



A Rapid Survey of Wild Birds in Different Habitats in the Aseer Region, Saudi Arabia

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ABSTRACT

Among the vibrant ecosystems in the Aseer region, wild birds constitute a significant component. The objective of this study was to provide an updated inventory of wild bird species in the Aseer region and investigate the differences among bird communities across various study locations. The study was conducted from late December 2022 to early January 2023. The study area was divided into six main sites. The study employed a comprehensive methodology involving field surveys, bird photography, and species identification techniques up to species level. The results documented a total of 63 bird species, including 36 resident species, 9 endemic species, 17 migratory species (winter visitors), and one introduced species. Significant homogeneity in bird communities between Site 2 and Site 3, as well as between Site 5 and Site 6 was observed. However, communities exhibited less similarity between Site 1 and Site 4 when compared to other locations. Notably, elevation above sea level emerged as a key factor influencing bird distribution. Continuous year-round research, accounting for seasonal changes, is crucial to document a diverse range of wild bird species in the Aseer region.

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Authors' Contribution

SAA and AGA identified bird species and managed photography. The research, data collection and analysis was carried out by SAA, HSA and ASA. SAA authored the initial draft of the manuscript. All authors contributed in completing this study.

Key words

Aseer region, Wild birds, Bird communities, Endemic birds, Saudi Arabia

INTRODUCTION

The Kingdom of Saudi Arabia, situated in the southwestern region of the Asian continent, covers an extensive area of approximately 2 million square kilometers. Within this vast territory, diverse terrains and various environments create habitats for many a bird species, contributing to a rich biodiversity. In the Kingdom, there have been confident records of 499 bird species. These species consist of 401 native and migratory species, 11 exotic species that have become feral, and 87 species classified as vagrant (Boland *et al.*, 2020). In addition, the Kingdom's introduced bird population comprises 21 different species, with a significant number of them being commonly found throughout the region (Alshamlah *et al.*, 2022). Numerous researchers have shown a keen interest in the discipline of ornithology, significantly contributing

to the understanding of Saudi Arabian avifauna. Notably, Philby (1933) conducted extensive expeditions covering the southern and central regions of Saudi Arabia. Furthermore, Bates (1940) diligently documented his observations and notes, building upon the work of his predecessors and possessed a profound understanding of birds in the Arabian Peninsula, encompassing their relationships and distribution across various environments. Moreover, Meinerzhagen (1954) published the renowned work "Birds of Arabia" focusing on avian species inhabiting the Arabian Peninsula and highlighted the significant influx of migratory birds to the region, noting their tendency to either overfly the area without stopping or make limited and narrow-scale stopovers during migration. Additionally, a book "Birds of Yanbu Industrial city and its Surroundings," documenting a list of birds observed in Yanbu Industrial city and its environs was published (Baldwin and Meadows, 1988). Different studies also reported biodiversity in eastern province birds, central regions including Riyadh region and Ha'er area (Bundy *et al.*, 1989; Stagg, 1987; Ajarem, 1991). Moreover, Felemban (1986) documented approximately 247 bird species and provided valuable information about the birds in the Souda region northwest of Abha and further studied birds in the main valleys of Tihama and southern Jeddah (Felemban, 1996). Meanwhile, a study was conducted for the observation of seasonal variations

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in bird communities in different environments in the Abha region, highlighting its significance as an important natural bird area (Alrumman, 2004). The center for mycological life intensified its efforts in the region, conducting numerous studies and research projects. Notably, on birds in southwestern Saudi Arabia include Rahmani *et al.* (1994) study on birds in the coasts of Tihama and Newton *et al.* (1994) survey of birds in mountain valleys.

Over the past two decades, a significant body of research has focused on specific bird species within Saudi Arabia, shedding light on behavior, ecology, and conservation requirements. One noteworthy study, conducted on the Eurasian spoonbill (*Platalea leucorodia*) in the Al Fanateer Island Reserve, Jubail city, Eastern Province of Saudi Arabia. Their research documented the nesting behavior of this bird species for the first time, including observations of egg incubation and chick rearing (Alrashidi *et al.*, 2022). Similarly, along the southwestern coastline of Saudi Arabia the risks facing the migrating Egyptian vultures (*Neophron percnopterus*), an endangered bird species were investigated and identified potential threats such as the vultures consuming toxic food remnants left for stray dogs and the risk of electrocution from power transmission lines (Shobrak *et al.*, 2020). In addition, an increased extinction rate for the Saker falcon (*Falco cherrug*) over the past two decades and highlighted the potential for the Peregrine falcon (*Falco peregrinus*) to reach the brink of extinction in the next hundred years (Shobrak, 2015). Moreover, environmental research has also played a crucial role in understanding various seabird species in Saudi Arabia (Alrashidi *et al.*, 2011; Almalki *et al.*, 2015).

The Aseer region is of particular importance due to its historical ecological significance (Bates, 1937), diverse geographical nature, encompassing a range of ecosystems such as forests, valleys, mountains, plains, slopes, agricultural areas, lakes, and small ponds. Moreover, it lies along migration routes for birds traveling from Northern Europe and Asia to Central Africa. Furthermore, it serves as a breeding ground for resident species, making it rich in diverse bird species (Meinerzhagen, 1945). However, the Aseer region has received limited attention in terms of avian research, possibly due to the areas challenging field conditions and terrain. Most efforts have focused on collecting and documenting records of local species (King, 1978). Stagg (1985) recorded approximately 250 resident and migratory bird species in parts of the southwestern region of Saudi Arabia. Jennings (1981) compiled a comprehensive bird species list for Saudi Arabia, covering most regions, including the southern parts. Several studies were conducted on birds in the Aseer National Park in neighboring regions, contributing

to a better understanding of the avian fauna (Brooks *et al.*, 1987; Rands and Rands, 1987; Jennings *et al.*, 1988). Additionally, Newton and Newton (1996), in collaboration with the center for mycological life, conducted a long-term study on the impact of seasonal changes on bird abundance and diversity in the Arar forests of the Aseer Mountains, specifically in the Reida Reserve. Their study aimed to conduct a detailed field survey of bird species occurring in the reserve, providing insights into their status, distribution, and situation.

The rationale for conducting a rapid survey study on wild birds in various habitats within the Aseer Region, Saudi Arabia, is driven by several key factors. Firstly, despite its recognized ecological importance, the Aseer Region has received limited attention in avian research, and there is a notable gap in our understanding of the bird species in this region. Secondly, the unique and diverse habitats in Aseer, ranging from mountainous terrain to lowland areas, offer a significant opportunity to explore bird biodiversity and the potential ecological roles these species play. Thirdly, the study aligns with conservation efforts by providing essential baseline data that can inform habitat preservation and management strategies, particularly in the face of ongoing environmental changes. Finally, a rapid survey approach allows for timely data collection, making it a valuable initial step in establishing a comprehensive understanding of the avian diversity and distribution in this region, which can guide future, more extensive research and conservation initiatives.

MATERIALS AND METHODS

Study area

The Aseer region, located in the southwestern part of Saudi Arabia (Fig. 1) between latitudes 17.25°N and 19.50°N and longitudes 50.00°E and 41.50°E, is part of the Sarawat Mountains, a significant terrain in the Arabian Peninsula characterized by rocky massifs of igneous, metamorphic, and sedimentary rocks. This region, situated within the Arabian Shield, boasts of the highest peak, Jebel Sawda, at 3133 meters above sea level (Al-Ahaidab and Ibrahim, 2000). These highlands, with dense vegetation including juniper forests, wild olive, dodder, and aloe, give rise to valleys and wadis that drain into the Red Sea, supporting higher plant and animal densities. The terrain gradually descends eastward to the Aseer Plateau, with changing vegetation and animal life due to decreasing rainfall and moisture. The region's landscape comprises rocky hills, valleys, and water bodies, covering 20% to 60% of the land area, with a generally moderate climate characterized by mild temperatures and regular rainfall, peaking in spring and summer (Abu Al-Fateh and Hussain,

1984). Humidity levels vary seasonally, with coastal areas experiencing higher humidity. Detailed climate data from 1991 to 2021 were obtained from NASA's weather agency (NASA-POWER, 2023).



Fig. 1. The map of the study area (Aseer Region) Kingdom of Saudi Arabia.

The study area was categorized into six primary locations based on their unique characteristics (Table I). The first site, situated in the center of Abha city, represents an urban environment with public gardens. The second site, west of Abha city, represents high-altitude mountainous environments and the Junipers habitats. The third site, east of Abha city, represents flat terrains with scattered and diverse vegetation. The fourth site, north of Abha city, exhibits diverse vegetation and varying elevation. The fifth site, south of Abha city, represents low-vegetation wadi environments characterized by high temperatures. The sixth site, in the Tihama region, represents flowing wadis

with dense and diverse vegetation and high temperatures.

The field research duration was less than a month (late December 2022 to early January 2023). Each site was visited only once (4 to 6 visiting hours) in the morning (6:00 am to 11:00 am). In some cases, it was necessary to stay until nighttime to observe nocturnal species such as owls.

The research plan was based on several key points, including: Survey of the selected site: The survey was conducted based on the geographical nature of the area. It involved either stationing in a high-altitude area and recording the quantitative and qualitative counts of observed birds or following a walking method covering approximately 1000 meters along designated paths and recording the counts and species observed (Issa, 2019). Depending on the distance, these birds were observed using binoculars (specifically Jeory 6 × 30mm) or the naked eye. The identification and categorization of the observed birds were accomplished by referencing the field guide by Jennings (1981, 1995), Stagg (1985), Johnsson (1992) and Porter *et al.* (1996) which provided a comprehensive list of bird species. Furthermore, to ensure accuracy, each bird species' scientific names and authorities were cross-referenced with information from the IUCN Red list of Threatened species. Moreover, bird species, counts and observed location (ground, trees, water, or nearby) were also recorded.

Statistical analysis

The results were statistically analyzed using SPSS (Version 21), including the analysis of means and differences among the study areas. Additionally, smartphone applications were also used including, My Altitude developed (Dayana Networks Ltd) for location and elevation determination. Merlin Bird ID (Cornell University) for bird species identification and sound referencing. OsmAnd maps (OsmAND B.V) for map navigation.

Table I. Main sites, subsites, coordinates, and the respective elevation of study areas.

Code	Location	Subsites	Coordinates	Elevation (m)
A	Central Abha city	Sama Abha Park	N 18° 15' 52 E 42° 29' 50	2340
B	Western Abha city	Al-Soudah, Ain Al-Thaibah, Al-Saqaa village, Rabiha courtyard	N 18° 16' 07 E 42° 23' 35	3000-3133
C	Eastern Abha city	Al-Marbaa, Ahad Rufaidah, Tur Al-Yazeed	N 18° 6' 23 E 42° 52' 10	2125-2322
D	Northern Abha city	Balhamar, Balsamer, Al-Namas, Wadi Bada	N 18° 47' 55 E 42° 15' 35	2400-2800
E	Southern Abha city	Wadi Dhal, Wadi Al-Diba	N 17° 55' 57 E 42° 27' 8	450
F	Tihama	Mahayil, Wadi Tathbe Rijal Alma, Rajal Alma	N 18° 32' 11 E 41° 49' 07	370

Table II. List of birds observed in Asen Region in southwestern part of Saudi Arabia during late December 2022-early January 2023.

No.	Residence type	Scientific name	Common name	Elevation (m)	location coordinates
1	R	<i>Merops cyanophrys</i>	Arabian green bee-eater	466	17°55'30" N 42°27'22" E
2	WV	<i>Oenanthe pleschanka</i>	Pied wheatear	2286	18°2'39" N 42°43'6" E
3	R	<i>Oenanthe bottae</i>	Red-breasted wheatear	2565	18°20'52" N 42°19'40" E
4	E	<i>Oenanthe lugentoides</i>	Arabian wheatear	2337	18°15'38" N 42°29'39" E
5	R	<i>Zosterops abyssinicus</i>	Abyssinian white-eye	2596	18°21'1" N 42°19'11" E
6	R	<i>Athene noctua</i>	Little owl	2354	18°15'39" N 42°29'28" E
7	E	<i>Otus pamela</i>	Arabian scops owl		18°11'28" N 42°16'48" E
8	E	<i>Pica Pica asirensis</i>	Aseer magpie	2639	18°39'44" N 42°14'39" E
9	WV	<i>Buteo buteo</i>	Common buzzard	219	17°50'22" N 42°21'6" E
10	WV	<i>Saxicola maurus</i>	Siberian stonechat	2861	18°15'40" N 42°23'24" E
11	R	<i>Pycnonotus xanthopygos</i>	White-spectacled bulbul	786	18°8'29" N 42°15'44" E
12	WV	<i>Anas acuta</i>	Northern pintail	2208	19°9'57" N 42°9'53" E
13	WV	<i>Ardeola ralloides</i>	Squacco heron	370	18°32'8" N 41°49'32" E
14	R	<i>Argya squamiceps</i>	Arabian babbler	2138	18°6'24" N 42°51'54" E
15	R	<i>Cinnyris osea</i>	Palestine sunbird	2606	18°21'9" N 42°19'8" E
16	R	<i>Cinnyris habenninicus</i>	Shining sunbird	465	17°55'29" N 42°27'22" E
17	R	<i>Hedydina metallica</i>	Nile valley	465	17°55'29" N 42°27'22" E
18	R	<i>Anthus similis</i>	Long-billed pipit	2344	18°15'39" N 42°29'48" E
19	WV	<i>Milvus migrans</i>	Black kite	1376	18°28'25" N 42°24'51" E
20	E	<i>Linaria yemenensis</i>	Yemen linnet	2602	18°20'56" N 42°19'9" E
21	R	<i>Columba livia</i>	Rock dove	464	17°55'31" N 42°27'24" E
22	WV	<i>Phoenicurus phoenicurus</i>	Common redstart	2274	18°2'52" N 42°42'57" E
23	WV	<i>Gallinula chloropus</i>	Common moorhen	2462	18°22'2" N 42°21'38" E
24	R	<i>Emberiza tahapisi</i>	Cinnamon-breasted bunting	587	18°8'10" N 42°14'4" E
25	WV	<i>Lanius karelini</i>	Turkestan shrike	366	18°32'9" N 41°49'37" E
26	WV	<i>Motacilla alba</i>	White wagtail	338	18°15'28" N 42°29'32" E
27	WV	<i>Motacilla citreola</i>	Citrine wagtail	369	18°32'8" N 41°49'43" E
28	WV	<i>Monticola saxatilis</i>	Common rock thrush	2372	18°15'42" N 42°29'37" E
29	WV	<i>Monticola solitarius</i>	Blue rock-thrush	373	18°32'8" N 41°49'46" E
30	R	<i>Monticola rufocinereus</i>	Little rock thrush	591	18°8'9" N 42°14'7" E
31	E	<i>Turdus menachensis</i>	Yemen thrush	2623	18°21'14" N 42°18'56" E
32	R	<i>Cercotrichas podobe</i>	Black scrub robin	466	17°55'31" N 42°27'23" E
33	R	<i>Oenanthe melanura</i>	Blackstart	371	18°32'8" N 41°49'45" E
34	WV	<i>Lanius nubicus</i>	Masked shrike	666	18°8'16" N 42°15'7" E
35	R	<i>Onychognathus tristramii</i>	Tristram's starling	2538	18°20'12" N 42°20'30" E
36	WV	<i>Tringa ochropus</i>	Green sandpiper	367	18°32'6" N 41°49'49" E
37	WV	<i>Aquila nipalensis</i>	Steppe eagle	2452	18°32'54" N 42°22'56" E
38	R	<i>Falco tinnunculus</i>	Common kestrel	2956	18°15'24" N 42°22'31" E
39	R	<i>Fulica atra</i>	Eurasian coot	2218	19°10'3" N 42°9'55" E
40	R	<i>Tachybaptus ruficollis</i>	Little grebe	2466	18°22'3" N 42°21'38" E
39	R	<i>Fulica atra</i>	Eurasian coot	2218	19°10'3" N 42°9'55" E
40	R	<i>Tachybaptus ruficollis</i>	Little grebe	2466	18°22'3" N 42°21'38" E

Table continued on next page.....

No.	Residence type	Scientific name	Common name	Elevation (m)	location coordinates
41	R	<i>Euodice cantans</i>	African silverbill	350	18°31'57" N 41°50'5" E
42	R	<i>Ammomanes deserti</i>	Desert lark	469	17°55'35" N 42°27'5" E
43	WV	<i>Falco amurensis</i>	Amur falcon	194	17°51'8" N 42°19'50" E
44	IV	<i>Acridotheres tristis</i>	Common myna	2265	18°13'21" N 42°29'20" E
45	R	<i>Scopus umbretta</i>	Hamerkop	371	18°31'47" N 41°49'13" E
46	R	<i>Ploceus galbula</i>	Rüppell's weaver	366	18°32'9" N 41°49'37" E
47	R	<i>Lophoceros nasutus</i>	African grey hornbill	466	17°55'30" N 42°27'22" E
48	E	<i>Dendrocoptes dorae</i>	Arabian woodpecker	2126	18°6'32" N 42°51'60" E
49	R	<i>Prinia gracilis</i>	Graceful prinia	456	17°55'19" N 42°27'23" E
50	E	<i>Sylvia leucomelaena</i>	Arabian warbler	455	17°55'24" N 42°27'18" E
51	E	<i>Sylvia buryi</i>	Yemen warbler	2601	18°10'55" N 42°27'27" E
52	R	<i>Upupa epops</i>	Eurasian hoopoe	2274	18°2'52" N 42°42'56" E
53	R	<i>Oena capensis</i>	Namaqua dove	365	18°32'2" N 41°50'11" E
54	R	<i>Streptopelia roseogrisea</i>	African collared dove	464	17°55'31" N 42°27'24" E
55	R	<i>Phylloscopus collybita</i>	Common chiffchaff	2221	18°4'8" N 42°41'45" E
56	R	<i>Emberiza striolata</i>	Striolated bunting	2352	18°15'40" N 42°29'36" E
57	R	<i>Muscicapa gambagae</i>	Gambaga flycatcher	2384	18°1'58" N 42°51'42" E
58	R	<i>Passer domesticus</i>	House sparrow	2289	18°2'40" N 42°43'4" E
59	R	<i>Corvus ruficollis</i>	Brown-necked raven	2204	18°4'56" N 42°41'26" E
60	R	<i>Corvus rhipidurus</i>	Fan-tailed raven	2466	18°2'35" N 42°49'49" E
61	R	<i>Galerida cristata</i>	Crested lark	2379	18°2'6" N 42°51'57" E
62	E	<i>Crithagra menachensis</i>	Yemen serin	2342	18°15'39" N 42°29'33" E
63	R	<i>Streptopelia senegalensis</i>	Laughing dove	2250	18°3'2" N 42°42'54" E

E, endemic; R, resident bird; WV, winter visitors; I, invasive species.



Fig. 2. Endemic birds recorded at each of the six study sites included in this study.

RESULTS

This comprehensive survey documented 63 different species of wild birds within the Aseer region. These avian species were categorized into four groups: resident birds (36 species), endemic birds (9 species), winter visitor birds (17 species), and one invasive species (Fig. 2). At the conclusion of the results section, all the bird species

observed in the study area were reviewed, including their local, scientific, and English names (Table II).

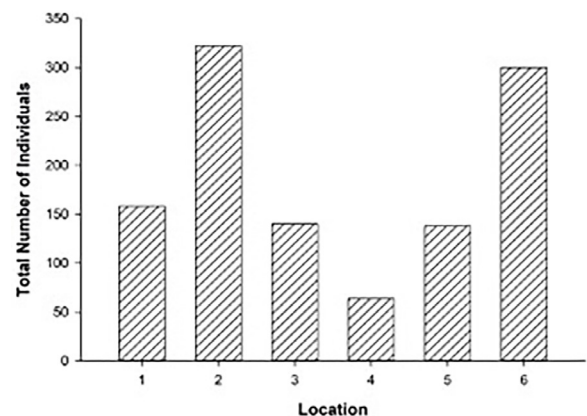


Fig. 3. Total numbers of birds recorded at each of the six study sites included in this study. Site number (1) represents Abha city: Sama Abha Park, site number (2) represents west of Abha city: Al-Sawda, Al-Suqah, Bahat Rabia, site number (3) represents east of Abha city: Al-Murabba, Al-Musqi, Tour Al-Yazeed, site number (4) represents north of Abha: Bilhamer, Balsamr, Al-Namas, Wadi Badduah, site number (5) represents south of Abha city: Wadi Dhal, Wadi Al-Diba, and site number (6) represents Tihama: Rijal Alma, Mahayil.

Over 300 birds were recorded at the second site (West of Abha city: Al-Sawda, AlSuqah, Bahat Rabia). Similarly, 300 birds were recorded at the sixth site (Tihama: Rijal Alma, Mahayil). Conversely, the first site (Abha city: Sama Abha Park), the third site (East of Abha city: Al-Murabba, Al-Musqi, Tour Al-Yazeed), and the fifth site (South of Abha city: Wadi Dhal, Wadi Al-Diba) each had a bird count approximately 50% lower compared to the second and sixth sites. As for the fourth site (North of Abha: Bilhamer, Balsamr, AlNamas, Wadi Badduah), a lower number of birds (70), were recorded (Fig. 3).

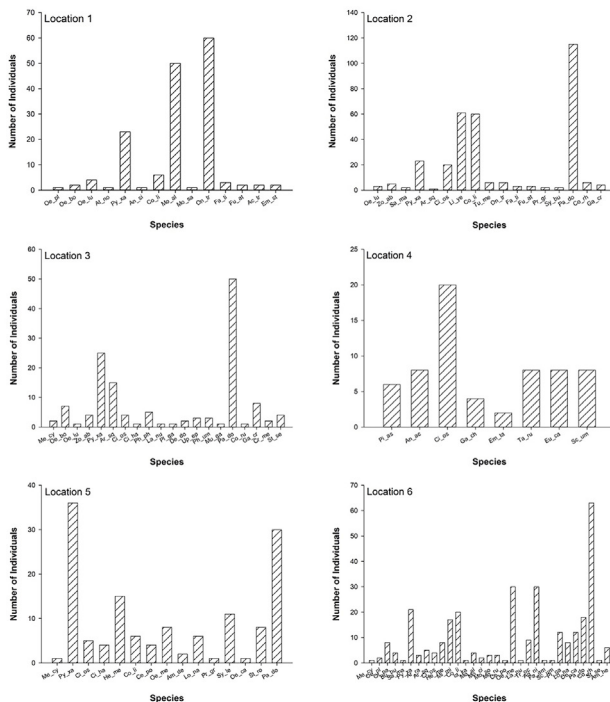


Fig. 4. Bird species observed at each of the six study sites included in this study. Site number (1) represents Abha city: Sama Abha Park, site number (2) represents west of Abha city: Al-Sawda, Al-Suqah, Bahat Rabia, site number (3) represents east of Abha city: Al Murabba, Al-Musqi, Tour Al-Yazeed, site number (4) represents north of Abha: Bilhamer, Balsamr, Al-Namas, Wadi Badduah, site number (5) represents south of Abha city: Wadi Dhal, Wadi Al-Diba, and site number (6) represents Tihama: Rijal Alma, Mahayil.

The sixth site (Tihama: Rijal Alma, Mahayil) exhibited the highest diversity of bird species, with 31 different species observed. In contrast, the recorded species varied from 20 to 14 species in the other sites. The first site (Abha city: Sama Abha Park) had 14 species, the second site (West of Abha city: Al-Sawda, Al-Suqah, Bahat Rabia) had 17 species, the third site (East of Abha city: Al-Murabba, AlMusqi, Tour Al-Yazeed)

had 20 species, and the fifth site (South of Abha city: Wadi Dhal, Wadi Al-Diba) had 15 species. The fourth site (North of Abha: Bilhamer, Balsamr, Al-Namas, Wadi Badduah) had the lowest species count (8) (Fig. 4).

Site number five (South of Abha city: Wadi Dhal, Wadi Al-Diba) and site number six (Tihama: Rijal Alma, Mahayil) showed a significant similarity in the observed bird species. Similarly, there was also similarity between site number two (West of Abha city: Al-Sawda, Al-Suqah, Bahat Rabia) and site number three (East of Abha city: Al-Murabba, Al-Musqi, Tour Al-Yazeed) in bird communities. However, site number one (Abha city: Sama Abha Park) and site number four (north of Abha: Bilhamer, Balsamr, Al-Namas, Wadi Badduah) exhibited distinct bird communities from those found in other study sites (Fig. 5).

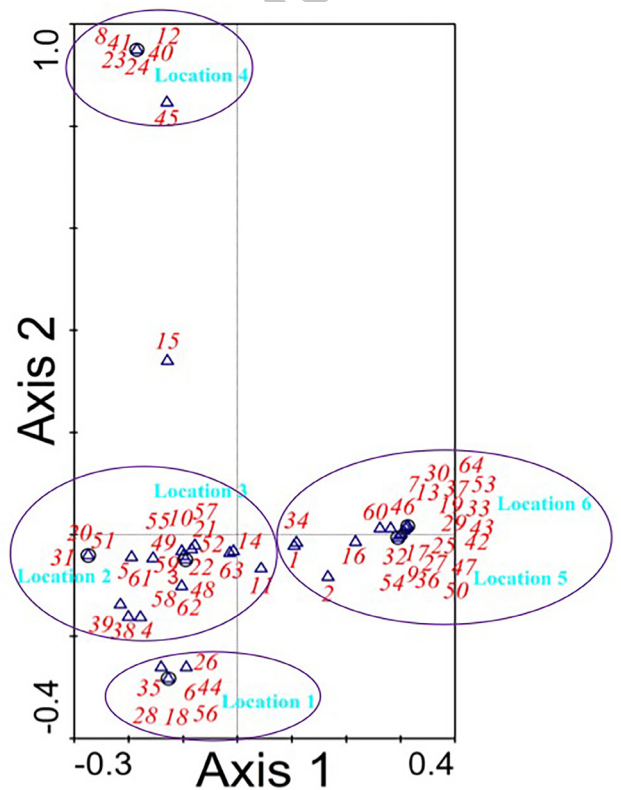


Fig. 5. Variation in bird communities in the six study sites included in this study. Site number (1) represents Abha city: Sama Abha Park, site number (2) represents west of Abha city: Al-Sawda, Al-Suqah, Bahat Rabia, site number (3) represents east of Abha city: AlMurabba, Al-Musqi, Tour Al-Yazeed, site number (4) represents north of Abha: Bilhamer, Balsamr, Al-Namas, Wadi Badduah, site number (5) represents south of Abha city: Wadi Dhal, Wadi Al-Diba, and site number (6) represents Tihama: Rijal Alma, Mahayil. The numbers in red in this figure represent the numbers of birds listed in Table II, first column.

DISCUSSION

Due to the distinct characteristics of the study area, which sets it apart from other regions of the Kingdom of Saudi Arabia in terms of its diverse and moderate climatic conditions, varied vegetation cover, and habitat diversity, it has become a suitable environment for numerous resident, migratory, and breeding bird species. It is imperative to preserve these bird populations as a crucial component of the environment and avoid their extinction or displacement due to irresponsible behavior of individuals. Therefore, this study was designed to update field surveys and monitor birds in the Aseer region, as well as to examine the differences among communities from various study sites.

The relatively low count of 63 different bird species recorded across the six study sites in the current study, compared to the significantly higher numbers documented by Felemban (1986) and Alrumman (2004), can be attributed to the difference in study duration. This study spanned a relatively short period of only 16 days, which limited the opportunity to capture the full spectrum of bird species present throughout the year. In contrast, the previous studies extended over a year or more, encompassing all seasons and documenting a broader range of bird species, including migratory ones during spring and autumn and summer visitors. Additionally, each study's specific geographic locations and habitats can significantly impact species diversity. The variations could also result from changes in environmental conditions, land use, and human activities over time, affecting bird populations and their distributions. Furthermore, differences in observation techniques and data collection methodologies can influence the number of species documented. Hence, the observed variation in species counts can be attributed to ecological, temporal, and methodological factors.

Moderate temperatures (20-30°C), especially during winter, along with flowing water in valleys and diverse vegetation cover, play a significant role in providing diverse habitats and environments. This, in turn, contributes to the biodiversity of other living organisms and the presence of a wide range of different food webs (Tu *et al.*, 2020). This may explain the abundance of bird populations in the sixth site (Tihama: Rijal Alma, Mahayil) compared to the other study sites. It also highlights the similarity between bird communities in the fifth site (south of Abha: Wadi Dhal, Wadi Al-Diba) and the sixth site (Tihama: Rijal Alma, Mahayil), which exhibited considerable resemblance in climatic conditions, thereby impacting other living components of the environment, including bird communities. This suggests temperature influencing the distribution and movements of birds during vertical migration between high and low altitudinal regions. In

our study area, the diverse bird communities observed are significantly influenced by the rich vegetation cover and notable habitat variations. The vegetation cover includes juniper forests, accompanied by a diverse mix of plant species such as wild olive (*Olea chrysoxylla*), dodder (*Dodonea viscosa*), Acacia (*Acacia* sp.), and aloe (*Aloe fleurentinorum*) (Al-Ahidab, 2000). This variety of vegetation plays a pivotal role in enhancing biodiversity. The positive relationship between bird presence and vegetation cover has been underscored by the findings of (Xu *et al.*, 2022). Their research highlights that an increase in bird populations corresponds to heightened vegetation cover, emphasizing the significance of diverse plant species.

Moreover, the study area features distinct habitat variations characterized by mountains, numerous valleys, and wadis. These habitat variations create unique environments, attracting a wide range of bird species. The impact of habitat variation on bird diversity aligns with the research of (Heikkinen *et al.*, 2004; Jones *et al.*, 2003), establishing a strong correlation between habitat diversity and bird species richness. Recent studies also have demonstrated the impact of climate conditions on bird distribution, confirming that global climate changes have affected bird migration and altered their behavior in terms of choosing breeding times and locations (Rushing *et al.*, 2020). Meanwhile, extensive breeding data were analyzed for 201 populations of 104 bird species (totaling 745,962 clutches) across all continents from 1970 to 2019 (Halupka *et al.*, 2023). The objective was to evaluate how annual offspring production by female breeders changed over this period in response to shifts in local temperatures and various life history traits of the species. The overarching trend revealed a decline in offspring production over the study duration. However, it is noteworthy that the responses to increasing temperatures varied considerably among different populations (Halupka *et al.*, 2023). Furthermore, in the first site (Abha city: Sama Abha Park), the third site (east of Abha city: Al-Murabba, Al-Musqi, Tour Al-Yazeed), and the fifth site (south of Abha city: Wadi Dhal, Wadi Al-Diba), bird populations were relatively similar, possibly due to environmental similarities in those locations. However, the fourth site (North of Abha: Bilhamer, Balsamr, Al-Namas, Wadi Badduah) recorded the lowest number of birds, which could be attributed to challenging weather conditions during the observation day (rain and wind), as well as the limited observation area, which encompassed depths of 100-200 meters on the sides of the main road. This difficulty arises from the nature of the densely populated and agricultural region, making it extremely challenging to expand the study area.

CONCLUSIONS

The rapid survey study conducted on wild birds across diverse habitats in the Aseer Region, Saudi Arabia, has provided valuable insights into the avian biodiversity of this region. Our findings underscore the importance of these habitats for supporting a wide range of bird species, highlighting the need for their conservation and management. Additionally, the study has laid the groundwork for further in-depth research to understand better the ecological dynamics, migratory patterns, and conservation status of these avian populations. This knowledge will be instrumental in guiding future conservation efforts and promoting the sustainable coexistence of wildlife and human activities in the Aseer Region.

RECOMMENDATIONS

1. Designate the area as a protected bird sanctuary, considering its overall biodiversity and particularly the diverse bird species found within it. This includes threatened species such as the Arabian Red-legged Partridge, Arabian Wheatear, and Aseer.
2. Magpie (as documented in the national reference on endangered animals in the Kingdom of Saudi Arabia, Part I, 1984).
3. Expand comprehensive survey and monitoring efforts of birds in the study area to assess the status and conditions of bird populations, with a specific focus on resident species. The findings should be disseminated in reference materials that can be consulted as needed.
4. Raise public awareness through various media channels about the importance of the environment in general, as well as the significance of birds and their habitats. Emphasize that the airspace of the Kingdom of Saudi Arabia hosts an immense number, estimated in the millions, of migratory birds annually, which must be protected.
5. Enforce strict penalties for bird hunting within the study area and promote awareness among residents and visitors through relevant authorities responsible for these matters.

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Ethical statement

This study adheres to ethical principles and guidelines for wildlife treatment and scientific research.

Every possible effort was made to minimize disturbance to observed birds and their habitats. Bird identification, photography, and data collection were carried out with utmost care to prevent harm. Additionally, the study aligns with local and international regulations concerning the ethical treatment of animals and the preservation of biodiversity.

Statement of conflict of interest

The authors have declared no conflict of interest.

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