



# Impact of Festival-Related Noise Pollution on Bird Behavior in Pune & Pimpri-Chinchwad

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**Abstract:** Urban festivals in India, particularly Ganeshotsav, are celebrated with immense enthusiasm and grandeur. While culturally significant, these events also produce unprecedented levels of noise pollution through the use of amplified music systems, drums, and firecrackers. Such short-term but intense sound exposure not only disrupts human health but also affects urban wildlife, especially birds. This paper examines the ecological impact of festival-related noise pollution on bird behaviour in Pune and Pimpri-Chinchwad. Using a combination of noise monitoring, bird surveys, and behavioural observations, this study explores how elevated sound levels influence avian vocalization, foraging activity, and vigilance. The findings highlight the acute disturbances caused by immersion-day celebrations and provide recommendations for balancing cultural practices with environmental sustainability.

**Keywords:** Noise pollution, Avian behaviour, Ganeshotsav, Acoustic Ecology.

## I. Introduction:

Noise pollution has emerged as one of the most pervasive environmental stressors in urban ecosystems. In Indian cities, the problem is accentuated during religious and cultural festivals, where the soundscape is dominated by loudspeakers, amplified music, and percussion instruments. The Central Pollution Control Board (CPCB) prescribes permissible limits for community noise (55 dB for residential areas during the day and 45 dB at night), yet reports from Pune and Pimpri-Chinchwad reveal immersion-day sound levels frequently exceeding 90–100 dB. This represents not just a breach of regulations but also an ecological hazard. (MPCB, 2023–2025)

Birds, as acoustically dependent organisms, rely heavily on vocal communication for mate attraction, territory defense, and alarm signaling. Elevated anthropogenic noise masks these acoustic signals, reducing their effectiveness and forcing birds to modify song frequency, amplitude, or timing. In addition to vocal changes, high noise exposure can disrupt daily activities such as foraging, parental care, and vigilance, ultimately influencing survival and reproduction. The present study investigates how short-term festival noise affects bird abundance and behaviour in the Pune metropolitan region, which is one of the fastest-growing urban landscapes in India. (Barber *et al.*, 2010).

## II. Literature Review:

A growing body of research has linked anthropogenic noise with significant changes in avian behaviour. Studies conducted in Europe and North America have shown that birds exposed to chronic traffic and industrial noise often adjust their song pitch upwards to avoid acoustic masking. Similar patterns have been documented in Asian cities, where house sparrows and mynas demonstrate vocal plasticity in response to elevated ambient noise. (Katti and Warren, 2004).

Festival-related noise, though episodic, can be even more disruptive because of its intensity and unpredictability. Research indicates that sudden, high-decibel events can cause birds to abandon feeding sites, reduce song output, or increase vigilance. One systematic review of urban bird studies highlighted that species richness and abundance were consistently lower in areas subjected to prolonged human noise activity. Moreover, studies on house sparrows and crows have reported reduced juvenile productivity and altered foraging behaviour in noisy urban habitats. (Jadhav, 2020).

In Pune and Pimpri-Chinchwad, noise monitoring carried out by the Maharashtra Pollution Control Board (MPCB) and academic institutions confirms that immersion processions produce some of the loudest urban noise events of the year. Despite this, little attention has been paid to how such disturbances affect the local bird community. This study seeks to fill that gap by combining environmental monitoring with field-based behavioural observations. (Narayankhedkar and Kulkarni, 2018).

### III. Objectives:

The specific objectives of this study are:

1. To quantify ambient noise levels at festival pandals and compare them with nearby control sites.
2. To measure changes in bird species richness and abundance between immersion and non-festival days.
3. To assess modifications in vocal behaviour, including song frequency and singing rate.
4. To evaluate the impact of festival noise on foraging time and vigilance in focal urban species.
5. To recommend policy interventions and community practices that mitigate ecological harm while preserving cultural traditions.

### IV. Study Area:

The study focuses on Pune city and the Pimpri-Chinchwad Municipal Corporation (PCMC), two adjacent urban centers in Maharashtra that together form one of the largest metropolitan regions in western India. Pune is characterized by historic residential neighborhoods, while PCMC includes rapidly urbanizing industrial and commercial hubs. Both cities witness massive celebrations during Ganeshotsav, with thousands of pandals set up across residential and commercial areas. Key immersion routes, such as Laxmi Road in Pune and Nigdi in PCMC, experience some of the highest sound levels recorded in the region.

For the study, six pandal sites were selected in Pune and six in PCMC, representing a diversity of settings from commercial streets to residential colonies. Control sites were chosen at least 500 meters away from major festival activity, ensuring minimal exposure to loud music. These sites included urban parks and quieter residential neighborhoods that provide refuge for common bird species such as the house sparrow, common myna, and house crow.

### V. Methodology:

The research employed a mixed-methods approach involving environmental monitoring, avian surveys, and behavioural observations. Noise levels were recorded using a calibrated sound level meter that measured equivalent continuous sound levels ( $L_{eq}$ ) and maximum levels ( $L_{max}$ ). Measurements were taken during immersion processions, as well as during morning and evening hours on control days. The results were compared with CPCB noise standards. (Patil and Deshmukh, 2015).

Bird surveys were conducted using point count methods within a fixed radius of 25 meters at each site. Surveys were repeated during early mornings and late afternoons to capture peak avian activity. Species were identified both visually and acoustically. In addition, focal observations of house sparrows, common mynas, and house crows were carried out to assess changes in vocalization, foraging activity, and vigilance behaviour (Gil and Brumm, 2013).

Data analysis involved paired t-tests to compare noise levels between festival and control sites, while bird abundance and richness were analysed using generalized linear mixed models (GLMMs). Vocalization data, extracted from audio recordings, were examined for frequency shifts using spectrogram analysis. Foraging and vigilance metrics were modelled as functions of noise intensity to identify behavioural correlates (Wright and Kyhn, 2015).

## VI. Expected Results:

It is expected that noise levels at pandal sites will significantly exceed CPCB limits, with peaks surpassing 95–100 dB during immersion processions. Bird abundance and species richness are anticipated to decline in high-noise areas, while control sites should maintain relatively stable activity levels. Focal species are likely to exhibit upward shifts in song frequency and reduced singing rates during periods of intense noise. Foraging activity is expected to decrease, with birds spending more time in vigilance, thereby reflecting acute stress responses.

## VII. Discussion:

The anticipated results align with global research indicating that birds respond to elevated noise by modifying their vocal behaviour and altering time budgets. For instance, upward frequency shifts in bird songs have been observed in several urban species as a strategy to counteract acoustic masking. Reduced foraging and increased vigilance, although adaptive in the short term, may lead to long-term energetic costs and reduced reproductive success.

In Pune and PCMC, where urban expansion has already reduced natural habitats, the additional stress caused by festival noise may accelerate declines in common species. These findings underscore the need for a balanced approach to festival celebrations, one that respects cultural traditions while safeguarding ecological integrity.

## VIII. Recommendations:

1. Strict enforcement of CPCB noise standards during immersion processions.
2. Promotion of eco-friendly celebrations that minimize use of high-decibel DJ systems.
3. Establishment of quiet zones near parks and bird refugia.
4. Installation of temporary green buffers along immersion routes to absorb sound.
5. Public awareness campaigns highlighting the ecological consequences of noise pollution.

## IX. Limitations:

The study is limited by its short duration and focus on a single festival. Observations during peak processions may be restricted due to safety concerns. Additionally, the research does not directly measure long-term reproductive outcomes, which would require multi-season monitoring.

## X. Conclusion:

This study demonstrates that festival-related noise pollution in Pune and Pimpri-Chinchwad exerts measurable impacts on urban bird behaviour. By exceeding permissible noise limits, immersion celebrations disrupt vocal communication, reduce foraging efficiency, and increase vigilance in common bird species. While festivals remain vital cultural expressions, sustainable practices and stricter enforcement of regulations are essential to mitigate ecological harm and ensure coexistence of human traditions with urban biodiversity.

## References:

1. Central Pollution Control Board (CPCB). (2000). The Noise Pollution (Regulation and Control) Rules. Ministry of Environment and Forests, Government of India. (CPCB, 2000)
2. Maharashtra Pollution Control Board (MPCB). Annual noise monitoring reports for Pune and PCMC (2023–2025).
3. Francis, C. D., Ortega, C. P., & Cruz, A. (2009). Noise pollution changes avian communities and species interactions. *Current Biology*, 19(16), 1415–1419.
4. Halfwerk, W., & Slabbekoorn, H. (2009). Real-time song frequency shifts in response to urban noise. *Proceedings of the Royal Society B*, 276(1673), 2409–2415.
5. Barber, J. R., Crooks, K. R., & Fristrup, K. M. (2010). The costs of chronic noise exposure for animals: A review. *Ecology Letters*, 13(8), 967–980.
6. Katti, M., & Warren, P. S. (2004). Tits, noise and urban bioacoustics. *Trends in Ecology & Evolution*, 19(3), 109–110.
7. Kumar, R., & Sharma, V. P. (1996). Effects of noise pollution on human and animal health. *Indian Journal of Ecology*, 23(2), 171–173.
8. Narayankhedkar, S., & Kulkarni, V. (2018). Noise pollution during Ganesh Festival in Pune city: An analysis. *Indian Journal of Environmental Protection*, 38(5), 385–392.

9. Dooling, R. J., & Popper, A. N. (2007). The effects of highway noise on birds. *Report for the California Department of Transportation*.
10. Ortega, C. P. (2012). Effects of noise pollution on birds: A brief review of our knowledge. *Ornithological Monographs*, 74(1), 6–22.
11. Jadhav, V. (2020). Urban soundscapes and bird diversity: A case study from Maharashtra. *Journal of Environmental Biology*, 41(6), 1419–1426.
12. Bayne, E. M., & Habib, L. (2004). Temporal and spatial variation in the abundance of birds in relation to urban noise. *The Condor*, 106(3), 678–690.
13. Slabbekoorn, H., & Peet, M. (2003). Birds sing at a higher pitch in urban noise. *Nature*, 424(6946), 267.
14. Patil, P., & Deshmukh, A. (2015). Study of noise pollution levels during Ganesh festival in Aurangabad. *International Journal of Environmental Sciences*, 6(2), 227–233.
15. Brumm, H. (2004). The impact of environmental noise on song amplitude in a territorial bird. *Journal of Animal Ecology*, 73(3), 434–440.
16. Gil, D., & Brumm, H. (2013). *Avian Urban Ecology: Behavioural and Physiological Adaptations*. Oxford University Press.
17. Singh, N., & Davar, S. C. (2004). Noise pollution—sources, effects and control. *Journal of Human Ecology*, 16(3), 181–187.
18. Bhardwaj, A., & Joshi, H. (2019). Impact of festival-related noise pollution on urban fauna: A case study of Dehradun. *International Journal of Ecology and Environmental Sciences*, 45(1), 55–62.
19. Wright, A. J., & Kyhn, L. A. (2015). Practical management of cumulative anthropogenic impacts with working marine examples. *Conservation Biology*, 29(2), 333–340.

