Results

Bird Community Composition:

A total of 3884 individuals belonging to 73 bird species, 53 Genus, 28 families, and 12 orders have been recorded in this study (Table 2). Site T16 (El Frea)

showed the highest value for species richness (28 species) while T15 (El Rahaba) showed the minimum number (14 species). The One-way ANOVA showed a highly significant difference ($P < 0.01$ and $F = 3.26$) between different sites in terms of species richness (fig. 2). The most abundant family was the Columbidae, which had 677 members, approximately 47% of whom were rock doves (*Columba livia*). The family Phasianidae was represented by 526 individuals, with only two species: Chukar partridge (*Alectoris chukar*) and Sand Partridge (*Ammoperdix heyi*). Family Alaudidae had 389 individuals, more than 90% of whom were Desert Larks (*Ammomanes deserti*). Family Hirundinidae had 368 individuals with about 88% of them being Rock Martins, (*Ptyonoprogne fuligula*). Raptors, mostly migrant species, were represented by two families, Accipitridae and Falconidae, with a total of 73 individuals.

Resident birds:

the resident species were the most abundant (3100) individuals, belonging to 25 bird species, 16 families,

and 7 orders, the *Alectoris chukar* species (chukar partridge) was the most common in the study area, followed by *Columba livia* (rock dove), *Carpodacus synoicus* (Sinai rose finch), *Ammomanes deserti* (desert larks) and *Ptyonoprogne fuligula* (rock martin) at almost the same level (Fig. 3).

Migratory birds:

Migratory birds were 784 individuals belonging to 48 bird species, 18 families, and 8 orders. the most abundant migratory bird's species were the *Sylvia curruca* (lesser whitethroat), followed by the *Phylloscopus collybita* (chiichaff) and then the *Pernis apivorus* (European honey buzzard) (fig.4).

Table (2) list of all recorded bird Species with taxonomic status

No	Species		Family	order	Notes
	English name	Latin Name			
1	Eurasian sparrowhawk	<i>Accipiter nisus</i>	Accipitridae	Accipitriformes	Winter visitor
2	Bonelli's eagle	<i>Aquila fasciata</i>	Accipitridae	Accipitriformes	Resident
3	Steppe Eagle	<i>Aquila nipalensis</i>	Accipitridae	Accipitriformes	Migratory
4	Steppe Buzzard	<i>Buteo buteo vulpinus</i>	Accipitridae	Accipitriformes	Migratory
5	Long-legged Buzzard	<i>Buteo rufinus</i>	Accipitridae	Accipitriformes	Migratory
6	Western Marsh-Harrier	<i>Circus aeruginosus</i>	Accipitridae	Accipitriformes	Migratory
7	Pallid Harrier	<i>Circus macrourus</i>	Accipitridae	Accipitriformes	Migratory
8	Black Kite	<i>Milvus migrans</i>	Accipitridae	Accipitriformes	Migratory
9	European honey buzzard	<i>Pernis apivorus</i>	Accipitridae	Accipitriformes	Migratory
10	Teal	<i>Anas crecca</i>	Anatidae	Anseriformes	Migratory
11	Swift	<i>Apus apus</i>	Apodidae	Apodiformes	Migratory
12	Hoopoe	<i>Upupa epops</i>	Upupidae	Bucerotiformes	Resident
13	Laughing Dove	<i>Spilopelia senegalensis</i>	Columbidae	Columbiformes	Resident
14	Rock Dove	<i>Columba livia</i>	Columbidae	Columbiformes	Resident
15	Domestic Pigeon	<i>Columba livia domestica</i>	Columbidae	Columbiformes	Resident
16	Collared Dove	<i>Streptopelia decaocto</i>	Columbidae	Columbiformes	Resident
17	European Bee-eater	<i>Merops apiaster</i>	Meropidae	Coraciiformes	Migratory
18	Cuckoo	<i>Cuculus canorus</i>	Cuculidae	Cuculiformes	Migratory
19	Lesser Kestrel	<i>Falco naumanni</i>	Falconidae	Falconiformes	Migratory
20	Kestrel	<i>Falco tinnunculus</i>	Falconidae	Falconiformes	Resident
21	Sand Partridge	<i>Ammoperdix heyi</i>	Phasianidae	Galliformes	Resident
22	Chukar partridge	<i>Alectoris chukar</i>	Phasianidae	Galliformes	Resident
23	Olive Tree Warbler	<i>Hippolais olivetorum</i>	Acrocephalidae	Passeriformes	Migratory
24	Olivaceous Warbler	<i>Iduna pallida</i>	Acrocephalidae	Passeriformes	Migratory
25	Desert Lark	<i>Ammomanes deserti</i>	Alaudidae	Passeriformes	Resident
26	Greater short-toed lark	<i>Calandrella brachydactyla</i>	Alaudidae	Passeriformes	Migratory
27	Crested Lark	<i>Galerida cristata</i>	Alaudidae	Passeriformes	Resident
28	Brown-necked Raven	<i>Corvus ruficollis</i>	Corvidae	Passeriformes	Migratory
29	Striolated Bunting	<i>Emberiza striolata</i>	Emberizidae	Passeriformes	Resident
30	Trumpeter Finch	<i>Bucanetes githagineus</i>	Fringillidae	Passeriformes	Resident

31	Sinai Rose Finch	Carpodacus synoicus	Fringillidae	Passeriformes	Resident
32	Syrian Serin	Serinus syriacus	Fringillidae	Passeriformes	Migratory
33	Red-Rumped Swallow	Cecropis daurica	Hirundinidae	Passeriformes	Migratory
34	House Martin	Delichon urbicum	Hirundinidae	Passeriformes	Migratory
35	Barn Swallow	Hirundo rustica	Hirundinidae	Passeriformes	Migratory
36	Rock Martin	Ptyonoprogne fuligula	Hirundinidae	Passeriformes	Resident
37	Eurasian crag martin	Ptyonoprogne rupestris	Hirundinidae	Passeriformes	Non-breeding
38	Sand Martin	Riparia riparia	Hirundinidae	Passeriformes	Migratory
39	Red-Backed Shrike	Lanius collurio	Laniidae	Passeriformes	Migratory
40	Masked Shrike	Lanius nubicus	Laniidae	Passeriformes	Migratory
41	Tree Pipit	Anthus trivialis	Motacillidae	Passeriformes	Migratory
42	White Wagtail	Motacilla alba	Motacillidae	Passeriformes	Migratory
43	yellow wagtail	Motacilla flava	Motacillidae	Passeriformes	Migratory
44	Robin	Erithacus rubecula	Muscicapidae	Passeriformes	Migratory
45	collared flycatcher	Ficedula albicollis	Muscicapidae	Passeriformes	Migratory
46	Bluethroat	Luscinia svecica	Muscicapidae	Passeriformes	Migratory
47	Rock Thrush	Monticola saxatilis	Muscicapidae	Passeriformes	Migratory
48	Blue Rock Thrush	Monticola solitarius	Muscicapidae	Passeriformes	Migratory
49	Spotted Flycatcher	Muscicapa striata	Muscicapidae	Passeriformes	Migratory
50	Desert Wheatear	Oenanthe deserti	Muscicapidae	Passeriformes	Winter visitor
51	Black-eared wheatear	Oenanthe hispanica	Muscicapidae	Passeriformes	Migratory
52	White-Crowned Wheatear	Oenanthe leucopyga	Muscicapidae	Passeriformes	Resident
53	Mourning Wheatear	Oenanthe lugens	Muscicapidae	Passeriformes	Resident
54	Blackstart	Oenanthe melanura	Muscicapidae	Passeriformes	Resident
55	Hooded Wheatear	Oenanthe monacha	Muscicapidae	Passeriformes	Resident
56	Wheatear	Oenanthe oenanthe	Muscicapidae	Passeriformes	Migratory
57	Black Redstart	Phoenicurus ochruros	Muscicapidae	Passeriformes	Migratory
58	Redstart	Phoenicurus phoenicurus	Muscicapidae	Passeriformes	Migratory
59	Stonechat	Saxicola rubicola	Muscicapidae	Passeriformes	Migratory
60	Palestine sunbird	Cinnyris osea	Nectariniidae	Passeriformes	Resident
61	Golden Oriole	Oriolus oriolus	Oriolidae	Passeriformes	Migratory
62	House Sparrow	Passer domesticus	Passeridae	Passeriformes	Resident
63	Chiffchaff	Phylloscopus collybita	Phylloscopidae	Passeriformes	Winter visitor
64	Willow Warbler	Phylloscopus trochilus	Phylloscopidae	Passeriformes	Migratory
65	White-Spectacled Bulbul	Pycnonotus xanthopygos	Pycnonotidae	Passeriformes	Resident
66	Streaked Scrub Warbler	Scotocerca inquieta	Scotocercidae	Passeriformes	Resident
67	Tristram's Starling	Onychognathus tristramii	Sturnidae	Passeriformes	Resident
68	Blackcap	Sylvia atricapilla	Sylviidae	Passeriformes	Migratory
69	Orphean Warbler	Sylvia crassirostris	Sylviidae	Passeriformes	Migratory
70	lesser whitethroat	Sylvia curruca	Sylviidae	Passeriformes	Migratory
71	Arabian Warbler	Sylvia leucomelaena	Sylviidae	Passeriformes	Winter visitor
72	White Pelican	Pelecanus onocrotalus	Pelecanidae	Pelecaniformes	Migratory
73	Lichtenstein's Sandgrouse	Pterocles lichtensteinii	Pteroclididae	Pteroclitiformes	Resident

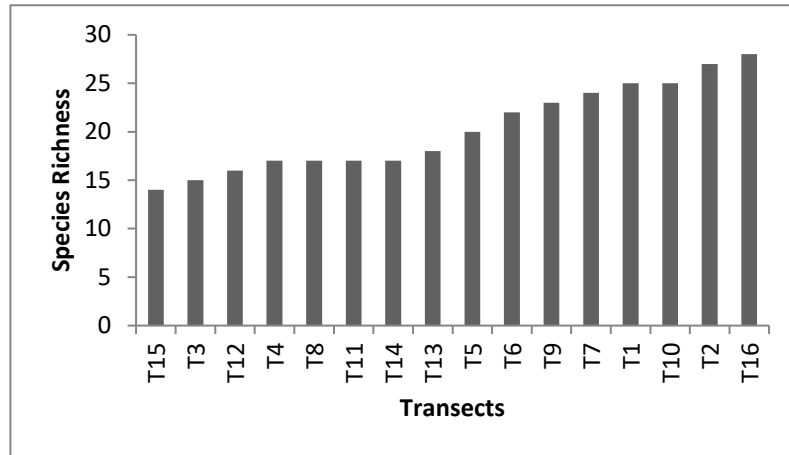


Figure (2) Species Richness for transects

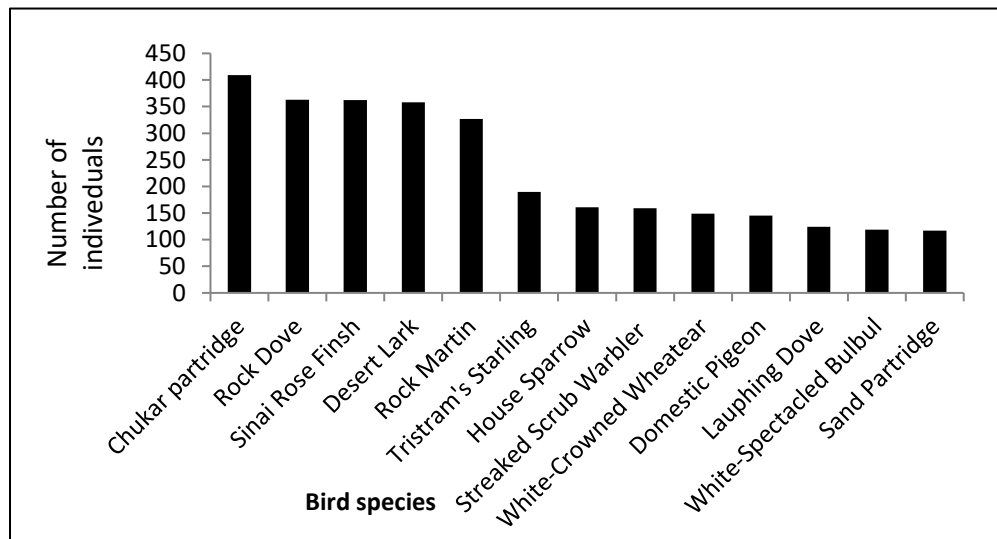


Figure (3) Top abundant resident bird species in the study area

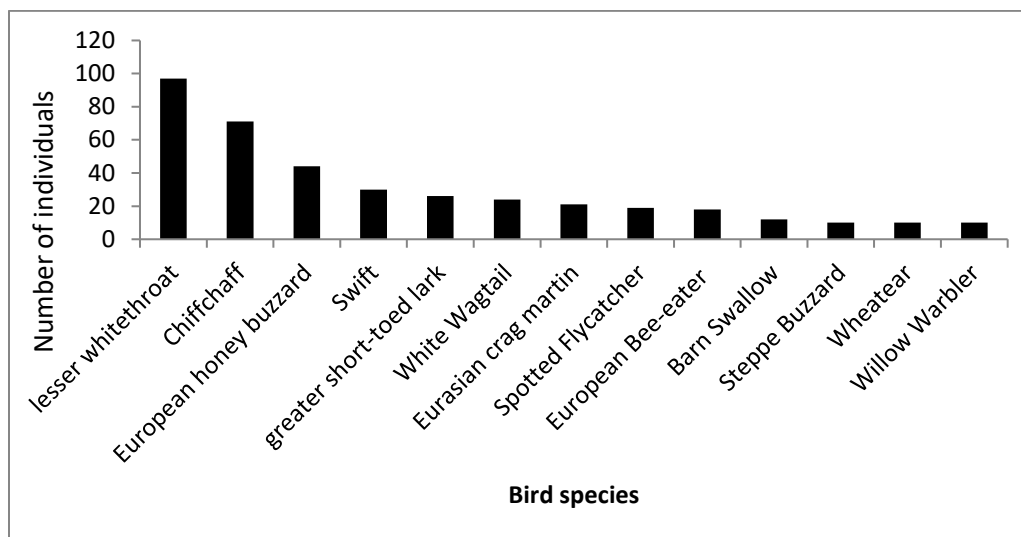


Figure (4) Abundant migratory bird species

Discussion

Saint Catherine is an important wide protectorate area covering most of the South Sinai Mountain area. Saint Catherine protectorate is also an important bird area and a stop-over and refueling station for migrant bird species. **Power, (2016)**; pointed out the importance of oasis areas in the Saint Catherine protectorate for birds, especially the migrant species passing through the area for refueling. Vegetation cover, especially orchards and trees like palms and acacia, was found to be of special attraction for both migrant and resident birds (**Power, 2016, Norfolk, 2015**).

The community composition of the study area pointed out that the total number of recorded species was 73 bird species for a study area of about 175 km². Other studies for Saint Catherine PA recorded much fewer species numbers. **Meakin, (2005)**; recorded a total of 52 bird species for a larger area span. **White (2007)**; recorded 33 species for a larger area span but with few sites. **Norfolk, 2015**; recorded 34 bird species while studying the difference between bird distributions in and out of Bedouin gardens. **Arcilla,**

2016; recorded 31 bird species in about 5 weeks of fieldwork in some Saint Catherine PA valleys and some valleys near the PA borders. In the present study, we record 73 bird species the reason for our records to be higher despite the smaller area span is the longer period, which allowed the records of resident bird and passage migrants species to be in different seasons.

The abundant bird species in the study area was the Chukar partridge *Alectoris chukar*, followed by rock doves *Columba livia*, Sinai Rose Finch *Carpodacus synoicus*, Desert Larks *Ammomanes deserti*, and Rock Martins *Ptyonoprogne fuligula*. That partially agrees with the findings of other studies in the area. As **White (2007)**; mentioned that the top 3 abundant species in the area were Rock Dove *Columba livia*, Laughing Dove *Streptopelia senegalensis*, and Sinai Rosefinch *Carpodacus synoicus*. While **Norfolk, 2015**, discussed the abundance of birds in two different habitats, Bedouin gardens, and unmanaged habitats. They found that the abundant species in the gardens habitat laughing dove *Streptopelia senegalensis*, chiffchaff *Phylloscopus collybita*, Tristram's Starling *Onychognathus tristramii*, Rock Martin *Ptyonoprogne*

fuligula, and White-Spectacled Bulbul *Pycnonotus xanthopygos*, respectively. While in the unmanaged habitat Desert Lark *Ammomanes deserti*, Rock Martin *Ptyonoprogne fuligula*, Laughing Dove *Streptopelia senegalensis*, Sinai Rose Finch *Carpodacus synoicus*, and Tristram's Starling *Onychognathus tristramii* were the abundant species in the given order.

Sites 16,2,10, and 1 (El Frea, Telah, Tree Forest, and Telah) showed higher total species richness. A considerable difference in bird species richness was evident between sites 1 and 2, both located in the same valley (Tellah), both have medium vegetation cover, with site 1 slightly higher in cultivated plant cover. The two sites also have adequate water sources, with a difference in the human impact activities between them. Human presence and mobility in site 1 through gardening, following grazing animals, and tourist hiking are higher than in site 2. Almost the same conditions apply for the other two sites (16 and 10), which have good vegetation cover, availability of water sources, and medium human activity.

Site 15 (El Rahaba) is considered the lowest site of the 16 study sites for human activity as it's a remote site from the city with no Bedouin orchards, zero cultivated plant cover, and 40 % wild plant cover, only occasional hiking activity from time to time. The site also has an available water source. Of all the above sites, 15 had the lowest bird species richness. That suggests that human activities attract birds' presence to a limit, as intense human activities turn into a disturbing factor, limiting birds' distribution.

This study recommends continuous bird surveys in the following years, all year round to record all resident breeding birds as well as passage migrants, especially raptors. Long-term monitoring is required to build conservation plans and define habitat change and how this affects bird communities.

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