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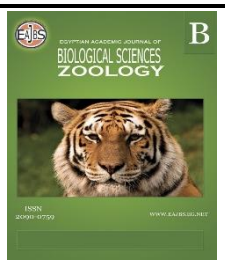

Survey of Bird Species at Petroleum Worker Camps at Marsa Matrouh Governorate, Western Desert of Egypt

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ABSTRACT

This investigation holds significant merit due to its execution within a region characterized by depauperate avifaunal assemblages in the Western Desert of Egypt. Notably, the study highlights the presence of wild bird populations within petroleum industry worker camps situated in the Marsa Matrouh Governorate.

The results show that the bird community recorded in the study area was rich in bird species and numerous (8425 individuals), these birds belonged to 16 species, grouped in 16 families and 6 orders. The dominant bird species were western yellow wagtail, house sparrow, rock pigeon, hooded crow, red-backed shrike and Eurasian collared dove. The highest number of bird species was recorded during autumn and then winter season according to the existence of migratory bird species, while the lowest was recorded during spring due to the return of migratory species and bird dispersal for nesting.

The bird's members for the order Passeriformes were the most existence than other different orders according to its global distribution, followed by the order Columbiformes in the second rank, then Pterocliformes, Ciconiiformes, Bucerotiformes and finally Falconiformes.

Autumn season led the other seasons with its highest value for bird richness and Shannon-Wiener diversity index, followed by winter for species richness and spring for Shannon-Wiener diversity index. Spring recorded the lowest value of species richness and summer recorded the lowest value for both Shannon-Wiener diversity index & species evenness.

INTRODUCTION

Egypt has a unique location; it's located in the northeastern corner of Africa, which makes it a bridge between Africa and Asia. Geographically it can be divided into four major regions, Nile Valley and Delta, Western Desert, Eastern Desert and Sinai Peninsula (Bubenzer *et al.,* 2020). These unique Egyptian habitats were considered a source of attraction for many bird species. However, each bird species has their particular kind of habitat, which makes it unique in its ecology and distribution (BirdLife International 2008).

Overall, 470 bird species had been recorded in Egypt, the most about 320 species as migrants, while the rest 150 species as residents (Baha El Din, 1999). These bird

species are distributed differently across Egypt according to their range.

Human presence has different effects on the abundance and densities of bird species, the negative effects through human developments and the positive effects of availability of food, water and Shelter (Gagne´and Fahrig 2011; Gagne´ *et al.,* 2016; Møller and Díaz 2018). Thus, different construction in the desert (e.g., petroleum work camps) leads to alteration in the ecology, and different impacts on the flora and fauna communities including wild birds (Colléony *et al.,* 2021; Hellen, 2021).

The Western Desert extends from the Marsa Matrouh Governorate on the Mediterranean Sea from the north to south where the Sudanese border and from the east the Nile River to the Libyan border in the west (Khalifa and Abdelall 2019). There were no rivers and streams draining into or out of the western desert (Ibrahim, 2011). This desert land is generally deemed as a primitive wasteland. Accordingly, it's poorly known ornithologically (Goodman *et al.,* 1986).

This work aims to survey birds at Khalda and Petrojet Kalabsha Camps (petroleum work camps) in Marsa Matrouh Governorate, western desert of Egypt, to give insight into avian abundance and species composition in the study area.

MATERIAS AND METHODS

Study Area:

The study was done at Khalda and Petrojet Kalabsha Camps in Marsa Matrouh Governorate, in the Western Desert of Egypt from October 2022 to September 2023. Three points were chosen in the study site, points A (30°31'43.4"N 26°05'05.9"E), B (30°32'51.6"N 26°05'44.8"E) and C at (30°32'28.8"N 26°05'07.6"E).

Bird Survey:

Bird survey was done monthly in the morning and in the evening. The point count method was used to survey bird species using point count method (Bibby *et al.,* 2000), where a fixed raising position was chosen in the different three points (A, B and C) mentioned above, all birds seeing within a radius of 50m for 10 min were recorded, this step was repeated 3 times in each point, the survey was accomplished in the early morning (Issa, 2019). Birds were surveyed using (10×50) binoculars and identified through Collins Bird Guide (Svensson *et al.,* 2009), while bird classifications were done according to (Clements Checklist v2023).

Bird Species Diversity:

Species richness (S), Shannon Weiner diversity index (H′) and Evenness Index (J') were estimated for each season (spring, summer, autumn and winter) as follows:

Species richness (S) is defined as the number (n) of all species that exist in an area (Omoro *et al.,* 2010):

$S=\Sigma n$

Shannon Weiner's diversity index (H′) is defined by the formula described by (Omoro *et al.,* 2010; Issa, 2019) as follows:

$H' = -\{\Sigma Pi*LN(Pi)\}$

Where:

Pi is the proportion of the species relative to all species in the sample.

LN (Pi) is the natural logarithm of this proportion.

Evenness Index (J') is used to compare the population size similarity of each species (Kiros *et al.,* 2018; Issa, 2019) using the equation:

$J'= H'/ H_{max}$

Where:

H′ = Shannon Weiner diversity index.

H_{max} = Natural logarithm of total number of species (lnS).

Statistical Analysis:

Statistical analysis of all the data was done by using statistical software (CoStat, 2005). The differences between treatments were compared using Duncan's multiple range tests at $P \leq 0.05$ level of significance (Duncan, 1955).

RESULTS

Bird Survey:

The composition of bird community recorded in Khalda and Petrojet Kalabsha Camps at Marsa Matrouh Governorate in Western Desert of Egypt was recorded in Table (1), comprised 6 orders (Bucerotiformes, Ciconiiformes, Columbiformes, Falconiformes, Passeriformes and Pterocliformes), consisting of 11 families representing 16 species, amongst these species 11 were recorded as resident wild birds, these species were (Eurasian hoopoe, rock pigeon, Eurasian collared-dove, laughing dove, lanner falcon, desert lark, greater hoopoe-lark, hooded crow, western yellow wagtail, house sparrow, spotted sandgrouse). On the other hand, the migratory birds represented (5) species (white stork, European turtle-dove, red-backed shrike, Spanish sparrow and common chiffchaff).

The highest relative abundance of birds was recorded with western yellow wagtail (35.74), followed by house sparrow (35.06), rock pigeon (8.64), hooded crow (5.99), red-backed shrike (3.91) and Eurasian collared dove (2.05), while the lowest relative abundance was recorded with lanner falcon (0.12).

Seasonal Density:

A total of 8425 individuals of birds were recorded during the study period **(**Table 2**).** The average number of birds population was highest during the autumn season at 213.56±92.33, followed by the winter season with 167.87±112.20, then the summer season with 94±67.54, while the lowest value during the spring season with 51.12±27.70 individuals.

The common species is that one is widespread and regionally abundant (Avolio *et al.,* 2019). The rock pigeon, laughing dove, desert lark, greater hoopoe lark, hooded crow and house sparrow are common bird species, that existed in the different year seasons with abundant numbers.

The statistical analyses between different seasons (autumn, winter, spring and summer) cleared no significant difference in mean abundance among the different seasons.

Order Passeriformes harbored the majority of surveyed bird species (83.18%), followed by the members of order Columbiformes with (13.60%), Order Pterocliformes fall in the third rank with (1.45%), While orders of Ciconiiformes, Bucerotiformes and Falconiformes had the least proportion of species with (0.93, 0.72 and 0.12%) respectively (Fig.1).

Table 1. Relative abundance and statues of bird species were found in the study areas during the course of the study.

English Name	Order	Family	Scientific Name	Statues	Relative Abundance
Eurasian Hoopoe	Bucerotiformes	Upupidae	*Upupa epops epops* (Linnaeus, 1758)	RB	0.72
White Stork	Ciconiiformes	Ciconiidae	*Ciconia ciconia ciconia* (Linnaeus, 1758)	MB	0.93
Rock Pigeon	Columbiformes	Columbidae	*Columba livia dakhlae* Meinertzhagen, 1928	RB	8.64
Eurasian Collared-Dove	,,	,,	*Streptopelia decaocto* (Frivaldszky, 1838)	RB	2.05
European Turtle-Dove	,,	,,	*Streptopelia turtur turtur* (Linnaeus, 1758)	MB	1.64
Laughing Dove	,,	,,	*Spilopelia senegalensis aegyptiaca* (Latham, 1790)	RB	1.27
Lanner Falcon	Falconiformes	Falconidae	*Falco biarmicus tanypterus* Schlegel, 1843	RB	0.12
Desert lark	Passeriformes	Alaudidae	*Ammomanes deserti* (Lichtenstein, 1823)	RB	0.85
Greater Hoopoe-Lark	,,	,,	*Alaemon alaudipes* (Desfontaines, 1789)	RB	0.65
Hooded crow	,,	Corvidae	*Corvus cornix pallescens* (Madarász, 1904)	RB	5.99
Red-backed Shrike	,,	Laniidae	*Lanius collurio* (Linnaeus, 1758)	MB	3.91
Western Yellow Wagtail	,,	Motacillidae	*Motacilla flava pygmaea* (Brehm, 1854)	RB	35.74
House Sparrow	,,	Passeridae	*Passer domesticus niloticus* (Nicoll & Bonhote, 1909	RB	35.06
Spanish Sparrow	,,	,,	*Passer hispaniolensis* (Temminck, 1820)	MB	0.72
Common Chiffchaff	,,	Phylloscopidae	*Phylloscopus collybita collybita (Vieillot, 1817)*	MB	0.25
Spotted Sandgrouse	Pteroclifformes	Pteroclidae	*Pterocles senegallus* (Linnaeus, 1771)	RB	1.45
Total					100

Table 2. Seasonal and total density of bird species were found in the study areas during the course of the study.

English name	Seasonal density					Total
	Autumn	Winter	Spring	Summer	Frequency	
Eurasian Hoopoe	**61**	**0**	**0**	**0**	**1**	**61**
White Stork	**44**	**0**	**0**	**34**	**2**	**78**
Rock Pigeon	**196**	**159**	**174**	**199**	**4**	**728**
Eurasian Collared-Dove	**173**	**0**	**0**	**0**	**1**	**173**
European Turtle-Dove	**86**	**52**	**0**	**0**	**2**	**138**
Laughing Dove	**32**	**27**	**26**	**22**	**4**	**107**
Lanner Falcon	**10**	**0**	**0**	**0**	**1**	**10**
Desert lark	**18**	**22**	**23**	**9**	**4**	**72**
Greater Hoopoe-Lark	**13**	**16**	**17**	**9**	**4**	**55**
Hooded crow	**129**	**121**	**134**	**121**	**4**	**505**
Red-backed Shrike	**329**	**0**	**0**	**0**	**1**	**329**
Western Yellow Wagtail	**1202**	**1809**	**0**	**0**	**2**	**3011**
House Sparrow	**1059**	**390**	**419**	**1086**	**4**	**2954**
Spanish Sparrow	**20**	**41**	**0**	**0**	**2**	**61**
Common Chiffchaff	**12**	**9**	**0**	**0**	**2**	**21**
Spotted Sandgrouse	**33**	**40**	**25**	**24**	**4**	**122**
Total	**3417**	**2686**	**818**	**1504**	--	**8425**
Mean	**213.56**	**167.87**	**51.12**	**94**	--	**526.56**
Std. Deviation	**369.33**	**448.79**	**110.78**	**270.14**	--	**977.98**
Std. Error	**92.33**	**112.20**	**27.70**	**67.54**	--	**244.50**
Mini	**10**	**0**	**0**	**0**	--	**10**
Max	**1202**	**1809**	**419**	**1086**	--	**3011**
F-value	**0.80**				--	--
***P*- value**	**0.49 n.s**				--	--

The statistical analyses one-way ANOVA cleared that no significant difference in mean abundance among the different year seasons ($P < 0.05$).

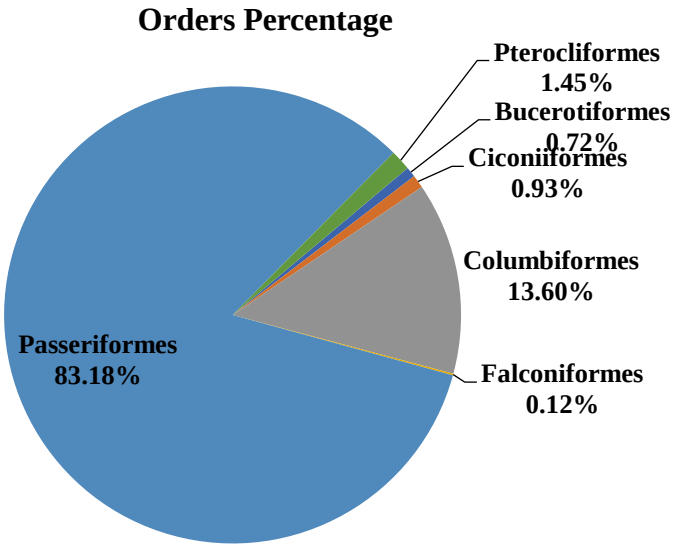

Fig. 1. A percentage of different orders were found in the study areas during the course of the study.

Bird Species Diversity Indexes:

Bird species richness, Shannon-Wiener diversity index and species evenness in the different seasons are illustrated in Figure 2. The species richness was higher during the autumn season (16 species) followed by the winter season (11 species), while the lowest value was in spring with only (7 species). The same trend was recorded with the Shannon-Wiener diversity index, where, the autumn season was recorded the highest value (1.45), while the lowest value (0.98) was recorded during the summer season. Regarding species evenness, the spring season recorded the highest value (0.70), followed by autumn (0.52), winter (0.50) and finally summer (0.47).

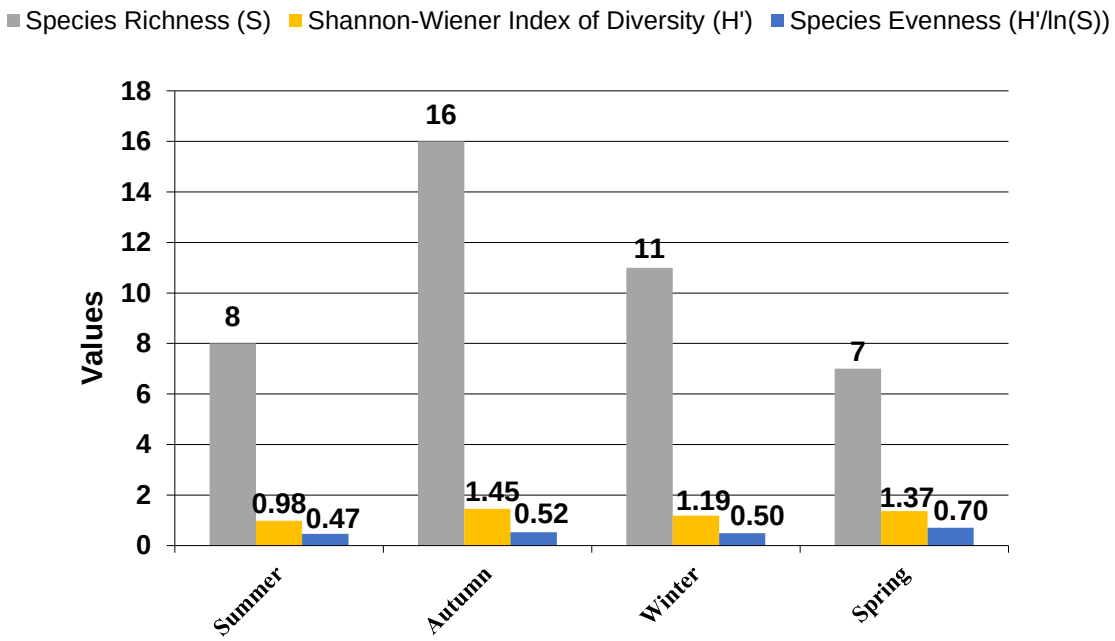

Fig. 2. Species richness, Shannon-Wiener diversity index and species evenness in different seasons at the study areas during the course of the study

DISCUSSION

The numbers of bird species recorded in this study were 16 species, theses in line with Mohallal and Ahmed (2018) who reported 22 bird species at Kharga and Dakhla Oases in the New Valley Governorate in the south of the western desert of Egypt. In contrast, it is less than the recorded (83 bird species) by White *et al.*, (2013) at Bahariya Oasis, Western desert, Egypt. The lowest number of bird species recorded in our study according to many factors, including adequate habitat and food for birds (Zhang *et al.*, 2023), disturbances, seasonality and of course the availability of resources (Shah and Sharma, 2022).

The migratory bird species in our study were only 5 species, these may be due to that petroleum company activities disturb migration bird species (Dingle and Drake, 2007), leading to a decrease in migratory species populations as a result of destructions of migration paths (Johnson, 2007).

The importance of this study lies in that it was conducted in an area labeled as a poorly avifauna area in Western Desert, Egypt. The study was conducted to survey bird populations and species composition at Khalda and Petrojet Kalabsha Camps (petroleum work camps) in Marsa Matrouh Governorate. The camps in the desert area required constructions and structures for human residency, including water and food supplies (garbage, dumps and landfills) which provide reliable food for birds. This is in line with (Hellen, 2021), who revealed that the presence of bird species oil pads is associated with vegetation structure, that's leads to the fact that birds are impacted by human settlements because there are a lot of changes in their habitat and foraging behaviors, accordingly there's a variation in species richness and abundance (Hayes *et al.,* 2023). On the other side, the construction may reduce or eliminate most common bird species (Trombulak and Frissell, 2000), because it alters the eco-system leading to the deactivation of food chains and that way rise to death for the species (McDonald *et al.,* 2009). The industrial noise, traffic and all human activity in these camps have an impact on the diversity of bird species (Blickley and Patricelli, 2010).

The study clear that order Passeriformes was the dominant order (83.18%), which might be due to its global distribution (roughly 6500 species) almost in every place on Earth (Schmitt and Edwards, 2022), or to the residential behavior of some members of this order (Shah and Sharma, 2022).

Species richness and Shannon-Wiener diversity index diversity in the autumn season were higher than in the other seasons due to migratory birds in that season, and the low numbers in summer due to migrant birds returning to their home (Katuwal *et al.* 2018; La Sorte *et al.* 2022) and the territorial behavior where birds exclude other birds from their home range during breeding season in summer (Desgranges *et al.* 2006) or the favorable climatic and ecological conditions (Shah and Sharma, 2022).

Declarations:

Ethical Approval: Not applicable.

Conflicts of Interest: There is no conflict of interest.

Informed consent: All the authors of this manuscript accepted that the article is submitted for publication in the Egyptian Academic Journal of Biological Sciences, B. Zoology, and this article has not been published or accepted for publication in another journal, and it is not under consideration at another journal.

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ARABIC SUMMARY

حصر لبعض أنواع الطيور البرية في معسكرات عمال البترول بمحافظة مرسى مطروح بالصحراء الغربية - مصر.

محمد عبدالله عيسي ،هاني أحمد عبدالعاطي أحمد ، أحمد محمد رزق
معهد بحوث وقاية النباتات-مركز البحوث الزراعية–الدقي–جيزة–مصر

تعد هذه الدراسة في غاية الأهمية وذلك لأنها أجريت في منطقة تعد من المناطق الفقيرة بالطيور البرية ، كما تسلط هذة الدراسة الضوء على وجود الطيور البرية في معسكرات عمال البترول بالصحراء الغربية بمحافظة مرسى مطروح بمصر.

وقد أوضحت النتائج غني منطقة الدراسة بالعديد من أنواع الطيور والتي يصل تعدادها الي (8425 فرداً)، تشكل 16 نوعاً والتي تتبع 16 عائلة و6 رتب. وكانت أنواع الطيور السائدة هي ابوفصادة الاصفر western yellow wagtail ، وعصفور النيل الدوري house sparrow ، والحمام الجبلي rock pigeon ، والغراب البلدي hooded crow ، والدقناش أحمر الظهرred-backed shrike ، واليمام المطوق Eurasian collared dove.

تم تسجيل اعلي تعداد لأنواع الطيور خلال فصل الخريف ثم الشتاء وذلك لوجود أنواع من الطيور المهاجرة ، بينما أقلها تعدادا في فصل الربيع وذلك يرجع لعودة الأنواع المهاجرة لمواطنها وانتشار الطيور للتعشيش.

وقد كانت الطيور من رتبة العصفوريات Passeriformes هي الاكثر تواجدا ويرجع ذلك لانتشارها عالميا , في حين كانت رتبة الحماميات Columbiformes في المرتبة الثانية , في حين حلت رتبة الصقريات Falconiformes بالمرتبة الاخيرة.

بالنسبة لمؤشري الوفرة richness وشانون للتنوعShannon-Wiener diversity فقد سجل موسم الخريف اعلي قيم , وفي المرتبة الثانية كان موسم الشتاء بالنسبة للوفرة وموسم الربيع لشانون للتنوع , بينما سجلت اقل القيم في موسم الربيع بالنسبة للوفرة وموسم الصيف لشانون للتنوع.