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ORIGINAL ARTICLE

Avifauna within the Main Campus of Imam Mohammad Ibn Saud Islamic University Riyadh, Saudi Arabia

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ABSTRACT

Avian diversity of two zones within the main campus of IMSIU University was studied during the period from July 2019 to June 2020. A total number of 1,653 individual birds was recorded across the main campus which falls under fifteen species belonging to thirteen families. Out of this number, 760 individual of them were recorded in Zone-A versus 893 individual in Zone-B. Species richness in Zone-A was 15 while species richness in Zone-B was 13. Census index of the Birds was recorded as follows: 4.6 Birds/ha and 7.9 Birds/ha in both Zones A and B, respectively. Bird species sighted was higher in Zone-B as compared with Zone-A, as indicated by Shannon-Wiener Diversity Index (H) which accounts for 1.83 in Zone-A and 1.65 in Zone-B. Pigeon (*Columba livia*), House Sparrow (*Passer domesticus*) and Laughing Dove (*Spilopelia senegalensis*) were among the most frequently sighted. From the current study, it is recommended that Zone-B be pedestrianized for the enrichment and protection of the avian species. Also, new policies should be put forward by the relevant authority within the main campus to maintain avian diversity, such as expanding afforestation and green landscapes, in addition to the establishment of artificial lakes and ponds.

INTRODUCTION

According to BirdLife International [1], over 10,000 species of birds are living in the world currently, where they are distributed between continental and island habitats in a ratio of 83% and 17%, respectively.

Avifaunal diversity in Saudi Arabia is very high because the region represents a large part of the Arabian Peninsula which is located in the intersections of three zoogeographic regions: The Afrotropical realm or Ethiopian Zone (encompassing Africa south of the Sahara Desert, the Arabian Peninsula, Madagascar, Southern Iran, Southwestern Pakistan, and the islands of the Western Indian Ocean), Palearctic Realm encompassing all of Europe, Asia (except for Southeast Asia), north of the foothills of the Himalayas, North Africa, and the northern and central parts of the Arabian Peninsula and a small portion of the Oceania realm [2,3].

The majority of the endemic species in the Arabian Peninsula belong to the Afrotropical origin and this is due to its location between the Asian–East African and the Black sea-Mediterranean migration routes. [4].

Very few studies have been conducted on the Avifauna in Saudi Arabia [5-11] and none of them made mention of the bird's diversity in an urban environment.

Avian diversity in urban areas usually reflects the healthiness and straightness of the environment and is associated with the spread of human-made parks as well [12-15]. The Imam University's campus at Riyadh City is considered to be one of the

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largest campuses in the region, where it contains a few green areas distributed poorly across the main campus. As far as we know, there is no specific study on bird diversity on the Main Campus of IMSI University.

The primary goal of this study was to identify and document the bird species and their diversity within the main campus of IMISIU University, as well as compare and contrast their diversity in selected areas within the main campus as well as the factors that could affect birds' diversity in these areas.

MATERIALS AND METHODS

Study area

The survey was conducted within the main campus of The Imam University in Riyadh, Saudi Arabia within Latitude: 24˚ 29' 9.22" N and Longitude: 46˚ 25' 29.07" E, at an elevation of 612 m above the sea level. The campus covers a vast area of 3.608 km2 that is 3608 hectares, less than 10% - ≈ 306 hectares- of this area has green vegetation, which includes a botanical garden, roadside plantations figure 1 that provide excellent habitats for birds, while the rest of it is divided among infrastructure facilities including roads, teaching and administration buildings, students and faculty members' 'accommodations, sport facilities, medical center and other under-construction buildings. The main campus is bounded by two highway roads and another two main streets with substantial traffic figure 1. The main campus contains a variety of species of trees and bushes such as *Phoenix dactylifera*, *Ficus benjamina*, and *Conocarpus erectus*, distributed over a dissimilar area within the campus, in addition to some of the high buildings which together with trees and bushes provide a wide range of habitats for the birds.

Observed sites

Two sites in the Main Campus of IMSI University were selected and set up for observing the study as shown in figure 1.

Zone-A: It covered 1.68 km2 or 168 ha with a length of 5.65 kilometers. This site is located between the Ath Thumamah Road north and Prince Mohammed Ibn Salman Ibn Abdulaziz Road South. While it is bordered on the west by King Abdullah City for female students and the local main road from the east figure 1. This area includes housing for faculty members, a student dormitory, medical center, stadium, and sports facilities, as well as under-construction buildings. The area includes local roads-with light traffic-for vehicles and commuters within the university. The total distribution of the vegetation accounts for approximately 8.9% ha of the total area in this zone.

Zone-B: It covered 1.11 km² or 111 ha with a length of 4.58 kilometers. It is located on the eastern side of Zone-

Figure 1 The map of the main campus of Imam Mohammad Ibn Saud Islamic University. Zone-A and B were set as an observation site within the main campus.

(A) and is separated by the local main road figure 1. This area included the botanical garden, roadside plantations, teaching and administration buildings, and the main mosque. The area also consists of artificial water sources such as small artificial ponds and fountains. This Zone is regularly subjected to heavy traffic during the working days, in addition to several car parks which spread over of this area compared to Zone-A. The total distribution of the vegetation accounts for approximately 6% ha of the total area of this zone.

Data analysis

Several diversity indexes were used in the current study such as Relative abundance (Pi), Shannon-Wiener Diversity Index (H) and Census Index. Shannon-Weiner Diversity Index has been considered to be acceptable for diversity estimation compared to other indexes because it is based on randomness present at a site and considers both species richness and equitability in the distribution of a sample.

The relative abundance, species richness, Shannon-Wiener Diversity Index and Census Index between the two zones were calculated using the following equations:

Relative abundance (P*i*)

$$Pi = Ni / N \quad [1]$$

where, N*i* is the number of individuals of a species, and N is the total population of birds.

Shannon-Wiener Diversity Index (H)

$$H = -\sum Pi \log pi \quad [2]$$

where, P*i* is the proportion of species *i* relative to the total number of species, and in P*i* is the natural Logarithm of this proportion.

Census Index

$$\text{Census index} = N / A \quad [3]$$

where N is the total population of birds, and A is the total zone area.

The land study methods: Google Earth software and satellite images were used in the present project to study and analyze the landscape of the main campus and measuring the vegetation areas, as well as the study sites.

Statistics: statistical analyses were performed using the scientific analysis software package GraphPad Prism version 4 (GraphPad Software Inc., San Diego, CA, USA) and Microsoft Excel sheets, home student 2016 PC.

The study protocol

The present study was conducted over a twelve months period, starting from July 2019 to June 2020. The study areas were visited twice a week. For the first visit, birds were observed from 06:00 to 08:00 in the morning and from 04:00 to 06:00 in the afternoon. For the second visit, the observation started early by dawn and extended until Dusk. The birds were observed by walking along the selected sites, where the birds' species were documented and numbers estimated with the aid of binocular (10x40). The status of each bird was stated as follows: R is resident; PM is passage migrant; RM is a resident migrant; W is Widespread, and r is rare. The birds were photographed with Digital Camera, Canon PowerShot SX50 HS 12.1MP. The species list of birds was arranged in their respective families with mention to the common and scientific name for each species. Field guides about the birds of the Middle East as reported by [16-19] and [8-11] were used to identify the bird species.

RESULTS

The main campus of IMSIU was divided into two observation sites as follows, 1) Residential and facilities area or (Zone-A), which covered approximately (165 ha) of an area of the main campus. 2) Teaching and Administration area or (Zone-B), which covers over an area of 112 ha. Fifteen species of birds as a total were recorded within these two sites (Figure 1 and Table 1).

33% of the total avian diversity in the campus was categorized as a Resident (R) such as Rock pigeon, Laughing Dove, Ring Dove, House sparrow, and white-spectacled bulbul, while 26% of this diversity was categorized as Resident Migrant (R.M) such as (White wagtail), and 33% was categorized as a Passage Migrant (P.M) such as Common swift.

- **Zone-A (Residential and facilities area):** The total number of birds (N) documented in Zone-A was 760. The species richness in this Zone was 15 species (Table 2), while the Census index (density of birds) was 4.6 individuals per ha (Table 4). The diversity of birds in this Zone was recorded as 1.83 (Table 3, Figure 3).

- **Zone-B (Administration and teaching area):** The total number of birds documented in Zone-A was 893. The species richness in this Zone was 13 species (Table 2), while the Census index (density of birds) was 7.9 individuals per ha (Table 4). The diversity of birds in this Zone was recorded as 1.65 (Table 3, Figure 3).

Teaching and Administration buildings in Zone-B, in comparison to Zone-A, provide a unique habitat for birds, especially (Rock pigeon) (Figure 4, picture 5 and 13).

The highest species richness was observed in Zone-A compared to Zone-B, which accounts for 15 versus 13 species, respectively.

Table 1: List of bird species and their families documented in the main campus of IMSIU during the study period.

Family	Common Name	Scientific Name	Status in University	Residential status	Feeding Type	Sampling Area		Total
						Zone-A	Zone-B	
Apodidae	Common swift	*Apus apus*	Seasonal	P.M	Insectivore	31	5	36
Columbidae	Rock pigeon	*Columba livia*	Widespread	R	Granivore	260	385	645
	Laughing Dove	*Spilopelia senegalensis*	Widespread	R	Granivore	154	163	317
	Ring Dove	*Streptopelia decaocto*	Widespread	R	Granivore	30	45	75
Corvidae	The House Crow	*Corvus splendens*	Rare	R	omnivore	2	0	2
strildidae	African silverbills	*Euodice cantans*	Widespread	P.M	Granivore	28	42	70
Hypocoliidae	Grey hypocolius	*Hypocolius ampelinus*	Rare	P.M	Frugivore	4	2	6
Motacillidae	White Wagtail	*Motacilla alba*	Rare	RM	Insectivore	2	0	2
Muscicapidae	black scrub robin	*Cercotrichas podobe*	Seasonal	RM	?	6	8	14
Passeridae	House Sparrow	*Passer domesticus*	Widespread	R	Granivore	166	176	342
Ploceidae	Black-headed weaver	*Village weaver*	Rare	?	Granivore	3	4	7
Psittacidae	Indian Ring neck Parakeet	*Psittacula krameri*	Seasonal	P.M	Granivore	7	5	12
Pycnonotidae	White-eared Bulbul	*Pycnonotus leucotis*	Widespread	R.M	Granivore & Insectivore	50	36	86
Sturnidae	Indian myna	*Acridotheres tristis*	Widespread	R.M	Omnivore	15	19	34
Upupidae	Hoopoe	*Upupa epops*	Seasonal	P.M	Insectivore	2	3	5
						760	893	1653

*R: Resident; RM: Resident Migrant; PM: Passage Migrant.

Table 2: The relative abundance and species richness in Zones A and B.

Zone-A				
Species	**Abundance (Ni)**	**Pi**	**Ln(Pi)**	**Pi xLn(Pi)**
Apus sp	31	0.040	-3.19	0.1305
Columba livia	260	0.342	-1.07	0.367
Passer domesticus	166	0.218	-1.521	0.332
Streptopelia decaocto	30	0.039	-3.23	0.127
Corvus sp	2	0.002	-5.94	0.0156
Euodice sp	28	0.037	-3.30	0.122
Hypocolius sp	4	0.0052	-5.247	0.027
Motacilla sp	2	0.0026	-5.94	0.015
Cercotrichas sp	6	0.0079	-4.841	0.038
Spilopelia senegalensis	154	0.202	-1.59	0.323
Village sp	3	0.004	-5.53	0.022
Psittacula sp	7	0.009	-4.687	0.043
Pycnonotus sp	50	0.0658	-2.72	0.179
Acridotheres sp	15	0.019	-3.92	0.077
Upupa sp	2	0.0026	-5.94	0.015
Total (N)	760			1.83
Zone-B				
Species	**Abundance (Ni)**	**Pi**	**Ln(Pi)**	**Pi xLn(Pi)**
Apus sp	5	0.0056	-5.185	0.029
Columba livia	385	0.463	-0.769	0.356
Passer domesticus	176	0.197	-1.624	0.320
Streptopelia decaocto	45	0.0504	-2.988	0.150

Corvus sp	0			
Euodice sp	42	0.047	-3.057	0.143
Hypocolius sp	2	0.002	-6.101	0.013
Motacilla sp	0			
Cercotrichas sp	8	0.009	-4.715	0.042
Spilopelia senegalensis	163	0.182	-1.701	0.310
Village sp	4	0.004	-5.41	0.024
Psittacula sp	5	0.0056	-5.18	0.029
Pycnonotus sp	36	0.040	-3.21	0.129
Acridotheres sp	19	0.021	-3.85	0.082
Upupa sp	3	0.0034	-5.69	0.02
Total (N)	893			1.65

Table 3: Shannon-wiener diversity index (H) of birds in zones A and B.

Zone	Shannon Diversity Index (H)
A	1.83
B	1.65

Table 4: Census index (density of birds in zones A and B).

Zone	No. of Birds	Area (ha)	Census Index (birds per hectares)
A	760	165	4.6
B	893	112	7.9

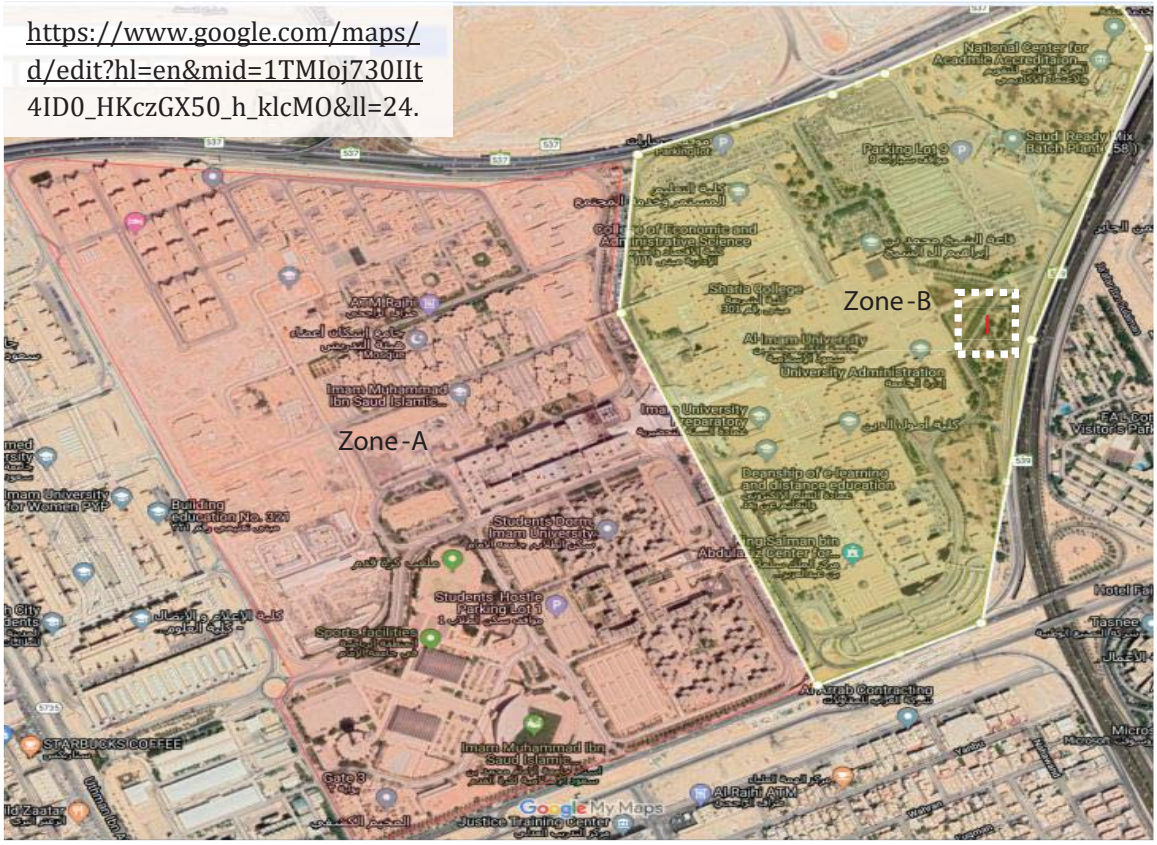

Figure 2 Represented the two study sites.
Zone-A covers an area of 1.68 square kilometers with a length of 5.65 kilometers.
Zone-B where it covers an area of 1.11 square kilometers with a length of 4.60 kilometers ((I) Botanical garden)).

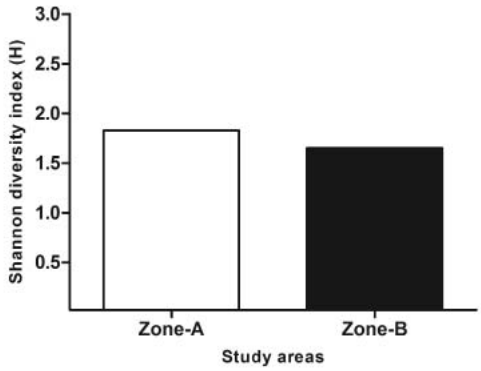

Figure 3 Shows the difference between the Shannon diversity index values, in the observed sites. Open and closed bars show the values of Shannon diversity index in Zone-A and Zone-B, respectively.

Both Rock pigeon and House Sparrow represented their highest existence in both Zones, with a notable increase in the population of Rock pigeon in Zone-B.

The current study shows that the majority of bird species within the main campus were classified as either granivorous or insectivorous birds (Table 1), with slightly high numbers of granivorous birds.

DISCUSSION

The current survey was carried out from March 2019 to December 2019 and provided a database for the bird species within the main campus of Imam Mohammad Ibn Saud Islamic University (IMSIU) in Riyadh city.

Figure 4 Displays the bird species that recorded within the Main Campus of IMSIU: 1) African silverbills; 2) Indian Ring neck Parakeet; 3) Ring Dove; 4) Black Scrub Robin; 5) House Sparrow; 6) Hoopoe; 7) Indian myna; 8) Laughing Dove; 9) White-eared Bulbul; 10) Grey hypocolius; 11) White Wagtail; 12) The House Crow; 13) Rock pigeon; 14) Black-headed weaver; 15) Common swift.

The study shows that the main campus of IMSIU plays host to eighteen species of birds that belong to thirteen families, and this indicates the healthiness and straightness of the ecosystem in a campus.

The fact that the spread of urbanization could lead to a decline of Fauna and Flora diversity [14], remains not entirely true especially in a desert environment such as Riyadh region, where natural water sources are absent. It was observed that animals "birds in particular" are often found around the green area where artificial water sources such as artificial ponds and fountains are located.

In both zones A and B observed, the most frequently found birds were: *Rock pigeon, House Sparrow, little brown* dove, and *white-spectacled bulbul* (Figure 4 Pictures 5,8,9 and 13). The reasons beyond the widespread of these species of birds, in particular, might be due to the availability of adequate food that varies between grain and insects, which are abundant in the study area. This finding is in line with both [13,14] studies.

As indicated from the comparative data between Zone-A and Zone-B, the highest density of birds was recorded in Zone-B in comparison to Zone-A, and this may be due to the existence of the botanical garden in Zone-B which constituted more than 60% of the total area with green vegetation within Zone-B. This result is consistent with the study conducted by [13] who pointed out the existence of a relationship between bird richness and the density of vegetation. Moreover, it was noted that Rock Pigeon was more abundant in this Zone, which might be due to the presence of high buildings with unique designs (Figure 4, pictures 5 and 13). These buildings provide a quiet and secure place for these species to build their nest. This observation is supported by several studies, which have shown the role of building design in the attraction of birds in urban settings [13,20,21]. Another factor that might play a role in the abundance of birds, is due to the fact that students and employees usually occupied the buildings in Zone-B during working days only, and is more secure and quieter after workings hours and on work-free day compared to the buildings in the Zone-A that are occupied by residents all day long.

Feeding and food availability in a specific habitat could play a significant role in the distribution and diversity of birds into the environment [13-15]. The current study shows that the majority of bird species within the main campus were classified as either granivorous or insectivorous birds (Table 1), with slightly high numbers of granivorous birds. This is due to the widespread availability of grains and insects in this region, which provided an essential source of food.

CONCLUSION

The current study recommends that Zone-B should be transformed entirely into pedestrianized Zone for enrichment and protection of the avian species. Also, policies should be stipulated within the campus to maintain avian diversity by expanding the afforestation and Green landscapes in addition to water bodies.

References

1. BirdLife International. A range of threats drives declines in bird populations. 2017. https://tinyurl.com/yckm5cm6
2. Procheş S, Ramdhani S. The World's zoogeographical regions confirmed by cross-taxon analyses. BioScience. 2012;62(3):260-270. doi: 10.1525/bio.2012.62.3.7
3. Linder HP, de Klerk HM, Born J, Burgess ND, Fjeldså J, Rahbek C. The partitioning of Africa: Statistically defined biogeographical regions in sub-Saharan Africa. Journal of Biogeography. 2012;39(7):1189-1205. doi: 10.1111/j.1365-2699.2012.02728.x
4. King B. Atlas of the breeding birds of Arabia. The Auk. 2012;129(1):181-182. doi: 10.1525/auk.2012.129.1.181
5. Alatawi AS, Bled F, Belant JL. An inventory of avian species in Aldesa Valley, Saudi Arabia. Check List. 2018;14(5):743-750. doi: 10.15560/14.5.743.
6. Ajarem JS, Al-Sadoon MK, Paray BA, Al-Mfarij AR. A provisional checklist of the avifauna of Turaif province, the Kingdom of Saudi Arabia. Saudi J Biol Sci. 2020 Jan;27(1):74-76. doi: 10.1016/j.sjbs.2019.05.003
7. Almansour MI, Jarrar BM. Occurrence and seasonal variation of the Avifauna at Domate Al- Jandal Lake, Al-Jouf Province of Saudi Arabia. Pakistan Journal of Zoology. 2013;45(1);85-91. https://tinyurl.com/4mbbz53e
8. Jennings MC. Breeding birds in central Arabia. Sandgrouse 1. 1980;71-81.
9. Jennings MC. The birds of Saudi Arabia: A check-list. Cambridge: 1981. p.112. https://tinyurl.com/yethuzyd
10. Jennings MC. An Interim Atlas of the breeding birds of Arabia. Riyadh, National Commission for Wildlife Conservation and Development. 1995. p.134.
11. Jennings MC. Atlas of the Breeding Birds of Arabia. Volume 25. London: Fauna of Arabia, NHBS LTD, Ciba-Geigy; 2010. p.751. https://tinyurl.com/2p89whad
12. Abbas SJ, Hussain S, Gabol K, Tabassum R, Abbas H, Khan MZ, Khan BN, Khan MU. Study of Avifauna in Safari Park and University of Karachi, Pakistan. International Journal of Pure and Applied Zoology. 2013;1(3):241-248. https://tinyurl.com/yc46duas
13. Serrano J, Guerrero J, Quimpo J, Andes G, Bañares E, General M. Avifauna Survey within a University Campus and Adjacent Forest Fragment in Bicol, Eastern Philippines. Applied Environmental Research. 2019;41(2):84-95. doi: 10.35762/AER.2019.41.2.8
14. Safdar S, Ali Z, Chaudhry MN. Avian Diversity at New Campus of Punjab University in relation to land use change. Pakistan Journal of Zoology. 2013;45(4):1069-1082. https://tinyurl.com/mt23cyar
15. Singh R, Jaiswal A, Singh J, Singh N, Bhaskar SK, Kumar N, Singh SK, Singh DK. Study of Bird Diversity in Gorakhpur University Campus. Journal of Biodiversity & Endangered Species. 2018 July;(2):2332-2543. doi: 10.4172/2332-2543.S2-002
16. Silsby J. Inland birds of Saudi Arabia. London: IMMEL Publishing. 1980.
17. MAHDI S. Water birds in Iraq and Arab world. Baghdad, Iraq: Al- Rasheid Publishing. 1983.
18. Bundy G, Connor RJ, Harrison CJO. Birds of the Eastern Province of Saudi Arabia. 1st Edition. Great Britain, London: HF & G Witherby LTD in association with Saudi Aramco. Dhaharan. 1989.
19. Fathel A. Birds Encyclopaedia. Osama Publishing, Amman, Jordan. 2002.
20. Marzluff JM, Bowman R, Donnelly R, editors. Avian ecology and conservation in an urbanizing world. Springer Science & Business Media. 2012 Dec 6.
21. Gehring J, Kerlinger P, Manville AM. Communication towers, lights, and birds: Successful methods of reducing the frequency of avian collisions. Ecological Applications. 2009;19(2):505-514. https://tinyurl.com/2jhkskmk

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