

Sun-orientation behaviour and perching spacing in Common Myna (*Acridotheres tristis*) during morning and evening

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Abstract

It has been observed that the sun is used as a compass by migrating birds. During the day, birds rest after their exploratory behavioral display. We observed that Common mynas rest about 2-3 hours after sunrise and again 2-3 hours before sunset, often perched on electric wires. This prompted us to study (i) If the number of birds sitting facing or opposed to the sun varied in the morning and evening times, (ii) if the sitting space between the birds varies, and (iii) if it has some relation to the temperature and day length. We conducted our study on a river bridge with a clear view of sunrise and sunset, from early November to December. The birds, while sitting on the wires, were counted, and the space between them was measured. We found that the number of birds sitting in the morning and facing the sun was higher than that of evening birds. Also, the space between birds was higher in the birds during the evening than in the morning. The distance between birds did not correlate with the space available, but the temperature seems to have some effect. This study suggests that birds show a higher tendency to orient toward the sun during morning hours compared to evening, possibly related to thermoregulation or behavioural rhythms.

Keywords: Orientation behavior, Common myna (*Acridotheres tristis*), sun compass, sunrise and sunset activity, resting behavior

Introduction

The Sun compass serves as a natural navigational tool for birds. It helps determine the direction by tracking the Sun's movement across the sky. This ability is regulated by their internal circadian clock, which compensates for the Sun's changing position throughout the day (Able, 1982; Daan & Aschoff, 1975) [1, 6]. Birds use this mechanism during their daily activities, such as foraging and returning to their resting spots, and seasonal activities, such as migration.

Research indicates that birds can adjust their Sun compass using magnetic field information, especially during sunrise and sunset when both cues are present. (Muheim *et al.*, 2006) [9] Bird activity often peaks during morning and evening hours, forming a bimodal activity pattern. (Aschoff, 1966; Morton, 1967; Bednekoff & Houston, 1994; McNamara *et al.*, 1994) [2, 3, 4, 7, 8]

This observation motivated us to study the bird's orientation during their resting period toward the sun and the space allocation on the perches. The question was to find out how many birds face the sun during their resting phase and how much space is between two birds while sitting on the perches.

Material and methods

We employed Common myna (*Acridotheres tristis*), a common urban bird species in India.

Data Collection and Statistics

Observations were conducted over 22 days between 4 November and 16 December 2022. Each day, we conducted observations in the morning and evening to capture a comprehensive view of the birds' behaviors across different times of day. We positioned ourselves on the Hanuman Setu

Bridge (shown in Figure 1), offering an ideal vantage point to observe birds perched on nearby wires.



Fig 1: Aerial image of Hanuman Setu Bridge, India. Dotted line indicates region of our work

We used a Canon 200D DSLR camera with a 55-250 mm telephoto lens to record these observations. This setup enabled us to capture high-resolution images of the birds at a considerable distance without disturbing their natural behavior. With clear visibility, we could monitor and capture photographs of the birds' activities at different times (morning and evening). Representative images of birds perched on wires during morning and evening observations are shown in Figure 2.



Fig 2: Optical images showing birds perched on electrical wires captured during two distinct times of the day: (a) Morning, where the birds are more visible due to better lighting conditions, and (b) Evening, where the birds appear as dark shapes or shadows because of less light in the background. These images highlight differences in lighting, contrast, and visibility between morning and evening observations

During this study, we measured two main parameters:

Orientation of Birds Relative to the Sun: During each observation period, we recorded each bird’s orientation, noting whether it was facing toward or away from the sun. Through this method, we obtained quantitative data on the birds’ alignment relative to the sun, helping us investigate if there was a consistent pattern across different times of day. Observing whether birds were more likely to face or turn away from the sun provided insight into possible behavioral motivations, such as using the sun as a navigational reference or engaging in pre-roosting rituals.

Spacing between Adjacent Birds: In this parameter, we measure the physical distance between each pair of adjacent birds along the wire. Using the photographs taken with the help of a camera telephoto lens, we analyzed the spacing by overlaying a plain scale in the images. Using this method, we calculated the average and range of distances between

individuals, helping us understand their social spacing and the possible existence of “personal space” in a communal environment.

For data analysis, we applied statistical methods to assess differences in Common myna behavior between morning and evening observations. The primary statistical test used was an unpaired t-test to compare morning and evening observations, which was chosen to determine if there was a statistically significant difference between the bird counts and behavioral metrics observed at the two different times of the day.

The bird count, an essential variable in this study, was determined manually by carefully examining each image captured throughout our observational periods. A detailed dataset for each duration of the day was collected in the bird’s field data sheet, format shown in Figure 3.

Birds Field Data Sheet										
Name-										Date of Visit-
Start time-										Finish time-
Temperature at start-										Temperature at finish-
Site Location-										
Species Name-										
Observation type -										
Behaviour-	Resting	Flying	Soaring	Perching	Foraging	Other	Face Direction (towards/opposite of Sun)	Direction from point-	Distance from point-	Flight direction-

Fig 3: Birds field data sheet for recording observations, including observer details, site location, species, behaviour (e.g., resting, flying), face direction, distance, and flight direction for systematic data collection.

Results

The data indicates a difference between morning and evening observations. Through careful observation and detailed counting, we recorded a higher abundance of Common myna during the morning hours, compared to the evening as represented in Figure 4. Further observations during our study revealed an interesting behavioral pattern among the Common myna: they tend to position themselves facing the sun, regardless of whether it is morning or

evening. However, an interesting pattern emerged when analyzing the ratio of birds facing the sun to those facing away from the sun. Specifically, a higher proportion of birds were observed facing the sun during the morning hours, while later in the day, the ratio shifted. In the evening, a greater number of birds were observed facing away from the sun.

Figures 5 and Figure 6 provide a detailed daily breakdown of this behavior, illustrating the total number of birds facing

toward the sun versus those facing opposite it. Figure 6 (a) shows this distribution during the morning, where a marked preference for sun-facing behavior is evident. Figure 6 (b), on the other hand, offers a similar analysis for the evening, where the trend reverses, and the birds predominantly face away from the sun. This shift may be associated with behavioural changes as birds prepare for evening resting. The data presented in Figures 5 and 6 offers valuable insight into how Common myna respond to changes in light and temperature, demonstrating the subtle yet significant ways in which they adjust their behavior over the day. Figure 7 presents the average distance between two individual birds observed during the morning and evening. The x-axis represents the distance between birds, while the y-axis

distinguishes between morning and evening time points. The data is represented by the downward dots for morning observations and the upward dots for evening observations. The graph illustrates that in the morning, birds remain close, with data points concentrated around a smaller distance (approximately 1.0 cm) body length equivalent (estimated from image scaling). As the day progresses into the evening, birds increase their spacing, evident from the upward dots scattered over a broader range (approximately 2.0 cm). In the morning, birds may cluster for warmth or group activity; in the evening, they might spread out as they prepare to settle for the night. The graph provides insight into how Common myna adjust their spacing throughout the day, indicating a clear pattern of closer grouping in the morning and greater dispersion in the evening Shown in Figure 7.

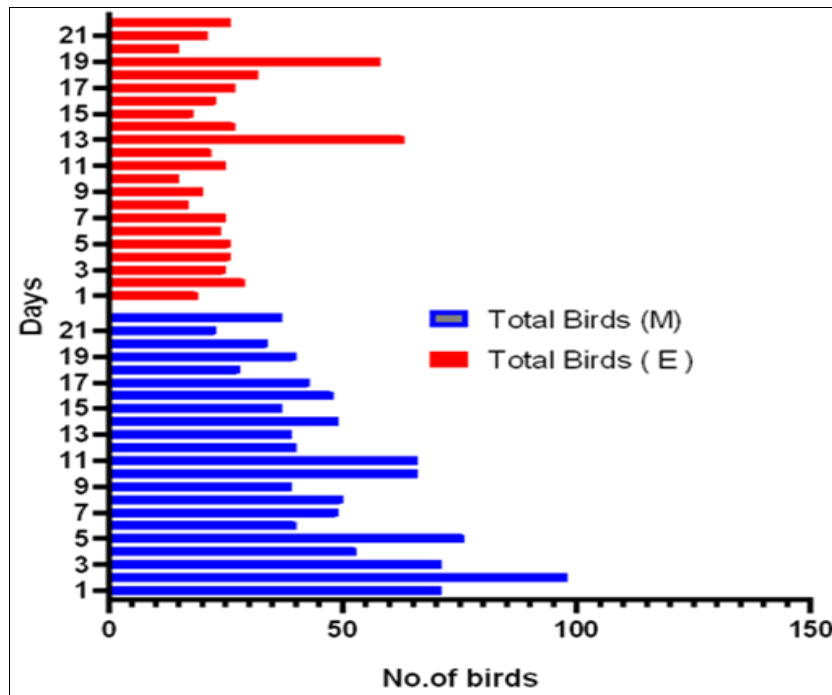


Fig 4: Bar graph showing the number of Common mynas observed during morning (down bar) and evening (top bars) observations. The x-axis represents the number of birds species, while the y-axis indicates the number of Days. Morning observations dominate in certain species, as shown by longer blue bars, while evening observations are more prevalent for others, indicated by longer red bars. The graph highlights variations in species activity or visibility based on the time of day, providing insights into diurnal behaviour patterns of birds

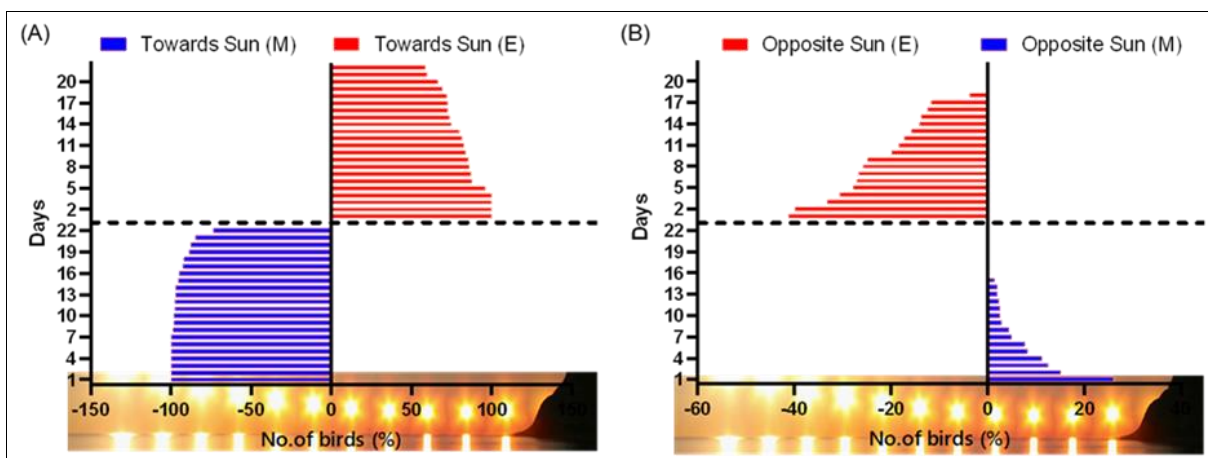


Fig 5: Presents a detailed comparison of the total number of birds, expressed as a percentage, observed sitting in two distinct directions during different times of the day. Panel (a) illustrates the percentage of birds sitting towards the sun in the morning and evening, 'M' indicate Morning 'E' indicate Evening while panel (b) shows the percentage of birds sitting opposite to the sun during the same time periods. This analysis highlights patterns in bird sitting orientation concerning the sun's position throughout the day

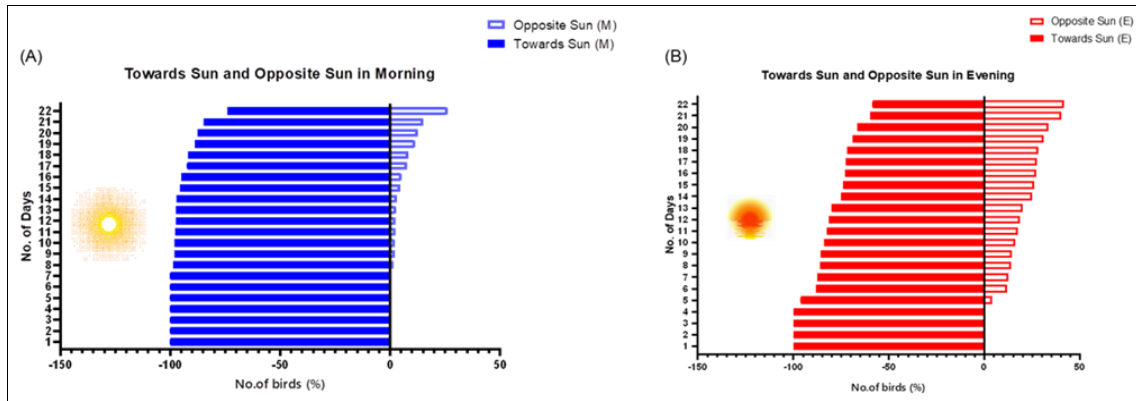


Fig 6: Provides a comprehensive analysis of the number of birds oriented in two distinct directions relative to the sun during different times of the day. It illustrates the count of birds facing towards the sun and those facing opposite to the sun during both the morning and evening periods. This figure aims to highlight the variations in bird orientation with respect to the sun's position across these timeframes

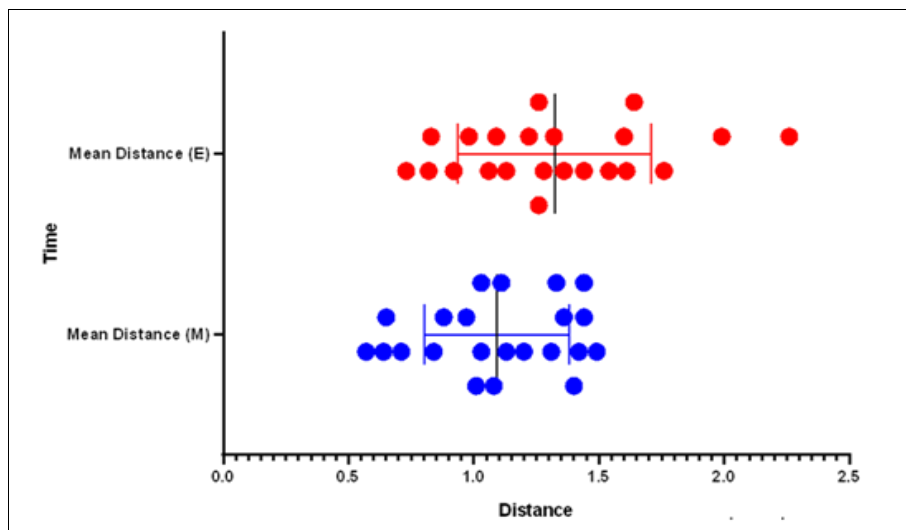


Fig 7: This figure illustrates the mean distance separating two individual birds within the study. The down bars represent morning time points, while the top bars indicate evening time points, illustrating the distance differences between two birds at these times

Discussion

This study examined sun orientation and spacing behaviour in Common mynas. Observations indicated that Common myna preferred facing the sun in the morning to a greater extent than in the evening. By facing the sun, Common myna may maximize heat absorption to warm their bodies and prepare for the day's activities.

On the other hand, the fewer birds facing the sun during the evening can be linked to a combination of factors such as temperature drop and the need for sun exposure. Common myna may change their position to conserve energy and minimize heat loss, making them less likely to face the setting sun. This shift could also be a behavioral adaptation for settling down to rest, as the cooling temperatures signal the approach of nighttime and a decrease in activity levels.

Our observations also indicated that the spacing between birds varied significantly between the morning and evening. In the morning, Common myna were observed sitting much closer together, suggesting that social interactions and warmth-seeking behaviors may be contributing factors. In the evening, however, the birds were observed sitting farther apart, which likely reflects a shift in behavior due to cooling temperatures and reduced activity levels. The increased spacing in the evening might be an adaptive response to avoid physical contact, which could lead to heat loss, and to facilitate settling into more comfortable positions for rest.

This suggests that temperature, comfort, and behavioral needs may play a more dominant role in determining how closely Common myna sit together. The study did not find a direct correlation between spacing and space availability. Temperature had a strong influence on bird behavior. The closer spacing in the morning can likely be associated with the birds' need for warmth, as their bodies are likely to cool overnight and need to absorb solar energy to maintain optimal body function and help in directional orientation. Their decision to spread out during the evening likely reflects a strategy for ensuring comfort and reducing the chance of excessive heat loss when temperatures drop. This adaptive response to temperature fluctuations demonstrates the birds' capacity to adjust their behavior to optimize thermoregulation. The Common myna' use of sunlight in the morning for warmth and preference for more distance in the cooler evening hours suggests that temperature is crucial in their daily activity patterns.

Conclusion

Morning observations showed a higher number of birds and a greater tendency to face the sun. In contrast, evening observations showed fewer birds and larger spacing between individuals. These patterns suggest that sun position and temperature may influence resting orientation and spacing behaviour in Common Mynas.

Data Availability: Data, corresponding date and time, has been provided in a tabular form as a supplementary file.

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Ethics: Birds were observed using non-invasive methods from a distance, ensuring no disturbance to their natural behavior.

Author Contributions: H.N. was responsible for conducting surveys and data collection. S.R. designed the study procedure, developing the framework and methodology for data gathering and analysis. S.M. and S.K. provided guidance and support throughout the research process, assisting in troubleshooting and offering critical insights to improve the study's rigor and accuracy. All authors contributed to the interpretation of results and manuscript preparation.

Conflict of Interest Declaration: The authors declare no competing interests.

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