

Distribution Patterns, Abundance, and Nesting Site Preferences of Parakeet Species in Margalla Hills National Park, Pakistan

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SUMMARY

This study thoroughly highlights the distribution, abundance, and habitat preferences of four parakeet species in Margalla Hills National Park (MHNP). Eighty-eight walking transects were carried out between October 2023 and June 2024. A total of 140 individuals were recorded, including the rose-ringed parakeet (*Psittacula krameri*), slaty-headed parakeet (*Psittacula himalayana*), plum-headed parakeet (*Psittacula cyanocephala*), and Alexandrine parakeet (*Psittacula eupatria*). The most prevalent species was the rose-ringed parakeet (79 individuals; mean 5.27 ± 0.92), which primarily occurred in open woodlands characterized by trees such as paper mulberry, peepal, kachnar, phulai, and Chinese tallow at lower elevations (450 m). The Slaty-headed Parakeet (56 individuals; mean 11.20 ± 4.08) was confined to pine and mixed forests of chinaberry and banyan at higher elevations (1,604 m). The Plum-headed Parakeet (4 individuals; mean 1.33 ± 0.33) was found in intermediate zones, while the Alexandrine Parakeet (1 individual; mean 1 ± 0), despite being previously abundant and widespread, was located in mid-to-upper elevations.

Keywords: Psittacines, Distribution, Abundance, Adaptation, Conservation

Citation: Anees, L., M. S. Nadeem, S. Ali, F. Irshad, and A. Hadi. 2026. Distribution Patterns, Abundance, and Nesting Site Preferences of Parakeet Species in Margalla Hills National Park, Pakistan. Journal of Wildlife and Ecology. 10: 65-73.

Received: 24 October, 2025

Revised: 21 December, 2025

Accepted: 11 March, 2026

Published: 30 June, 2026

INTRODUCTION

Four species of parakeets, i.e., Rose-ringed Parakeet (*Psittacula krameri*), Slaty-headed Parakeet (*Psittacula himalayana*), Plum-headed Parakeet (*Psittacula cyanocephala*), and Alexandrine Parakeet (*Psittacula eupatria*), are present in Pakistan (Roberts, 1991). Psittacines, or parakeets, belong to the order Psittaciformes. Members of this group are distinguished by their strongly curved beaks and zygodactylous feet. Most psittacines are secondary cavity nesters (Forshaw, 1989). The Rose-ringed Parakeet, locally known as "Toota," is a highly social species characterized by vibrant green plumage. Adult males are readily identifiable by a distinctive reddish-black neck ring and bright red beak. Its native range spans sub-Saharan Africa to Indo-China, with established populations in Pakistan and India (Ali and Ripley, 1987). The species, valued in aviculture for its vocal mimicry, lives in a variety of habitats, including deciduous woodlands and arid scrublands, as well as urban and densely populated areas (Juniper and Parr, 1998; Khan, 2002).

The Slaty-headed Parakeet is slightly larger than the Rose-ringed Parakeet.

Males display bright grass-green plumage with a yellowish breast and a distinctive maroon wing patch and exhibit sexual dimorphism, with males having a maroon wing patch (Perry, 2000). This species breeds in spring, laying 3–4 eggs between April and June, and is closely associated with humid Himalayan forests (Dey et al., 2021). In Pakistan, it occurs during winter in the Kaghan Valley, lower Swat, Murree, and Margalla Hills, remaining in foothills and lower valleys rather than descending to the plains (Roberts, 1991).

The Alexandrine parakeet is widely distributed across Asia, from Afghanistan through Pakistan to Indo-China, and northward to Nepal and Bhutan (Juniper and Parr, 1998). It is the largest Indian parakeet, distinguished by a maroon shoulder patch; males possess a broader rose-pink nape band, a thicker black facial stripe, and larger heads (Perry, 2000). In Pakistan, its range is restricted to well-forested areas of Punjab and the subtropical pine zone of the Murree foothills (Roberts, 1991). The species eats fruits, vegetables and seeds (Ali and Ripley, 1983). This parakeet breeds in tree cavities from February to March (Juniper and Parr, 1998).

The Plum-headed Parakeet is the smallest of the long-tailed parakeets and is endemic to the Indian subcontinent (Jathar et al., 2006; Thompson, 1998). Males have a deep plum-colored head, while females have a grayish-blue hue. It lives in forests, open woodlands, and cultivated regions, usually in small flocks, consuming fruits and nectar-bearing flowers. In Pakistan, it is limited to the lower Murree foothills and Margalla Hills (Roberts, 1991). Despite the park's ecological importance and high avian variety, no published research has investigated the distribution and abundance of parakeet species in this area. This study seeks to provide baseline data to aid in the conservation and management of parakeets in MHNP.

MATERIALS AND METHODS

STUDY AREA

The study was carried out in the Margalla Hills National Park (MHNP), which is located north of Islamabad and covers an area of 17,386 hectares (Figure 1). The park, located between 33°39'0"–33°49'30"N and 72°51'0"–73°13'0"E, features harsh terrain, steep slopes, and elevations ranging from 685 m in the west to 1,604 m in the east (Shinwari and Khan, 2001). It consists of four ranges—Saidpur, Nurpur, Golra, and Bara Kahu—and hosts 616 plant species, primarily subtropical deciduous scrub forest, with a chir pine zone in the north. MHNP has a varied fauna, with 117 bird species from 48 groups and 30 animal species (Aslam and Yasmeen, 2021).

WALKING TRANSECT METHOD

The walking transect method (Burnham et al., 1981) was employed to survey parakeet species in Margalla Hills National Park (MHNP). This system provided a uniform strategy for recording species presence, abundance, and behaviour across a wide range of ecological niches, making it especially suitable for parakeets, which are extremely mobile, vociferous, and canopy-dwelling.

METHODOLOGY

The study spanned nine months, from October 2024 to June 2025, and included eighty-eight walking transects ranging from 500 m to 2 km. The surveys

encompassed forty sites across four ranges of the Margalla Hills National Park (MHNP), with systematic transects designed to ensure repeatable and consistent observations. During peak parakeet activity, we conducted fortnightly surveys in the mornings (07:00–12:00) and evenings (15:00–18:30), when parakeets are most active for feeding and roosting. All individuals observed or heard along each transect were recorded, along with their GPS positions, behavioural remarks, and associated tree species. Bushnell 10×42 binoculars were used for long-distance visual detection, while Garmin portable GPS units were used for precise mapping. Photographic records were captured with a Nikon D500 DSLR and a Tamron 150–600 mm G2 lens, providing a realistic depiction of plumage for identification. Species were identified using Grimmett et al. (2008) and Mirza (2007) field guides. Observations of parakeet nests in survey regions were also regularly recorded.

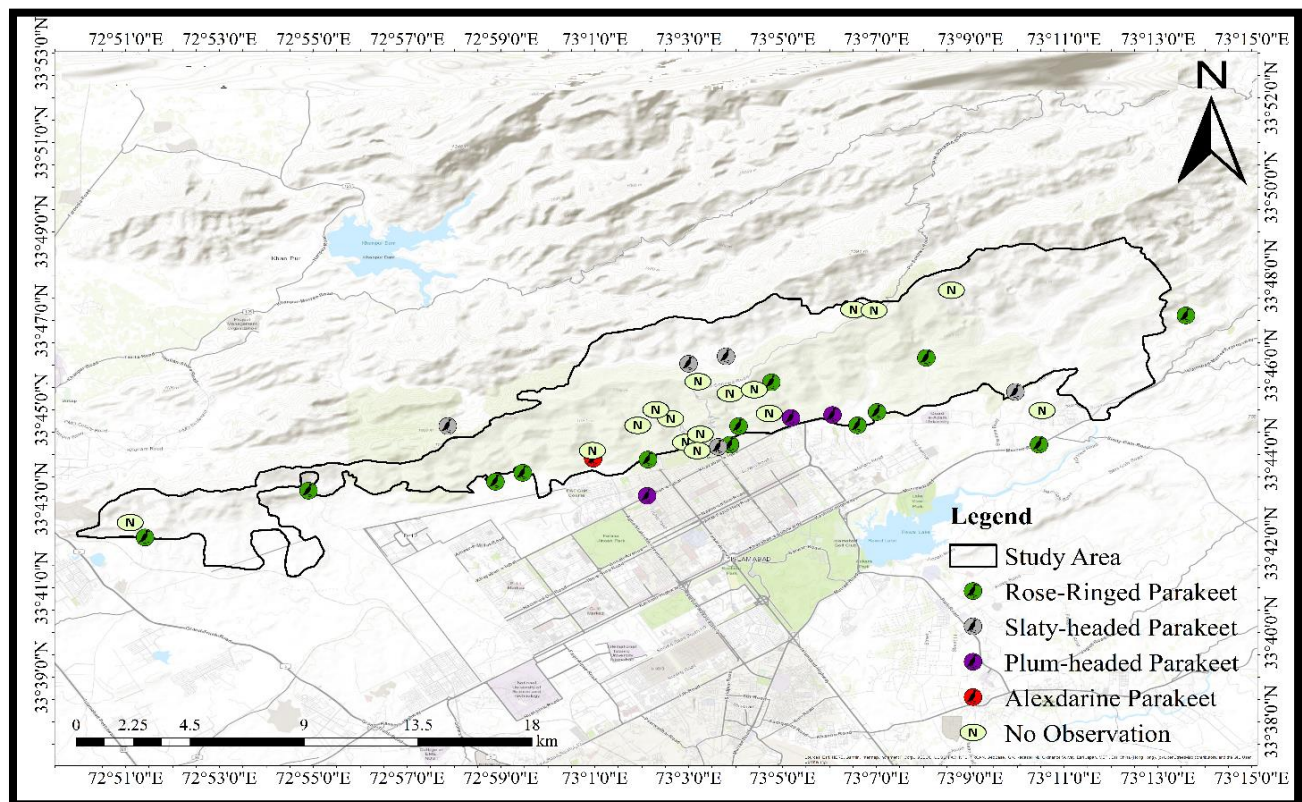


Figure 1: Distribution map of four Parakeet species within MHNP (2024-2025).

DATA ANALYSIS

Data were compiled in MS Excel, and site-specific and overall abundance were calculated for each species. The mean values and standard errors were calculated using MegaStat® 10.1 (Orris, 2002). Statistical analyses were carried out in SPSS v25.0 (IBM Corp., 2017), and species dominance was determined using Simpson's Dominance Index.

$$D = \sum (n_i / N)^2$$

D= Dominance index

n_i= Number of specific species

N= Total number of individuals

RESULTS AND DISCUSSIONS

A total of 140 parakeet individuals representing four species: *Psittacula krameri* (Rose-ringed Parakeet), *Psittacula himalayana* (Slaty-headed Parakeet), *Psittacula cyanocephala* (Plum-headed Parakeet), and *Psittacula eupatria* (Alexandrine Parakeet) were recorded. Parakeets were sighted from 23 sub-sites out of 40 sub-sites, while a total of 17 sub-sites were noted where no parakeets were observed. The Rose-ringed Parakeet was found in all four sites of MHNP, while the Slaty-headed Parakeet was not found in the Nurpur Range, the Alexandrine Parakeet was only found in the Golra Range (n=1), and the Plum-headed Parakeet was only found in the Nurpur (N=1) and Saidpur ranges (n=3) (Figure 2).

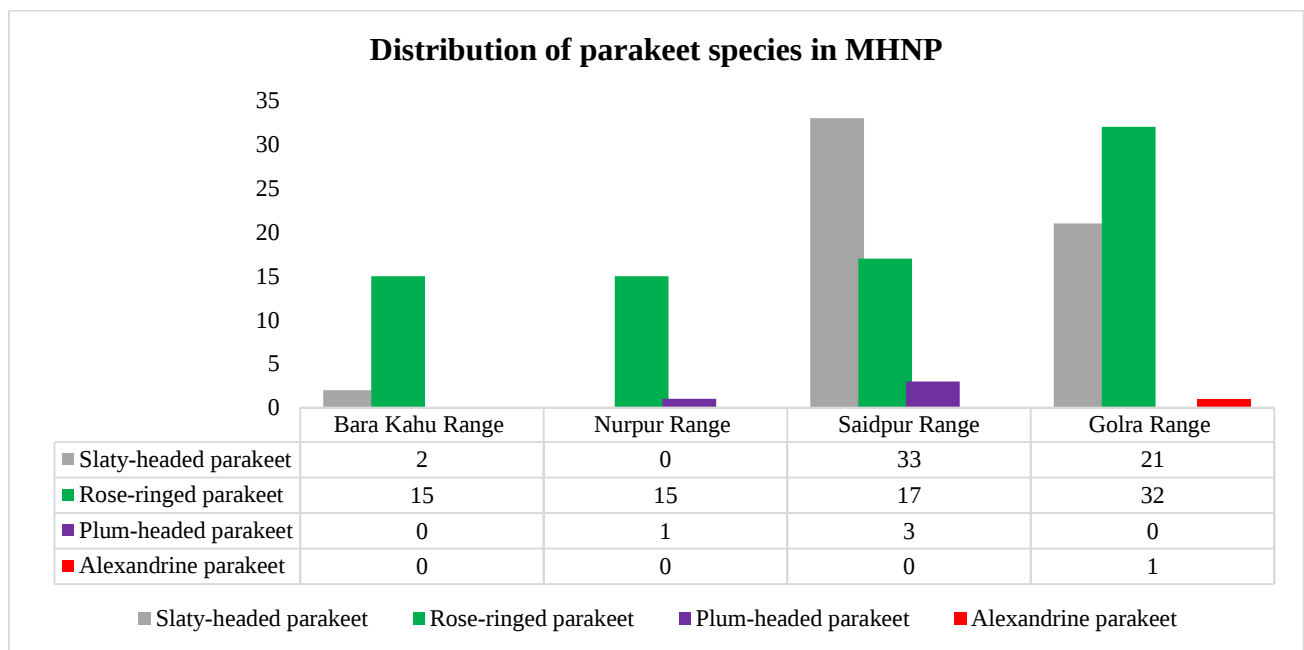


Figure 2: Distribution of parakeet species in Margallah Hills National Park (MHNP) across four defined ranges; Bara Kahu, Nurpur, Saidpur and Golra.

DISTRIBUTION OF PARAKEET SPECIES IN MHNP

Surveys conducted inside Margallah Hills National Park (MHNP) indicated unique spatial distributions and abundances of four parakeet species (Figure 1), which are influenced by ecological factors and habitat preferences. The Rose-ringed Parakeet was the most common, with 79 individuals (mean 5.27 ± 0.92) recorded across all four ranges. They mainly live at lower elevations (~450 m) in open woodlands dominated by Paper Mulberry, Peepal, Kachnar, Phulai, and Chinese Tallow, which provide abundant food and nesting sites. The Slaty-headed Parakeet, with 56 individuals (mean 11.20 ± 4.08), was found at higher elevations (1,604 m) in pine and mixed forests with Chinaberry and Banyan trees. The Plum-headed Parakeet, represented by 4 individuals (mean 1.33 ± 0.33), lived in intermediate zones with mixed scrub and deciduous forests rich in shrubs and fruiting trees. The Alexandrine Parakeet, the rarest species with a single recorded individual (mean 1 ± 0), occupied

mid-to-upper elevations (Table 1).

Species distributions were unbiased, with Rose-ringed Parakeets commonly seen in small flocks of 2–4 and Slaty-headed Parakeets in groups of 2–10, indicating that MHNP's altitudinal variation and vegetation diversity promote distinct ecological niches. ArcGIS software was used to systematically map (Figure 1) and assess the geographical distribution patterns of parakeet species in Margalla Hills National Park (MHNP).

Table 1: The mean distribution values and standard errors ($\pm$ SE) of four parakeet species were observed in Margallah Hills National Park, Pakistan (N = 40).

Species	Mean $\pm$ Standard Error (SE)
Rose-ringed parakeet (<i>Psittacula krameri</i>)	5.27 $\pm$ 0.92
Slaty-headed parakeet (<i>Psittacula himalayana</i>)	11.20 $\pm$ 4.08
Plum-headed parakeet (<i>Psittacula cyanocephala</i>)	1.33 $\pm$ 0.333
Alexandrine parakeet (<i>Psittacula eupatria</i>)	1 $\pm$ 0

ABUNDANCE OF PARAKEET SPECIES IN MHNP

The rose-ringed parakeet had the greatest representation, demonstrating that it is more widespread, appearing in all transects. However, the Alexandrine parakeet had the lowest percentage (n=1), reflecting that this species was the least abundant, as illustrated in Figure 3.

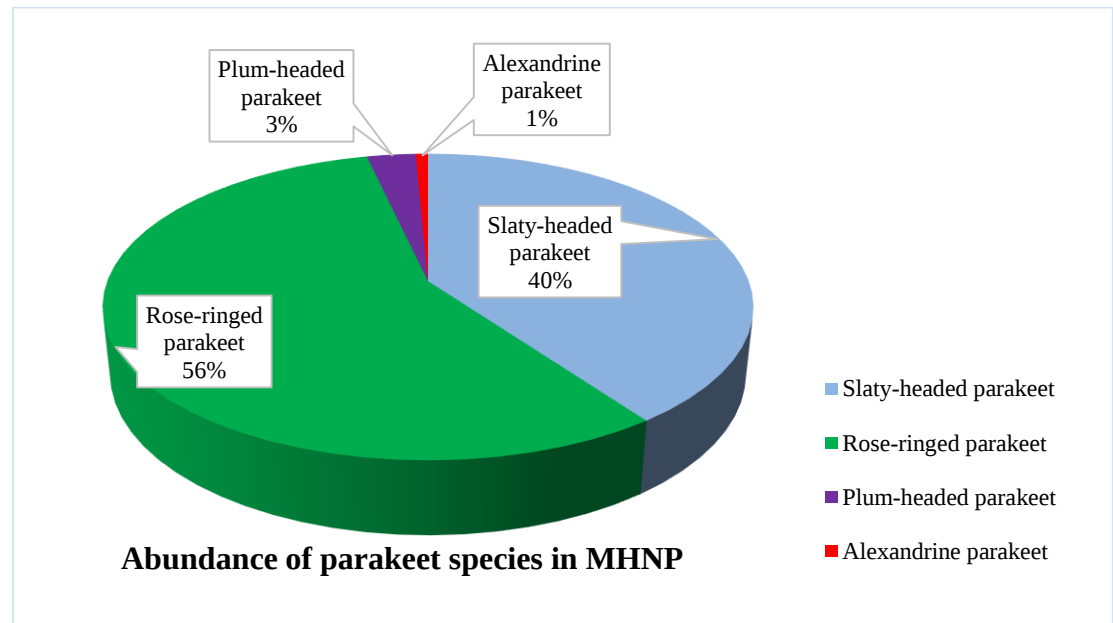


Figure 3: The graph depicts percentage abundance of parakeet species in MHNP.

SIMPSON'S DOMINANCE INDEX ANALYSIS

To quantify species dominance and relative abundance, Simpson's Dominance Index (D) was constructed using the formula:

$$D = \sum (n_i / N)^2$$

Table 2: Calculation of Simpson's dominance index (SDI).

Species	Number of Individuals (n _i)	n _i /N	(n _i /N) ²
Rose-ringed parakeet	79	79/140 = 0.56	0.3136
Slaty-headed parakeet	56	56/140 = 0.4	0.16
Plum-headed parakeet	4	4/140 = 0.028	0.00078
Alexandrine parakeet	1	1/140 = 0.0071	0.0000050

N (Total Number of individuals) = 140

$$D = \sum (n_i / N)^2 = 0.3136 + 0.16 + 0.00078 + 0.0000050 = 0.4743$$

The Simpson's Dominance Index for the parakeet population in MHNP was computed as $D = 0.4743$, indicating a moderate level of species dominance. This data represents an unequal distribution of individuals, with the Rose-ringed Parakeet accounting for roughly 56% of the overall population. This trend implies that, while the parakeet population is viable and energetic, it is exhibiting indicators of ecological disarray (Table 2).

NESTS OF PARAKEET SPECIES OBSERVED IN MHNP

During the study period, seven parakeet species' nests were found in MHNP, as indicated in Table 3. Four of these showed evidence of current occupancy and activity, such as parakeets roosting, vocalizing, and entering or leaving the hole. During the study period, a female Plum-headed Parakeet was discovered roosting alone in a nest cavity in a Paper Mulberry tree at Margallah Road, and a Rose-ringed Parakeet (Figure 4) was also seen using a Paper Mulberry nest cavity in Muhallah Kurwal. The remaining three nests were categorised as inactive because they exhibited no activity during several dawn and dusk observations, lacked vocalisations, had no visitors, and showed no signs of recent use.

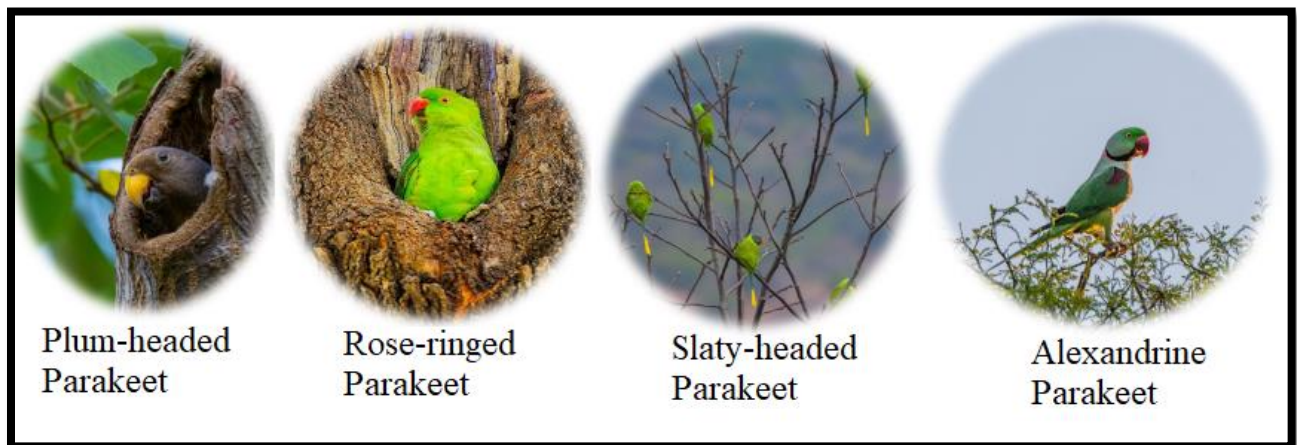


Figure 4: Species of parakeets in MHNP.

The mature trees located in deciduous shrub forests and pine-dominated zones were found to be the primary sites of nesting activity among parakeet species in MHNP, according to field observations. The most popular trees for nesting were Phulai (*Acacia modesta*), Mango tree (*Mangifera indica*), Peepal (*Ficus religiosa*),

and Paper Mulberry (*Broussonetia papyrifera*). The average nesting height was between 6.5 and 9 meters above ground, and nest cavities were usually found at moderate to high elevations within the canopy. The findings highlight the crucial ecological role of mature, cavity-bearing trees in sustaining breeding populations within Margallah Hills National Park by showing that nesting site selection among parakeet species is strongly influenced by the availability of particular tree species and canopy height (Table 3).

Table 3: Nests of parakeet species observed in MHNP.

Nest Location	Nest Status	Nest-Occupying Species	Associated Tree	Nest height
Muhallah Karwal	Active	Rose-ringed Parakeet	Paper Mulberry <i>Broussonetia papyrifera</i>	8m
Saidpur	Dormant	Not occupied	Paper Mulberry <i>Broussonetia papyrifera</i>	7m
Margallah Road	Active	Plum-headed Parakeet	Paper Mulberry <i>Broussonetia papyrifera</i>	6.5m
E-7 Islamabad	Dormant	Not occupied	Paper Mulberry <i>Broussonetia papyrifera</i>	9m
Rumli	Active	Rose-ringed Parakeet	Peepal <i>Ficus religiosa</i>	8m
Nurpur Shahan	Dormant	Not occupied	Mango tree <i>Mangifera indica</i>	7m
Kalinjer	Active	Rose-ringed Parakeet	Phulai <i>Acacia modesta</i>	8.5m

DISCUSSIONS

Parrots face a conservation paradox: certain exotic urban populations are growing worldwide, raising concerns about their ecological relevance, while many wild populations are diminishing due to habitat degradation and the pet trade (Gibson and Yong, 2017). The biggest concern is still habitat destruction from logging and agriculture, particularly in tropical areas with high endemism (Olah et al., 2016). Their unique nesting requirements make them more susceptible to the loss of trees, and forest fires further devastate food sources and nesting locations, interfering with reproduction and uprooting populations (Khan et al., 2004). Due to unsustainable trapping driven by the pet trade's demand for their colorful feathers and vocal mimicry, many species are in danger of declining or going extinct locally (Pires, 2012; Forshaw, 2017). For them to survive in the long run, habitat conversion and commercial exploitation must be addressed (Collar and Juniper, 1992).

The National Council for Conservation of Wildlife (NCCW) imposed a national export prohibition in 2008 due to the significant reductions in Pakistan's parakeet numbers caused by extensive trading. However, effective conservation planning is still hampered by the lack of baseline population data (Dawn, 2010). The Rose-ringed Parakeet is categorized as Least Concern (LC) by BirdLife International because of its wide habitat adaptation and steady population trends (2024a). However, due to persistent reductions associated with habitat degradation and pet

trade trapping, the Alexandrine Parakeet is classified as Near Threatened (NT) (2017). Due to their extensive range and stable numbers, the Plum-headed and Slaty-headed parakeets also have LC status, although they are still vulnerable to regional threats (BirdLife International, 2024b; 2024c).

CONCLUSION

The current study discovered that the distribution of parakeets in MHNP is unequal, with higher abundances in low-disturbance, heavily forested areas. The scarcity of Alexandrine and Plum-headed parakeets raises questions about their continued existence in the face of challenges to parakeets in MHNP, including poaching, forest fires, tourism, habitat degradation due to deforestation for urban growth, and fuelwood drastically diminishing ancient nesting trees. The Islamabad Nature Conservation and Wildlife Management Act, 2024, which forbids their shooting, capture, and trade while guaranteeing habitat conservation, protects all four parakeet species present in Margalla Hills National Park (MHNP).

LIMITATIONS OF THE STUDY

The study's main limitations were budget and resource limits, which limited the frequency of data collection, the use of sophisticated monitoring tools, and coverage of the park's whole geographic span.

FUTURE PROSPECTS

This study emphasizes how urgently community-based monitoring and stricter enforcement of wildlife laws are needed to safeguard parakeets in MHNP, especially the Alexandrine Parakeet. Campaigns to raise public awareness and educate people about their ecological significance might encourage community involvement in protecting nesting places, reporting poaching, and preserving habitat.

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Competing interests: Authors have declared that no competing interests exist.
Funding: Authors have no source of funding for this work.
Authors' contributions: Data were collected and a manuscript was written by Anees and Irshad; statistically analyzed by Anees; supervised by Nadeem; and critically reviewed and approved as final by Hadi.

